

EU-LUPA

European Land Use Pattern

Applied Research 2013/1/8

Executive Summary

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This report presents the **draft final** results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

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EU-LUPA

European Land Use Patterns

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CHAPTER 1
LAND USE CHARACTERIZATION IN EUROPE
Draft Final Report Part C Scientific report
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1 Land use Patterns in Europe

1.1 Introduction

Europe's Resource Efficient Strategy sets the goal of no additional land consumption after 2020, yet this mandate will mostly likely work against the goals of a number of regions; particularly those seeking to ascend the socio-economic ranks toward the most established European nations. The fact that the magnitude of land change has been more or less maintained throughout the period from 1990 to 2006, and prospective new members of EU appear ready to make use of land change as a vehicle for economic progress, it seems that measures of compensating any limitations in this respect would be needed. Therefore, it is both an unlikely and unrealistic goal for a number of European regions.

Existing European policy regarding land use lacks a comprehensive and integrated approach that takes the inherently broad number of trade-offs between many sectoral, social and environmental issues. In particular, this includes activities relating to: industry, transport, energy, mining, forestry, agriculture (EEA, 2010), as well as recreation and environmental protection/conservation. According, to the EEA, "these trade-offs can be tackled through integrated planning for land use and territorial planning, sectoral policies, as well as targeted policy instruments, such as protected area networks." (EEA, 2010: 5). Similarly it is expected that the integration of the European Landscape Convention as a tool in territorial planning would become an important contribution to the planning process. Along these lines, institutional arrangements dictating land use policy in Europe include the EU objective for Territorial Cohesion – with which this project is closely connected to – the Water Framework Directive, Common Agricultural Policy (CAP), Natura 2000, and with an increasing importance, Energy 2020. Important tools for informing, monitoring and evaluating these policies and programmes are Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), and most importantly, the advent of the Corine land cover inventory (EEA, 2010).

Within this context, it is increasingly understood that a more integrated, comprehensive and up-to-date policy approach is needed; one that can bolster sustainability through increased efficiency and a multi-functional approach. As such, this project seeks to provide evidence to support such a policy initiative by providing a new and insightful way of characterizing land use patterns and their dynamic relationship with socio-economic growth. For example, it emphasizes that we need land to grow, but our growth puts pressure on the social, economic and environmental services we can obtain from it. But it also shows that the drivers, the enablers and the ingredients of what we require for development are the very things

pressuring the over-consumption of land. This pressure cannot continue to escalate as we continue to develop and it means that a growth model that is blind to the host of thresholds related to land and its resources cannot continue sustainably.

Land is one of the environmental conditions that, right alongside energy resources, water and climate, we need to use within a sustainable level in order not to endanger our continued development. But we could even go a step further to say that land is the most tangible of these conditions. Like many resources, we continue to be dependent on land and its resources. We rely on it in the sense that land type is one of the most integral components for determining how land is used. For example, one can't grow crops, raise cattle or tend to a forest on land that isn't suitable for farming plants, letting animals graze or growing trees. Just as one can't build a ski resort without mountains, sell beach holidays without sand and ocean or construct buildings without wood and stone.

Yet its tangibility also rests on the fact that land is that which is at the interface of our existence. It is the space where we situate ourselves, interact with one another and move about space. But it is also the interface where we interact with a variety of other resources, such as water and climate. This perspective begins to highlight that while we are dependent on what land provides us, we also have an ability to manipulate it away from its natural landscape in order to meet our needs. It can be deforested through logging or by environmental pressures and relatively small disruptions to the balance of soil nutrients can hamper agricultural production. Perhaps more worrisome, the onset of negative impacts of pollution and overuse can develop very quickly and dramatically.

Another example is the extent with which we develop our built environment. With an almost unanimous interruption of natural land surface, cities for instance can be built almost anywhere - from the middle of deserts like in Dubai or Las Vegas to the shores of beaches and edges of lakes like in Barcelona or Geneva. All of these processes reflect how we cause change to the natural environment and invoke our existence on the land we consume.

It is strikingly clear that we have double-sided relationship between land and growth. We are dependent on land to provide the resources we need to grow, yet our ability to grow is inseparable from our need to conserve and protect land. With this in mind, the task of LUPA is to provide evidence on land use and its changes that can support policy; which in turn can support an improvement of land use performance and thus land use efficiency. To achieve this, the project outputs seek to characterize regional patterns and trends of land use in Europe. Parts of this process

include research and analysis of the existing land or land-related policy, as well as the patterns and changes in land use functions, particularly in relation to the cause-effect relationships with economic, social and environmental changes.

But the tangibility, dependence and interconnectedness we share with land itself (in this case relating to the bio-physical perspective of what covers the land) puts emphasis on the importance of accounting for land patterns and attributing these patterns to the general conditions of socio-economic development. Accordingly, the focus of this report is on the development of a land use characterization for Europe - one which perceives land in relation to the drivers, effects, challenges, or put more plainly, the general conditions of regional development in Europe. This characterization is to take place primarily by the classification of patterns of land and the processes of land change through regional typologies with a European coverage.

The main input into this process will be Corine Land Cover (CLC) data that has been produced by the European Environment Agency (EEA) since 1990. This dataset will be used in three ways: first, as a means of classifying land cover; second, as a means of characterizing land cover changes; and third, to characterize the intensity of human intervention on the land. All three perspectives in the typologies of land and land change allow us to move towards evidence-based understandings on regional and territorial patterns and processes of land use in Europe.

Yet in the last two paragraphs alone, land characterizations have included land, land cover, land change, intensity of land intervention, and not least, land use. This shows a need for deciphering between these terms in order to clearly describe how CLC data can be used to characterize land use. Therefore, following a brief discussion on the use of typologies, a more detailed theoretical discussion will be provided on how we approach land use through the availability of CLC and socio economic data in this task. Following this, methodological discussions of the typology approaches will precede the characterization of land use and land use changes. This will include the use of typologies on prevailing characteristics of land use, hotspots of land use change and land use changes.

1.2 Integrating land use information: typologies

The focus of this report is on a characterization of land use for Europe - one that can be used to interpret land cover in relation to the drivers, effects, challenges, or put more plainly, the general conditions of regional development. Through the use of regional typologies this characterization aims to identify land patterns and dynamics in Europe and attribute these processes to shifting regional socio-economic characteristics. In turn, this

can help to address major territorial challenges and political priorities in order to increase land use efficiency at the European, national and regional levels.

The use of typologies is meant to provide an analytical basis for characterizing and analyzing patterns and processes of land use changes. This is centered on the aggregation and regionalization of CLC data, both in terms of the account on the prevailing characteristics of land use but also regarding land cover flows. Once completed, these land cover typologies will be placed in the context of land use in two ways. On one hand, they will be compared with the results of the land use functions (LUFs) exercise, which has also been completed in Task 2.2 of this project.

In parallel to this however, the objective of typologies has also been to find an innovative way of accounting for land use patterns and dynamics through the use of land cover data. As discussion will show, while land cover and land use are two terms that often get misused in place of each other, we have approached a means of investigating land use through CLC data by means of the intensity concept. Consequently, the typologies do not directly integrate data reflecting regional socio-economic conditions in Europe, but the intensity concept shows a clear correlation between the presence of land cover types and the characteristics of socio-economic development that takes place as a result.

1.3 Theory, hypothesis and approach

Distinction between land use and land cover

In the discussion of characteristics and changes in relation to land use a very common approach is to draw a direct connection between land cover and land use. This infers a direct implication of land cover on the way that land is used. An example of this approach, as done by Lambin et al. (2003: 216) defines land use as "the purpose for which humans exploit the land cover". The key element in this connection is *vegetation* as a productive resource, which implies that CLC classes show information related to vegetation as a basis for production.

Historically, there have been many reasons for choosing such an approach to defining land use. First and foremost, it enables an analysis based on what is immediately visible through the land cover, which in turn provides a rather direct connection between land cover information and economic activities (at least to the extent that land cover actually reflects such a relationship). This however, has been the situation in predominantly agrarian societies, just as in societies where forestry and other direct land cover uses provide the main economic activities.

Typically this approach is very common in relation to discussions in relation to *developing* countries where these types of direct connections between economic activities typify the mainstay of both society and economy (see Lepers et al (2002), Turner et al (2007), and more recently in a global scale by Lambin (2010)). Similarly, a tradition has developed in relation to *developed* countries emphasizing the historical use of land as a background for understanding the present characteristics of rural areas. This has been documented in a European setting by Dovring (1960) and followed up by Reenberg (2009) among others.

However, the parallel increase of urbanization and the development of non-land-based production (e.g. the service, financial sectors as well as many high-tech industrial developments) have significantly constrained the validity of such an assumed synergy between land use and land cover. As a result new territorial-based logics beyond land cover now have the predominant role in determining how land is used. Thus, some of the most important elements are now what characterizes land use in already built-up areas, connectedness through proximity to other cities, settlements and linking infrastructure, as well as increased demands for ownership, leisure and recreation.

In this case we have to look no further than the fact that, according to Turner et al. (2007) land change in Europe has increased to unprecedented levels over the past couple of decades. What's more, the fastest of these changes relate to the covering of land with artificial surfaces, which increased by 6 258km², or 3.4% of the European continent between 2000 and 2006 alone. Not only does this have to do with the fact that Europe's population is still increasing, but also the fact that people in Europe generally have the desire for increased living space per person.

In many ways, the increased pressures to develop sustainably have also increased the divergence between the two terms. For instance, there is increased demand for the production of energy from the landscape, which can involve a transition of land uses vis-à-vis land cover often remaining the same. In parallel, the role of improving land efficiency through increasing the functions that we can obtain from our land is also accentuated. These issues point to a major problem in this connection; namely that to base any land use analysis only on the Lambin et al (2003) definition of "the purpose for which humans exploit the land cover" is insufficient. By doing so it leaves out what tends to be an increasing part – if not the determining part – of what characterizes the use of the land resources in our current socio-economic setting.

Taking these present day conditions into consideration, the focus on the trends, dynamics and driving forces of European land use means that a

clear land use definition is a critical issue in the EU-LUPA project. In the following text we present some key elements in our understanding of the concept. But we do so with a specific focus on the fact that our analysis of *land use* is primarily based on the availability of data that comprehensively accounts for the characteristics of *land cover*. This necessitates a further discussion on the differences between land use and land cover, the implications and vulnerabilities of using land cover data to interpret land use, and as a result, our chosen method to navigate land use patterns using land cover information. Ultimately this will lead us through to the notion of intensity.

While it is easy to interchange the terms "land cover" and "land use" as terms describing overlapping or even identical perspectives to the way land exists or is consumed in time and space, the distinction between the two can be made very simply. *Land cover* is a term that reflects the bio-physical nature of the land surface. To determine the land cover is simply to ask one's self what they see when they look to the ground. Therefore, in its absolute sense it is void of human perception and be placed in zero-sum terms. Examples of land cover could be given in relational terms (i.e. natural or non-natural) or in absolute terms (i.e. grassland or bare rock).

In contrast, a *land use* is an adjective that is used to describe the manner in which the land is perceived or consumed by humans. For example, 'recreational', 'preserved' or 'waste' land uses are often legal entities but also speak to the human perception or valuation of land. Yet, describing land use also relates to describing the nature of human activities that use, exploit and consume land. For example, agriculture, industrial land, transport areas, pastures, agro-forestry, plantations and irrigated land all relate directly to the use of land in space. Here, human intervention does not operate in zero-sum terms and allows for the inclusion of multiple functions on a given piece of land. For instance, we often hear the term mixed land use within planning policy as a way of describing the conditions and benefits of over-lapping land uses.

Deciphering land cover and land use using Corine data

While the land cover land use distinction above is straightforward, the use of Corine land cover data adds a layer of complexity. The Corine Land Cover Programme was initiated in the mid-eighties as a voluntary agreement to provide researchers and policy makers in multiple fields with an inventory of land cover based on satellite images (Bossard et al., 2000). This valuable resource has now been developed for three time series' (1990, 2000 and 2006), with another expected in the coming few years. However, the diverse value of the resource – for economists, engineers, biologists, geographers or planners to just name a few – pressures on CLC data to account for the different land dimensions for

different utilities. By the EEA's own record this has limited the ability for CLC nomenclature to strictly reflect land cover without introducing human usage into the nomenclature:

"...However, it should be emphasized that due to the physiographic nature of CLC classes, and to a limited extent the functional distinctions that are introduced in the nomenclature it is hardly imaginable to fully match the CLC nomenclature starting from an automated classification procedure, without additional human interpretation work." (Bossard et al. 2000, pp 6)

The unavoidable consequence is that even though CLC data is often assumed to provide an 'objective' characterization of land cover, this actually isn't the case. Rather, human-related aspects (pertaining to human intervention on land) are used in conjunction with bio-physical (non-human) perspectives. Thus, the nomenclature of CLC classes is something between land cover and land use. In fact, in a majority of the 44 classes human interventions and perceptions are explicitly used to define land cover.

For example, the class Agricultural areas say very little about the bio-physical nature of the land surface, but says a great deal about planned or perceived *use* of the land. The Artificial surfaces class is also broken down to an entirely human perspective on use of land, which includes: Port Areas, Airports, Construction Sites, etc. This trend is taken a step even further with the EEA's production of land cover flow data. By including flow types such as Urban Land Management, Urban Residential Sprawl and Withdrawal of Farming the classification is almost entirely based on a the above notion of land use rather than land cover.

While it is clear that the CLC nomenclature is conflicted, it is most sensible to seek consistency with their approach. The EU LUPA notion of land cover is therefore synonymous with the definition that is inferred through the CLC and CLC flow nomenclature. And as such, CLC data is used to describe *land cover* conditions in the EU LUPA project, even though it is understood that underlying perceptions of land use and human functions are included in the characterization.

Responding to limitations in the traditional analysis

As indicated above, a traditional approach to land use does not sufficiently go beyond the uni-dimensional linkage between the use of land only for production. In this perspective, the land cover is directly part of one type of production, and this disregards the fact that land is actually an important part of many human activities. For example, the production of energy by means of windmills requires land for the situation of the tower and turbine, but its presence has an impact on the surrounding area in

terms of human visibility, noise, danger to animals, etc. As such, other land activities such as hiking or other forms of recreation that could take place within proximity to the windmill are affected. Further, the “consumption” of land through these more discreet landscape qualities represents another way of perceiving land use characteristics; however they do not have a specific link to production activities and therefore cannot be appropriately recognized through such a uni-dimensional approach.

In order to overcome some of the major problems in the traditional approach to defining land use characteristics, at least four types of linkages would need to be emphasized and considered in connection with the definition of land use categories:

- ***The use of land as a means of production:*** This group of activities is similar to the definition by Lambin et al (2007), where qualities of the land itself becomes an important contributor in connection with questions regarding to land intensity and value.
- ***The use of land as locus standii for production purposes:*** This includes activities that are localized, but not necessarily directly linked to a “consumption” of the qualities and productive forces of the land itself. Instead, qualities such as the questions of accessibility, proximity, water, sewage disposal, etc. are important issues. In the case of windmills mentioned above several of these issues are at stake.

Another example is evident with the CLC class Artificial surfaces, which is subdivided in classes where specific functional qualities have been used in determining the class qualities. However, while those activities connected to urbanized activities are directly reflected, while many other activities are still missing.

- ***The use of land as a means of recreation:*** This group includes land areas where the consumption of land areas is important in relation to recreational purposes. Here, recreational purposes are seen in a dual perspective, both in terms of environmental functions for recreation in the current society but also in terms of recreating (preserving) the environment for future development. In this connection a number of sub-groups could include:
- ***Reproduction directly connected to socio-economic growth:*** This group includes housing, recreational parks, amusement parks, sports facilities not only in near-urban areas, but also including summerhouses and second homes in rural areas. As such, a key issue in this connection is the transformation of areas into land cover characteristics defined by human activities or perceptions.

Some of these activities are already included in the CLC classification Sports and Leisure Facilities, but this could be extended to rural areas in order to reflect, for instance, environmental protection. Protected areas are not included as the CLC class, but new types of protection are being implemented that were not foreseen when existing CLC classifications were decided.

Land use in the EU LUPA project

It is now clear that even though a CLC-prescribed notion of land cover can be used to infer land use such an approach leaves room for improvement for meeting the multiple elements of a comprehensive and up-to-date definition of land use. This would be a notion that simultaneously reflects direct and indirect uses, mono- and multi-functional uses, and especially, its contribution to socio-economic production which is not explicitly related to the consumption of land.

In fact, one may argue in line with Verburg et al (2008) that the term land functions would be a more suitable concept when referring to the goods and services provided by the land systems. Their view is that land functions “not only include the provision of goods and services related to the intended land use (e.g. production services such as food and wood production), but also include goods and services such as the provision of esthetic beauty, cultural heritage and preservation of biodiversity that are often unintended by the owner of the land.

Based on the need to approach these multiple perspectives of land use, the EU LUPA project has introduced the notion of Land Use Functions and has completed a comprehensive analysis of changing performance in relation to six individual land use functions:

1. LUF1: Provision of work
2. LUF2: Provision of leisure and recreation
3. LUF3: Provision of primary products
4. LUF4: Provision of housing and infrastructure
5. LUF5: Provision of abiotic resources
6. LUF6: Provision of biotic resources

Synthesis of these functions also allows for the summaries of land use functions relating to:

1. Provision of economical functions
2. Provision of environmental functions
3. Provision of Societal functions

4. Provision of total functions

However, the analysis of relationships between socio-economic development and land use remains as a cornerstone of this project. Thus, the questions two issues remain unanswered: first, how can we take CLC data a taken a step further to include a practical, relevant and informative notion of land use – one that includes the regional socio-economic patterns and dynamics of Europe.

Integrating the socio-economic and land cover dimensions – Intensity of land use

The concept of land use intensity is introduced into the LUPA project to acknowledge and respond to the understanding that while socio-economic development is less and less attributed to land-based production; it is an ever increasing driver of land changes. Seen from this perspective, it is not only important to know how much land is changing, but it is crucial to know if land changes reflect minor changes (which usually reflect on-going socio-economic processes) or if they reflect major shifts in land cover (which are often part and parcel with structural socio-economic changes or environmental impacts). Furthermore, it is important to consider that increased human landscape intervention is among the strongest pressures on biodiversity (Environment Council, 2010), and potentiating land use efficiency is a direct means of improving the sustainability of land use in general.

This aim is in direct relation to a key question of the project; namely, how and to what extent land cover changes interact with ongoing changes in the ways the land is *used* for socio-economic purposes. This in turn raises questions of how the typologies in the LUPA project can reflect on both the physical characteristics of land patterns and the socio-economic dynamics of land use that are behind these changes.

In light of this, land use intensity is defined as: the degree of human intervention caused by activities taking place on a given parcel of land - activities that, in most cases, do not have a direct and one-to-one implication on the characteristics of land cover. Therefore, the intensity is not related to the amount of input used – a driver that usually leads to an increase of production from a piece of land (cf. Gabrielsen, 2005). As described at length above, such a characterization would be reminiscent of what we are trying to avoid – land use characterization that is preferential the inputs and outputs of land-based production. But at the same time, land use intensity is not only related to the per capita use of artificial surfaces, for this is also too narrow a concept which tells more about the efficiency of land use than is doe about intensity (cf. Prokop et al. 2011).

In contrast, the quantitative assessment of land use intensity is created based on the inference that the ordering of the CLC classes – from CLC 34 – Glaciers and Perpetual Snow to CLC 1 – Continuous urban fabric – are representative of has an increasing level of land use intensity¹. As shown in the Methodology section, this ordering is based on a conservative set of guidelines and assumptions that are used to reinforce the plausibility of scoring land use intensity through the CLC classification hierarchy in lieu of additional validation.

We are aware that this relatively simplified approach may be criticized for being too simplistic. However, the structure of the CLC at an overall scale obviously shows tendencies towards the interpretation as indicated above. Thus, it is clear that when looking into details there are limitations to how much characterization and distinction can be incorporated into the scale of intensity reflected by the CLC classification.

Nevertheless, preliminary validation of the land use intensity concept uses indicators that can infer the value of land in relation to the range of socio-economic activities it provides (again, especially those which are not related to land-based production). Two indicators that best serve this purpose are population density and gross domestic product (GDP). In terms of the former, the presence of greater concentrations of people is quite clearly indicative of higher land use intensity. This impacts land especially through the development of artificial surfaces in order for people to establish their everyday lives and routines in space. As mentioned, the desire for increased living and recreation space reiterates that increased population in a given area creates more intensive land use – which through the creation of impervious surfaces reflects the complete manipulation of landscapes.

GDP is also a good indication of land use intensity because of the safe assumption that increasing economic output is equal to situations of greater land intervention. This is not only placed in terms of land-based production but also incorporates the role of urban areas as areas of relatively high economic output. However, one of the problems in relation to GDP being a perfect indicator of intensity is that economic outcome of the land use activities may not always be registered where the economic activity takes place. For instance, the registration of the economic outcome of production from a factory may depend on the accounting system, i.e. whether it is registered where the production takes place, where the workforce is living, or where the central office of the factory is situated. Similarly the energy outcome of a windmill may be registered

¹ CLC 35 – 44 reflect Wetlands and Water bodies and have not been considered in the analysis due to uncertainty over the associated socio-economic activities that may take place on them.

where it is situated or where the owner of the mill is residing. But even with these constraints in mind, both population density and GDP are presumed as robust indicators of land use intensity.

Thus, the general causality of land use intensity is similar to that of physical land take; that as the development of society and economy take place both the amount of land changes and the invasiveness with which we change it increases. We can then take things a step further toward by saying that situations where population and economy grow vis-à-vis relatively low levels of land use intensification and land take will imply greater land performance and efficiency.

2 Methodology

2.1 Working with CORINE

Section 1.3 discusses the use of CLC data in the EU LUPA land use characterization at length, particularly in relation to the distinction between the concepts of land cover and land use. It was mentioned that the CORINE Land Cover Programme was initiated in the mid-eighties and has now been developed for three time series' (1990, 2000 and 2006). Consistency has been a key goal of the EEA and as a result each of the releases of CLC data uses the same classification scheme and nomenclature. Table 1 shows that the CLC land classification is available at three levels depending on the type of analysis being conducted. In the most general sense, land cover is classified into 5 classes, at the second level it is classified into 15 classes and at the third level into 44 classes. This consistent classification allows for the distinction between different types of land processes taking place at different scales and magnitudes. As discussed above, this is an important benefit in the classification of land use intensity.

One of the limitations however, is that the spatial coverage is not entirely consistent for each time series. This prevents full European coverage of the typologies for the entire 1990-2006 time series. As a result, the typologies are constructed at all three time scales to provide the fullest extent of European coverage possible. Yet, this is also advantageous for identifying changes in land patterns that have taken place through time; for instance based on trajectories of regional development related to entering EU membership. It also allows for the inclusion of analysis of socio-economic and environmental alongside CLC data that is not unanimously available back to 1990.

Aggregating CLC data to 1km² land types

One of the best assets of CLC data is its ability to produce very high resolution results for such a wide area. Land cover classification is

available at both a 100m and 250m grid for each CLC in all three time series'. However, in some cases such a high resolution is not advantageous because it provides very fine, fragmented land cover results that fail to identify dominating land cover patterns. Here dominating land pattern is important to know because it starts to show the socio-economic uses of the land. This is especially crucial for identifying dominant land cover classes that are often relatively discrete in their distribution but have disproportionately high roles in a socio-economic perspective. The foremost example of this situation is that of artificial surfaces – areas that cover only 4% of Europe's land but accommodate an increasing majority of people and economic activity (EEA, 2010).

Thus, CLC data is aggregated from a 100m² to a 1km² grid-level for its use in constructing typologies that characterize land patterns in Europe. This harmonization is based on the principle that when aggregating CLC it is not possible to represent the entire mosaic of land cover classes or land cover changes for each 1km² cell. As such, the process represents a simplification of the data that is necessary for analyzing important trends taking place on regional, national and European scales.

The aggregation to a 1km² grid is calculated using the CLC class (from 1-44) of the 100 grid-cells comprising each 1km². However, simply using one method of calculating an aggregated CLC class for a 1km² cell leaves open the possibility of significant mischaracterization. For example, Figure 1 provides a hypothetical example showing how CLC classes at a 100m² grid can be aggregated based on the maximum, minimum, median, mean and majority land class. Choosing between these different values reflects the ability of each to enhance and/or maintain different land cover characteristics in each of the 1km² areas. A minimum aggregation value of 2 corresponds to Discontinuous urban fabric while a maximum aggregation value of 41 corresponds to Water bodies. Median and majority classification result in different characterization of Agricultural areas.

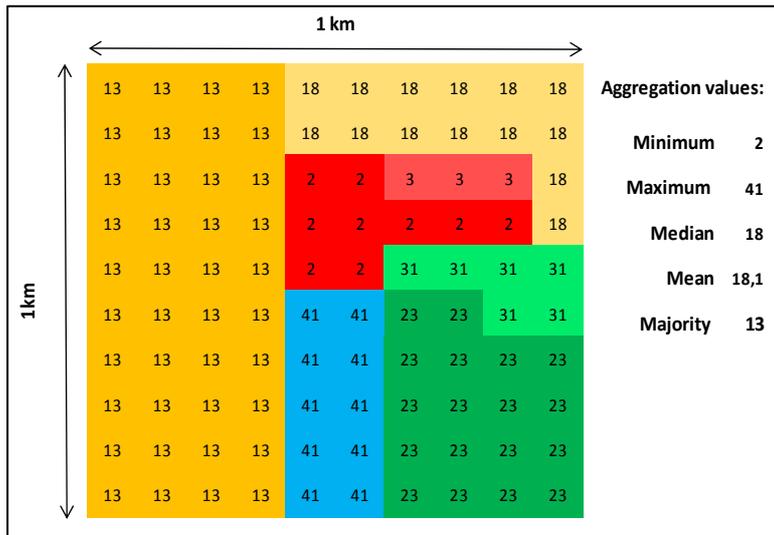


Figure 1 Hypothetical example of aggregating a 100m² grid to 1km² using five aggregation methods

Thus, each of the aggregation methods has their own advantages and disadvantages. For example, the maximum and minimum represent the span of CLC classes represented in a 1km² - information which to some extent is indicative of the landscapes represented. Furthermore, the minimum aggregation determines if the area possesses any form of urban or agglomeration characteristics – a benefit that identifies discrete but crucial land classes that may otherwise disappear due to dominance of other classes. In contrast, the maximum aggregation provides a very good impression of where extensification thresholds could be impactful.

The median aggregation shows the dominant (majority) CLC class if one land type accounts for more than 50% of the cells in a given area. If this is not the case then it reports the CLC class that most likely dominates the area. As such, it limits the pull tendency of deviating outlier land classes in a given area and provides statistical results that come closest to reflecting the reality of the dominant CLC class. Yet perhaps most importantly, and in contrast to a majority aggregation that shows the most frequent CLC class in a given area, it also reflects on the associations of land cover classes in each cell, an issue that may become important when generalizing larger territorial structures based on a number of individual grid cells.

Most importantly, however, the aggregation possibilities highlighted above show that no single aggregation procedure effectively captures that land dynamics operating within a given area. This is a crucial component to the use of the aggregated CLC data in the typologies as the Maximum, Minimum, Median and Majority aggregations will be used together to formulate the dominant land cover type at a 1km² scale.

2.2 Analyzing land use patterns using typologies

Typologies are defined as the classification of entities into types based on shared or common characteristics. In the context of the EU LUPA, their general role is to serve as an analytical tool to support the development of land use policy recommendations for Europe. More specifically, through the use of CLC data, they are used to characterize land use and land use change in Europe.

In looking to develop typologies the answers to three central questions are sought:

1. What are the general characteristics of land use in Europe?
2. What characterizes land use changes?
3. How are both of these connected to the socio-economic development?

Ultimately, it is the objective of this report to show that by responding to the first two questions the EU LUPA typologies provide an optimal characterization of land use patterns that reflect socio-economic dynamics. This in turn reveals additional insight into the nature of land use patterns and their relationships with socio-economic development.

It is also understood that concern during the typology formulation is that they should be simple, operational and easy to communicate, have a high explanatory power and be built on robust and complete data. The most immediate impact of these demands is that an individual typology cannot sufficiently characterize each of the dimensions required. Instead, one typology is necessary to interpret the prevailing characteristics of land use in Europe and another is needed to account for land use changes.

In generating typologies that seek to have a high explanatory power, it is advantageous to make them available for mapping at both the grid and regional formats. This relates to the need to integrate two different dimensions of territorial structures; on one hand represented by land cover data that is "independent" independent of administrative bonds; and on the other hand by socio-economic data that is constructed by explicit administrative bonds – in this case, the NUTS2 and NUTS3 levels. At the same time, it is also important to point out that a gridded output is needed to acknowledge land functions that take place in overlapping or close proximity and for pursuing intra-regional analyses in the case studies.

Given the complexity of patterns and processes driving land use and land use change, as well as the nature of the data that is needed to account for both land cover and socio-economic dimensions, it is not possible to aggregate all of the relevant and interesting information into a single

typology. Accordingly, a complete understanding requires consistent framework for integration of scales and themes. The result is that this task uses CLC data in three general ways to create typologies of land use patterns in Europe:

1. In relation to the prevailing characteristics of land use: answering the question, based on the distribution to CLC data and its embedded notion of intensity, what characterizes the land use in Europe? The results are typologies of prevailing characteristics of land use provided at both a 1km² grid level and a regionalized NUTS2/3 level. As presented above, aggregated CLC data is used for 1990, 2000 and 2006 to provide a grid-level and a regional typology covering the full time period.
2. In relation to the intensity of land use change: as presented above, intensity is the degree of human intervention on the land caused by socio-economic activities. It is included in the analysis based on an inferred intensity hierarchy that is inherent in the CLC classification. This allows for the production of a basic typology showing Hotspots of Land Use Change, which typifies regions based on the levels of physical change (by area) and intensity change that takes place.
3. In relation to land use change: this is the cornerstone of the EU LUPA land use characterization and it answers the question, based on the regional clustering of all CLC flows, and changes in land use intensity, what characterizes land use changes in Europe? The results are typologies of Land Use Change provided at a regionalized NUTS2/3 level.

2.3 Typologies on the prevailing characteristics of land use

The term “prevailing” is important in this connection because it implies that the unchanged elements of European land cover as well as any changes that take place are included in the typologies. The alternative approach would be to use data from a base year (e.g. 1990) to imply a point of departure for all observed land changes. The advantage of the former approach is that it provides a comprehensive interpretation of land cover that does not infer that land change is a fixed process with a clear beginning and end, but rather a dynamic and on-going *process* through time and space.

Section 3.1 described the multiple processes of aggregating CLC data from 100m² to 1km² and the benefit of the different approaches. Using these aggregations the process of developing the prevailing characteristics typologies is completed at two levels: the grid-level and the regionalized typology. These provide an overall characterization, which in turn acts as a point of departure for analysing land changes in Europe.

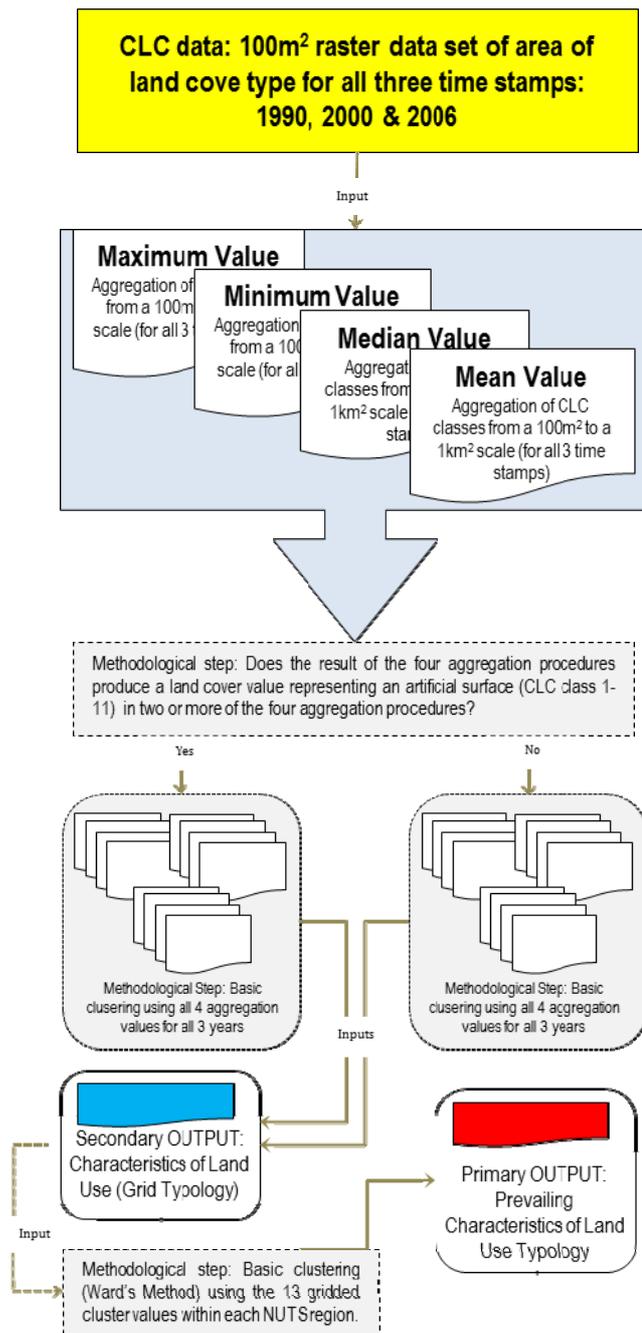


Figure 2 Methodological flow to analyse land characteristics

Prevailing characteristics of land use – grid level

As shown in Figure 2, the method of creating the prevailing characteristics of land use typology begins with the previously discussed aggregation procedure, and algorithm step and a clustering procedure. This is broken down in the following steps:

1. The first step is to select the aggregation data to be used in the clustering. As described above, the maximum and minimum aggregations represent the span of land cover types in each 1km² area, while the median and majority aggregation most effectively characterize the dominant land characteristics, as well as the

association of vegetation characterizing the grid cell without being affected by outlier land covers. Therefore, these four datasets are used as inputs in the first clustering procedure.

It is also important to acknowledge the issue of gaps in the CLC data. One of the objectives of the prevailing characteristics typology is to provide a full European coverage while using CLC data going back to 1990. In order to achieve this data from the 2000 release of CLC is used in countries missing either 1990 or 2006 data.

2. The four datasets for each of the CLC time periods are then analysed using an algorithm that identifies similarities and differences between each of the Maximum, Minimum, Median and Majority aggregation procedures. The reason for this exercise is to emphasize the role of urban areas. Considering that Artificial surfaces cover only 4% of Europe, it has a very low extent compared to its socio-economic impact. In order to ensure its proper representation in the cluster results any 1km² grid showing an Artificial surfaces CLC class in at least two of the four aggregation processes is characterized as an urban cell. Similarly, an urban cell is identified if the average of the four clustering processes is between the values 1-11, i.e. one of the Artificial surfaces CLC classes. Any cell not identified as urban is considered a rural cell.
3. Next, two cluster procedures are completed; one for the 815 590 urban cells and one for the remaining rural cells. In both procedures Ward's cluster method is used to combine the four aggregation datasets for all three years². The result is the generation of 6 clusters with an urban component and 7 rural clusters.
4. The clusters results are then smoothed using a GIS tool called Majority Filter. This tool runs a 3km²x3km² filter over the raster data and assigns the dominant cluster value to each of the nine 1km² cells in the matrix. As with the intention of the aggregation procedure, this limits the singular occurrence of cells which can be considered "territorial outliers", and thereby eventually blur the general picture and make interpretation difficult.
5. Lastly, the cluster results are named and therefore transformed from clusters into 13 land use types. The naming process is in many ways a subjective process that makes use of the statistics characterizing the clusters, first of all the mean and standard deviation values of the dominant value for the cluster, as well as tables showing the

² Datasets for 4 aggregation datasets times 3 time periods equals 12 CLC classification values for each cell the in the cluster procedure.

distribution of the 44 CLC classes³ for each cluster. These tables are shown in Appendix 6.3 and they reveal the composition of land attributes in each cluster.

Prevailing characteristics of land use – regional level

According to the methodological flow presented above, the gridded typology is transformed to the NUTS2/3 level by performing a basic cluster analysis (Ward's method) using the mean and standard deviation of the dominant values for the 13 gridded Land use types. Therefore, regions in the same cluster are brought together based on their similar composition of land use types. The result of the regionalization of the gridded land use types was the production of 16 clusters. The use of 16 clusters as an initial state was carried forward after the cluster procedure was processed with a query for as few as 8 clusters and as many as 20 clusters. 16 clusters was chosen based on the combined objectives of not blurring the regional characteristics too much by having too few clusters on one hand, and not generating too many clusters with only one or a few regions on the other hand. And the final set of 14 clusters was the result of a response to a general request of limiting the number of clusters as much as possible without compromising significant detail in the result.

The clusters are then subjectively named and transformed in to regional land use types using the composition of clusters based on the CLC classes in each cluster. A table showing this composition is shown during the characterization of the Prevailing Regional Types and in Appendix 5.4 (See Table 3).

³ The distribution of the grids among the 44 CLC classes is shown using the Majority aggregation method.

2.4 Analysis of Land Changes

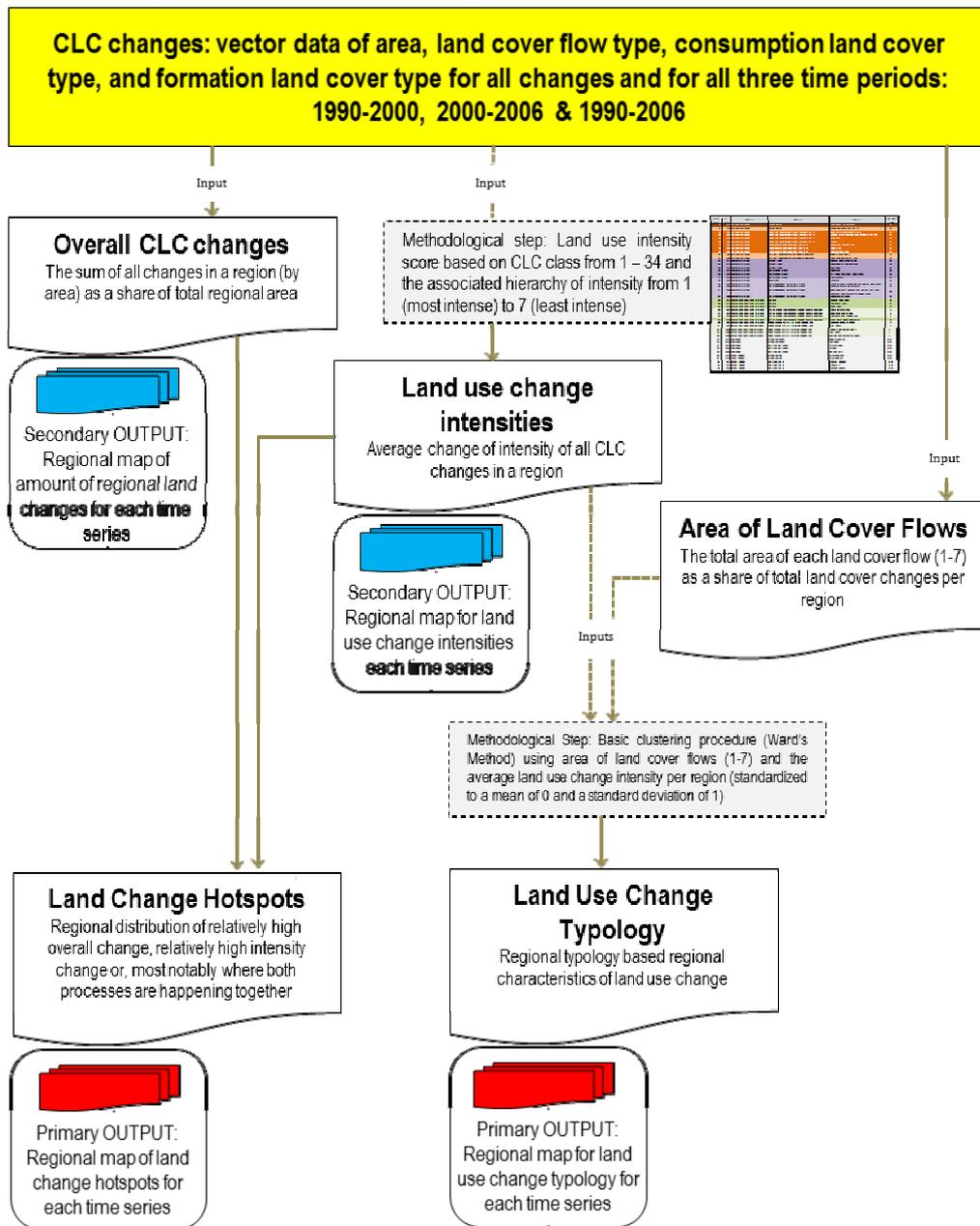


Figure 3 Methodological flow to analyse land changes in the EU LUPA project

Land Use Intensity

Land use intensity is defined as the degree of human intervention caused by activities taking place on a given parcel of land. It's quantitative assessment is created based on the inference that the ordering of the CLC classes – from CLC 34 – Glaciers and Perpetual Snow to CLC 1 – Continuous urban fabric – are representative of has an increasing level of land use intensity. CLC 35 – 44 reflect Wetlands and Water bodies and have not been considered in the analysis due to uncertainty over the associated socio-economic activities that may take place on them.

As shown in the column “intensity code” in Table 1, 34 of the 44 CLC classes are assigned an intensity score, with the score of 1 being the most intensive. This ordering is based on a conservative set of guidelines assumptions that are used to reinforce the plausibility of scoring land use intensity through the CLC classification hierarchy in lieu of additional validation.

According to the ranking in Table 1:

- The land cover classes between levels 35 and 44 (classified as Wetlands or Water bodies) have not been considered in the analysis. This is due to uncertainty over the associated socio-economic activities that may take place on these land cover types. These categories are not left out due to insignificance, but because they obviously relate to other rationales than the general land cover changes.
- In total, seven intensity scales have been generated – three levels in the Artificial surfaces class and two classes in both the Agricultural areas and Forest and Semi Natural Areas classes. In terms of the Artificial surfaces class, Continuous urban fabric is considered as the most intensive land cover type because it represents urban cores and centres of sub-urban areas where over 80% of the land is impervious (Bossard et al. 2000). Likewise, these are areas that are known to support a majority of economic activity in Europe, as well as being the home to a high share of the European population.

Table 1 Ranking of CLC classes based on Land Use Intensity

GRID CODE	CLC CODE	LABEL1	LABEL2	LABEL3	Intensity Code
1	111	Artificial surfaces	Urban fabric	Continuous urban fabric	1
2	112	Artificial surfaces	Urban fabric	Discontinuous urban fabric	3
3	121	Artificial surfaces	Industrial, commercial and transport units	Industrial or commercial units	2
4	122	Artificial surfaces	Industrial, commercial and transport units	Road and rail networks and associated land	2
5	123	Artificial surfaces	Industrial, commercial and transport units	Port areas	2
6	124	Artificial surfaces	Industrial, commercial and transport units	Airports	2
7	125	Artificial surfaces	Mine, dump and construction sites	Mineral extraction sites	2
8	126	Artificial surfaces	Mine, dump and construction sites	Dump sites	2
9	127	Artificial surfaces	Mine, dump and construction sites	Construction sites	2
10	141	Artificial surfaces	Artificial, non-agricultural vegetated areas	Green urban areas	3
11	142	Artificial surfaces	Artificial, non-agricultural vegetated areas	Sport and leisure facilities	3
12	211	Agricultural areas	Arable land	Non-irrigated arable land	4
13	212	Agricultural areas	Arable land	Permanently irrigated land	4
14	213	Agricultural areas	Arable land	Rice fields	4
15	221	Agricultural areas	Permanent crops	Vineyards	4
16	222	Agricultural areas	Permanent crops	Fruit trees and berry plantations	4
17	223	Agricultural areas	Permanent crops	Olive groves	4
18	231	Agricultural areas	Pastures	Pastures	5
19	241	Agricultural areas	Heterogeneous agricultural areas	Annual crops associated with permanent crops	5
20	242	Agricultural areas	Heterogeneous agricultural areas	Complex cultivation patterns	5
21	243	Agricultural areas	Heterogeneous agricultural areas	Land principally occupied by agriculture, with significant areas of natural vegetation	5
22	244	Agricultural areas	Heterogeneous agricultural areas	Agro-forestry areas	5
23	311	Forest and semi natural areas	Forests	Broad-leaved forest	6
24	312	Forest and semi natural areas	Forests	Coniferous forest	6
25	313	Forest and semi natural areas	Forests	Mixed forest	6
26	321	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Natural grasslands	7
27	322	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Moors and heathland	7
28	323	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Sclerophyllous vegetation	7
29	324	Forest and semi natural areas	Scrub and/or herbaceous vegetation associations	Transitional woodland-shrub	6
30	331	Forest and semi natural areas	Open spaces with little or no vegetation	Beaches, dunes, sands	7
31	332	Forest and semi natural areas	Open spaces with little or no vegetation	Bare rocks	7
32	333	Forest and semi natural areas	Open spaces with little or no vegetation	Sparsely vegetated areas	7
33	334	Forest and semi natural areas	Open spaces with little or no vegetation	Burnt areas	7
34	335	Forest and semi natural areas	Open spaces with little or no vegetation	Glaciers and perpetual snow	7
35	411	Wetlands	Inland wetlands	Inland marshes	N/A
36	412	Wetlands	Inland wetlands	Peat bogs	N/A
37	421	Wetlands	Maritime wetlands	Salt marshes	N/A
38	422	Wetlands	Maritime wetlands	Salines	N/A
39	423	Wetlands	Maritime wetlands	Intertidal flats	N/A
40	511	Water bodies	Inland waters	Water courses	N/A
41	512	Water bodies	Inland waters	Water bodies	N/A
42	521	Water bodies	Marine waters	Coastal lagoons	N/A
43	522	Water bodies	Marine waters	Estuaries	N/A
44	523	Water bodies	Marine waters	Sea and ocean	N/A

- CLC classes 3-9 (Industrial, Commercial and Transport Units or Mine, Dump and Construction Sites) are ranked highly in second place because they classify land that is highly manipulated and related directly to meeting the needs of socio-economic production.
- CLC classes 2 and 10-11 represent the third most intensive urban type. Class 2 – Discontinuous urban fabric – accounts for land where vegetated areas that cover between 20-70% of the land surface (Bossard et al. 2000). It therefore represents transitional, suburban areas between cities and the rural hinterland where the intensity of human intervention is reduced relative to Continuous urban fabric. Green Urban Areas and Sports and Leisure Facilities are also included in this group. On one hand, these are areas of increased protection compared to more intensive urban classes, but are still more intensive

than agricultural or forest land due to their proximity to urban areas, and thus heightened contribution to social functions.

- Agricultural classes are, for the most part, are grouped together because it is very difficult to differentiate agricultural intensities due to regional topographical, territorial, cadastral and economic (land value) conditions, which are strong drivers determining agricultural land structure (see Gabrielsen, 2005). The only distinction that has been made within the 11 agricultural classes is where the land classes in the groups Arable land and Permanent Crops are allocated an intensity score of 4 and Pastures and Heterogeneous Agricultural areas are given a score of 5.

The rationale behind this distinction is that the former group is indicative of agricultural areas that are strictly dedicated to food production through cropping. In agricultural terms this is characterized as an intensive activity demanding high inputs, especially fertilizer, water, labour and management (Gabrielsen, 2005). In contrast, the latter group is representative of a mosaic of agricultural activity with a generally lower level of intensity. For instance, by area, Pastures is a dominant CLC class in this group, and is an activity characterized as being relatively low-input (Gabrielsen, 2005). Agricultural areas with significant areas of natural vegetation and Agro-forestry Areas are included in the latter group, which further indicative of a pattern of reduced land use intensity.

- The 11 Forest and Semi-natural Areas classes are broken down into two groups, with CLC classes 23-25 and 29 having a score of 6 and the remainder having a score of 7. The reason for prioritizing the first group of classes is that they represent an economic production dynamic in the forest sector; where harvested forest areas are next classified as Transitional Woodland-shrub. By area, this is by far the most prevalent land cover transition that takes place in Europe. The remaining classes encompass landscapes either covered by vegetation without a specific production potential or by little or no vegetation as all. In turn, they are essentially natural landscapes with minimal prospects for substantial human intervention.

The utility of ranking CLC classes according to intensity allows for the possibility to assess land changes in terms of intensification or extensification of land use. To achieve this, all land changes are accounted based on the consumption intensity score (what the land changes from) and the formation intensity score (what the land changes to). The intensity score of each land change thus amounts to the difference between the two scores. For example:

- A change from Natural Grassland (CLC class: 26, intensity score: 7) to an Airport (CLC class 6, intensity score 2) is an intensification of 5.
- A change from Pastures (CLC class 18, intensity score: 5) to Natural Grassland (CLC class 26, intensity score 7) is and extensification of -2.

The sum of these scores for all of the land changes in a region is then divided by the number of land changes (regardless of the size of the change) to infer the intensity of land use change at a regional level for Europe. This also allows for the analysis of land use change hotspots, which combines the total area of land change with the average change in land intensity for each region to identify hotspots showing where extreme land cover changes have taken place due to large changes in terms of land area and/or substantial changes in land intensity.

2.5 Land Use Change Typology

Regionalizing land use change

An account of land changes are taken directly from the EEA's production of land cover flow (LCF) data. Based on the 44 CLC classes there are 1892 possible changes and the LCF data and classifies them into 50 CLC flows. These 50 flows are further grouped into 9 general CLC flows:

- a. lcf1 Urban land management
- b. lcf2 Urban residential sprawl
- c. lcf3 Sprawl of economic sites and infrastructures
- d. lcf4 Agriculture internal conversions
- e. lcf5 Conversion from forested & natural land to agriculture
- f. lcf6 Withdrawal of farming
- g. lcf7 Forests creation and management
- h. lcf8 Water bodies creation and management
- i. lcf9 Changes of Land Cover due to natural and multiple causes

For our typology we have not added lcf8 and lcf9 due to their causal uncertainty.

Using GIS, vector data for all of the considered LCFs is intersected by the NUTS2/3 administrative areas in order to regionalize the data. Accordingly, the main input into a regional clustering procedure is two perspectives; first, the distribution of the first seven LCFs (as a percentage of all changes) in each NUTS2/3 region. It has been considered to use the raw percentages of the LCFs as a share of all regional changes because it not only provides the relative distribution (percentages) of the LCFs, but also the amount of changes that have

taken place area-wise. The amount of land change is also then considered in the naming of the Land use change types.

The second input is the change of Land Use Intensity inferred by each of the LCFs. In order to bring the intensity data to a numerical level comparative to the LCF classes mentioned above, it has been standardized to a new mean of 0 and a standard deviation of 1.

The Ward's Method of clustering was conducted with queries for different numbers of clusters. This aimed at limiting outliers with only single or a few NUTS regions, while at the same time preventing too large clusters that do not allow for major regional variations to be highlighted. As a solution a total of 10 clusters have been determined as optimal.

Unlike the typology for the Prevailing characteristics of land use, where an aggregated typology for the full 1990-2006 time period was optimal, this situation is not replicated for the Land Use Change Typologies. This is due to the fact that coverage of CLC data is neither unanimous nor consistent for the three time periods and only including regions with full CLC representation would not sufficient cover the extent of the ESPON territory. Another reason for keeping the time periods separate is that providing a Land USE Change typology for 2000-2006 allows us to compare the results of the typology with the LUFs analysis. And not least, the ability to keep the typologies separate for each CLC time period improves the analytical capability of the typologies by allowing for more detailed analysis of the interplay between the temporal, spatial and socio-economic dimensions that both drive and react to land use change.

The results of the cluster analysis for each of the three available time periods⁴ produce 30 clusters, each of which is subjectively named based on the distribution of the seven LCFs in each region and the average change in Land Use Intensity for all changes. An example of the statistics for the 2000-2006 time period are presented in Table 2 where the colour scale from purple to pale orange represents the average change for each LCF in the regions of each cluster. For instance, it is identified that for the 198 regions in Cluster 1, an average of 1.246% of their areas when though changes characterized as Forest Creation and Management. Considering that this flow dominates in Cluster 1, it is not surprising that the average change of Land Use Intensity is quite neutral at 0.055. This reflects the reality of the Forests Creations and Management LCF, which is dominated by the flow of land between CLC classes 23-25 (Forests) and CLC class CLC class 29 (Transitional Woodland-shrub). As shown in Table 2 indicates no change in Land Use Intensity.

⁴ 1990-2000, 2000-2006 and 1990-2006

Similar tables to Table 2 were produced for each time series (these are presented in Section 4.3 during the description of each Land Use Change Type) to support the naming of the clusters. As the process unfolded iteratively, it became clear, as expected, that the same regional characteristics of change were typical in certain clusters across multiple time periods. Accordingly, Figure 4 shows that a total of 13 Land use change types have been identified out the 30 clusters (ten for each time series). As shown in the three columns on the right-hand side of the legend, seven of the types characterize clusters in all three time series' while one characterizes clusters in two of the three time series and five types characterize clusters in only one of the three time series.

As a means of incorporating land use into the typologies -beyond the extent is it acknowledged in the land cover flow data - the notion of land use intensity is central to both the clustering exercise and the classification of clusters. The columns labelled "Average Intensity" in Figure 4 show that the Land use change types are hierarchically ordered from the highest level of intensification down to the highest level of extensification. This is transposed into the nomenclature of the types so that the name of each one reflects the change of land use intensity (human intervention on the land for socio-economic purposes) due to the physical-economic-social characteristics of the changes.

Even though the nomenclature of the Land Cover Flow types infer land use to an even greater extent than the general CLC classification the inclusion of the intensity measure in both the clustering and the naming means that the EU LUPA land change typologies are able to effectively characterize land use change in Europe.

Table 2 Distribution of average change for each LCF in the regions of each cluster – 2000-2006

2000-2006	Average land change per region per cluster									
Land Cover Flows	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL8	CL9	CL10
Lcf1 urban land management	0,015	0,020	0,040	0,044	0,057	0,116	0,051	0,094	0,052	0,000
Lcf2 urban residential sprawl	0,009	0,031	0,047	0,082	0,107	0,220	0,112	0,010	0,070	0,000
Lcf3 sprawl of economic sites and infrastructures	0,043	0,080	0,107	0,165	0,273	0,283	0,222	0,063	0,375	0,015
Lcf4 agricultural internal conversions	0,132	0,077	0,101	0,068	0,056	0,043	0,045	0,347	0,005	0,000
Lcf5 conversion from forested & natural land to agriculture	0,016	0,044	0,050	0,033	0,030	0,024	0,064	0,022	0,000	0,000
Lcf6 withdrawal of farming	0,043	0,031	0,022	0,023	0,021	0,022	0,006	0,316	0,000	0,000
Lcf7 forests creation and management	1,246	0,795	0,456	0,311	0,136	0,161	0,092	0,716	0,013	0,000
Average intensity change per plot of land change	0,055	0,320	0,640	0,952	1,750	1,304	2,106	-0,350	2,814	4,688
Percent of region recording land change	1,528	1,116	0,879	0,815	0,784	0,920	0,631	1,775	0,519	0,015
Number of regions	198	123	148	72	48	107	16	17	10	2

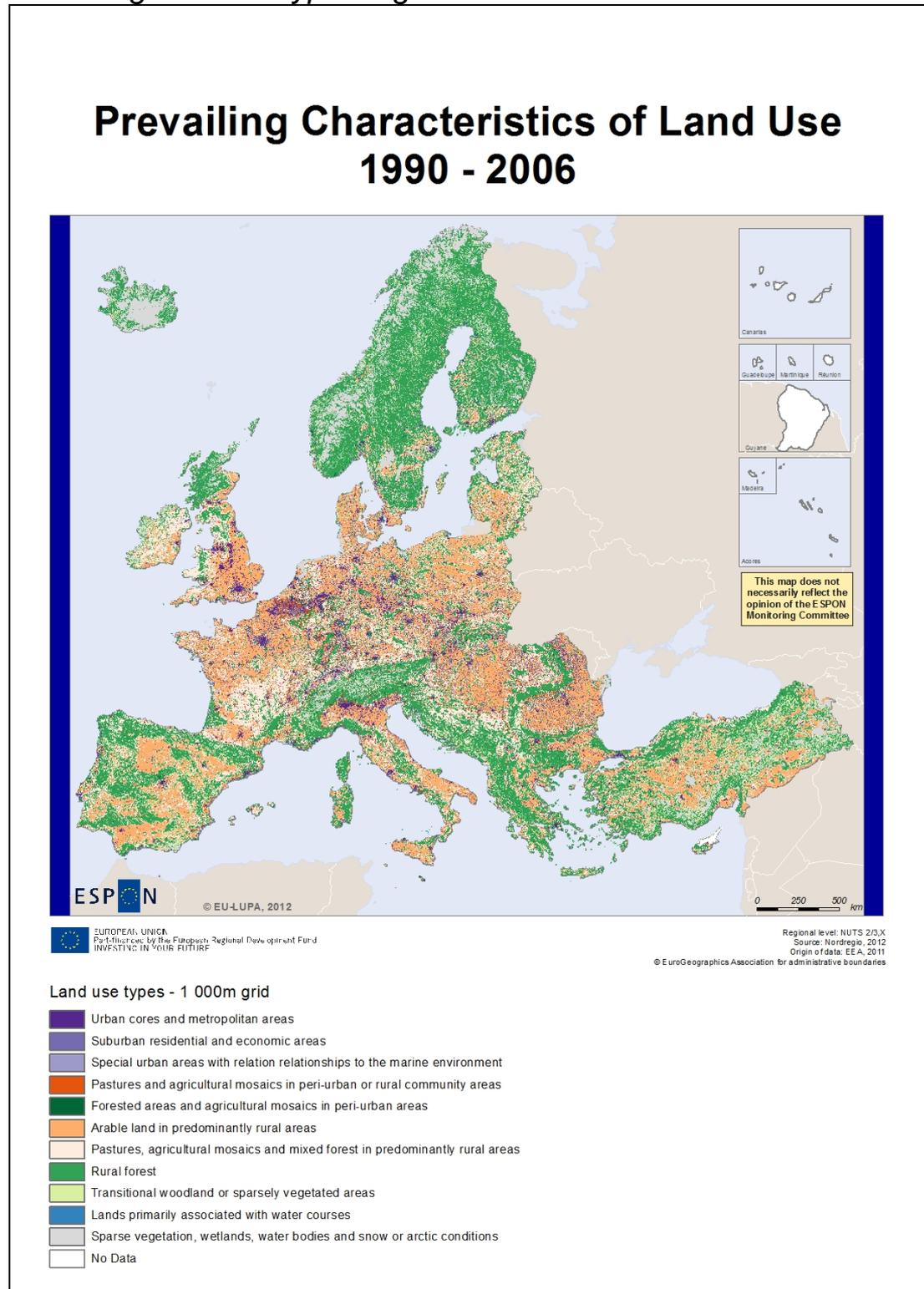
Land Use Change Types	Average Intensity			Cluster Number		
	2000-2006	1990-2000	1990-2006	2000-2006	1990-2000	1990-2006
Very high intensification with artificial surfaces mainly replacing natural areas	4,69	4,29	4,17	10	10	10
Very high intensification due to specific areas of residential and economic sprawl	2,11-2,81	3,08	2,45	7 and 9	7	9
High intensification due to residential and economic sprawl surrounding urban internal conversions	N/A	1,98	1,68		9	8
High intensification due to residential and economic sprawl	1,75	N/A	N/A	5		
High intensification due to residential and economic sprawl combined with forest conversions	N/A	1,52	N/A		8	
Medium-high intensification due to diverse urban processes	1,30	1,09	1,09 - 1,40	6	2	1 and 4
Medium intensification due to some urban sprawl combined mainly with forest conversions	0,95	0,72	0,85	4	3	5
Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl	0,64	0,44	0,62	3	6	7
Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl	N/A	N/A	0,35			3
Low intensification mainly due to agriculture and forest changes	0,32	0,20	0,05	2	4	2
Low intensification dominated by forest conversions	0,05	N/A	N/A	1		
Extensification due to agricultural processes and forest changes	N/A	0,00	N/A		1	
High extensification due to forest and agricultural changes but specifically the withdrawal of farming	-0,35	-0,35	-0,29	8	5	6

Figure 4 Legend of all Land use change types, their associated cluster value from the clustering procedures and the average change of land use intensity incurred by regions in each type

3 Results and Analysis

3.1 Prevailing characteristics of land use

Prevailing land use types – grid level



Map 1 Grid typology for the Prevailing characteristics of land use

Using the methodology described above, the results of the prevailing characteristics of land use typology at the grid level is presented in **¡Error! No se encuentra el origen de la referencia.**. The method of grouping and naming the thirteen clusters has produced eleven stable land use types covering the spectrum of landscape in Europe – from dense urban cores with intensive human intervention to sparse and remote natural landscapes. These land types are presented in Figure 5, which shows the distribution of each main land type within each cluster. Using this figure, along with the detailed matrix tables in Appendix 5.3, a short anecdote justifying each characterization is provided.

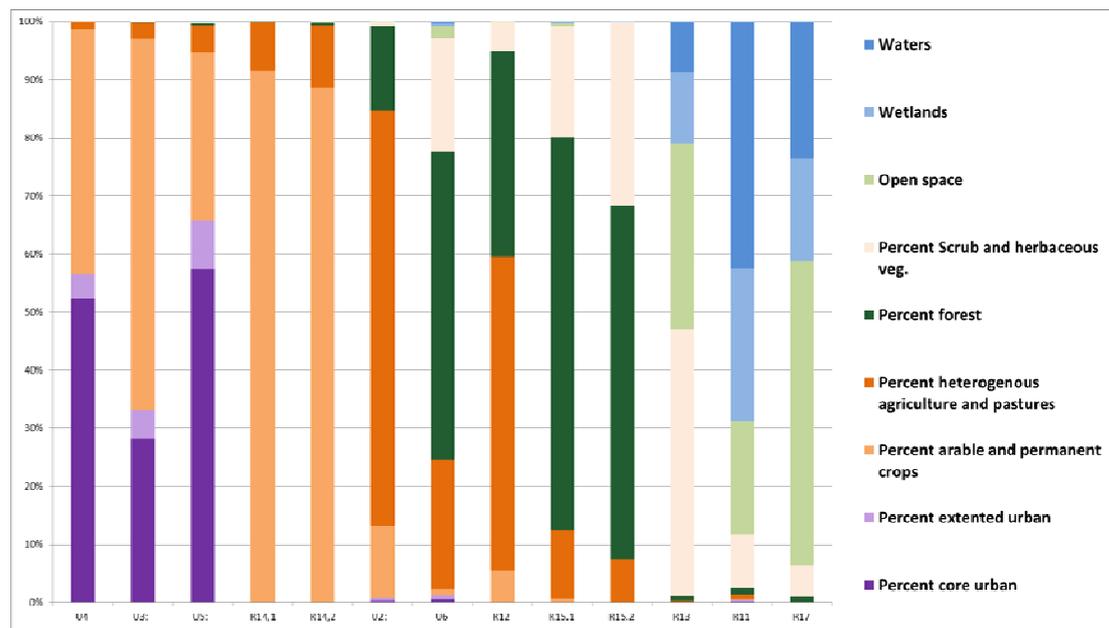


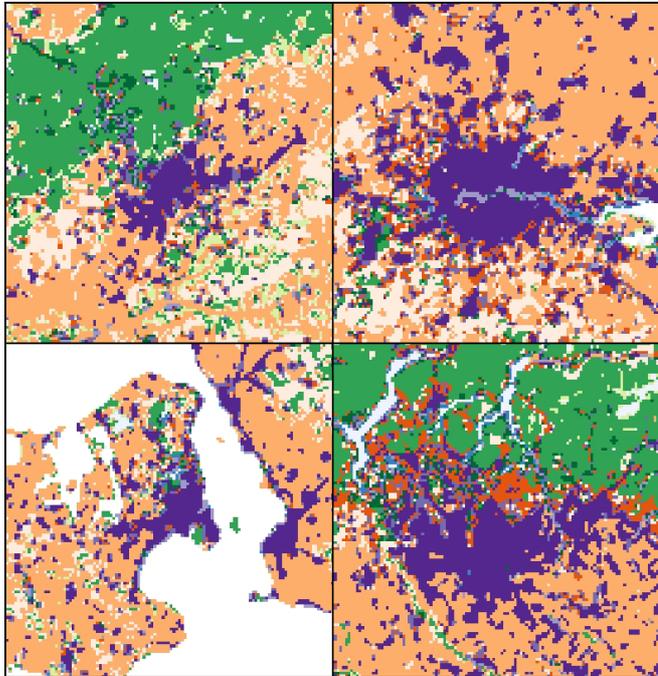
Figure 5 Distribution of main land types (based on CLC classes) in each cluster used to generate the gridded Prevailing characteristics of land use typology

1. U4: **Urban cores and metropolitan areas** – This land type is dominant for an average of 3.2%⁵ of the land in Europe. Over two thirds of all “CLC - continuous urban fabric” is accounted for in this land type and over 55% of the area is characterized as “CLC – artificial surfaces”. As shown in the maps of Madrid, London, Copenhagen and Milano this land type quite clearly conspires to what is generally viewed as the urban configurations of these city regions. The dark purple fills the city centres and expands outwards according to higher urban densities and transport infrastructure.

Each of the images in **¡Error! No se encuentra el origen de la referencia.** show that the urban cores and metropolitan areas land type “picks up” some land area that penetrates into suburban and

⁵ The “average” is calculated based on the statistical dominance each land type shows across the range of available CLC data from 1990, 2000 and 2006.

peri-urban areas. This is reaffirmed by the graph in Figure 5 showing that over 40% of this land type is actually typified as arable land and permanent crops. Again, this is viewed as an advantage of this typology in that it is achieving its aim of identifying the *prevailing land type* across the European landscape.



Map 2 Urban cores as shown through the results of the gridded typology on the Prevailing characteristics of land use. Clockwise from top-left: Madrid London Copenhagen Milano

1. U3: ***Suburban residential and economic areas*** – Slightly higher than urban cores and metropolitan areas, this type is dominant for an average of 3.31% in Europe. Yet looking at the map of the urban cores above, it is quite easy to see its distinction from the previous land type. Whereas the urban cores and metropolitan areas basically accounts for exactly what its name implies, the lighter purple accounts for suburban and peri-urban conditions that are extending into the countryside. This is especially noticeable in the urban maps above where Madrid, Milano and to a lesser extent Copenhagen show that a “sprawled” urban configuration into the rural hinterland appears to be evident. In contrast, this seems to be less prevalent in London where satellite towns with a denser urban fabric seem to be the norm.
2. U5: ***Special urban areas with relationships to the marine environment*** - Accounting for an average of only 0.7% of Europe’s land, this is a very interesting urban land type. Even though the statistical results in Figure 5 above show a very low inclusion of

waters or wetlands (less than 2%), analysis of the spatial distribution of this land type shows that the cluster analysis has identified land dominated by urban processes in that are in direct proximity to marine environments. As shown by the maps above, the urban area in direct proximity to the River Thames in London is included in this type, just as are the port and coastal areas surrounding Copenhagen. This pattern extends to all port, river, lakeside and coastal areas in Europe.

The statistical results presented in Figure 5 and Appendix 6.3 validate this land type by showing the comparatively low inclusion of non-artificial surface land types (less than 30%). It also accounts for roughly 70% of land classified as port areas by CLC 2006 data.

3. R14.1 & R14.2: ***Arable land in predominantly rural areas*** – This land type accounts for an average of 22.36% of land in Europe. As shown in Figure 5 above, it is the result of merging two individual clusters that showed to have quite similar characteristics. Over 85% of the land in both clusters relates to land classified as “arable land” or “permanent crops” by the aggregated CLC data. The remaining area is almost exclusively related to pastures and rural mosaics. **¡Error! No se encuentra el origen de la referencia.** shows that high concentrations of arable land are notable throughout continental Europe but excluding the Nordic countries, the Alpes region, Northwest Spain and the western Balkans where forest land cover is more dominant.
4. U2: ***Pastures and agricultural mosaics in peri-urban areas*** - Unlike arable land in rural areas, this land type accounts for only 3.28% of Europe. Based on its distribution in the urban core maps above it is clearly noticeable that it also has a much different cadastral structure compared to the more homogeneous distribution of arable land in rural areas. In this case land is separated much more heterogeneously into pastures and arable areas that are close proximity to urban conurbations. Both of these factors indicate that the relatively small land plots could be related to higher property values associated with their urban proximity.
5. U6: ***Forested areas and agricultural mosaics in peri-urban areas*** – At only 1.7% it is similar to the previous land type in that it covers a comparatively small area of Europe compared to rural forest. As is noticeable in the case of Milano and Copenhagen above, this relates to the fact that it accounts for land dominated by forested areas, but which is located in quite close proximity to larger urban areas.
6. R12: ***Pastures, agricultural mosaics and mixed forest in predominantly rural areas*** – Covering an average of 21.61% of

Europe, this is the third most extensive land type in Europe. Similar to the previous land type (Forested areas and agricultural mosaics in peri-urban areas) it is a very diverse land type in which statistically significant proportions of land are covered by non-irrigated land, pastures, agricultural mosaics and forest land cover. It appears that this land type is accurately accounting for rural areas that have quite diverse, transitional or heterogeneous land functions across a variety of sectors (e.g. diverse types of farming, forestry, tourism, etc.)

7. R15.1 & R15.2 **Rural Forest** – With an average coverage of 32.4% of Europe this is the most extensive land type. Similar to arable land in predominantly rural areas, this is the second land type that involves the amalgamation of two clusters into one land type. Figure 5 visualizes the justification for this by showing that both clusters have broad leaved, coniferous or mixed forest covering over 60% of the landscape. The matrix tables in Appendix 6.3 show that the only difference between the two clusters is a tradeoff between the amount of land covered by scrub and/or herbaceous vegetation associations and that which is covered by pastures heterogeneous agricultural areas.
8. R13: **Transitional woodland or sparsely vegetated areas** - Accounting for an average of 5.7% of Europe the statistics indicate that this land type is mainly transitional woodland and scrub, which is often associated with forestry activities, as well as open spaces with little or no vegetation. Spatially, this land type is concentrated in Sweden (likely associated with transitional woodland related to logging activity) and Ireland, southern Spain, and Turkey (likely related to areas of little very sparse vegetation and large areas of open land).
9. R11: **Lands primarily associated with water courses** – As shown by the statistics in Appendix 6.3, a majority of this land type is explained by the dominance of inland waters and this land type accounts for areas that are in direct proximity to inland watercourses. Statistically it is rather insignificant as it only accounts for less than 0.3% of the space mapped by CLC data.
10. R 17: **Sparse vegetation, wetlands, water bodies and snow or arctic conditions** – This land type accounts for roughly 7% of Europe and it is quite clear on **¡Error! No se encuentra el origen de la referencia.** above that this is concentrated in areas with seasonal or perpetual snow cover, such as Iceland, the Alpes and Norway. Large inland lakes such as those in Sweden are included in this land type, as well as the expansive intertidal flats in The Netherlands and Denmark.

Overall, spatial characteristics of land cover appear very clear on the map. For example, differences between urban versus non-urban as well as different types of rural landscapes are striking. This is especially true in relation to geography and topography, but also in terms of identifying different types of rural landscape. For example, the plethora of forest in the Nordic countries, in Scotland, and northern Spain provides a preamble for the importance of the forest sector in these regions.

The differences between arable land with a higher production potential (shown in orange) compared to less productive pasture, mosaics and mixed vegetation (shown in beige) are also notable. Another very interesting observation is noted by the distribution of the land cover types among the first three “urban” land types where, artificial surface land covers are almost exclusively paired with areas characterized as having some sort of agricultural function. In contrast, the statistical results in Appendix 6.3 show that an extremely small amount of forested areas are grouped in “urban” land types. This further validates the typology by reaffirming that a vast majority of land surrounding urban settlements is dominated by land types reflecting some sort of socio-economic consumption.

Besides enabling a detailed overview of the distribution of dominant land types across the European landscapes, the main utility of the stable land use types is to serve as an input into the generation of prevailing land types at the regional level. At the same time, the gridded results have also been valuable for characterizing landscapes at the regional and local level in the case studies. As such, further analysis of the results is available through each of the four case studies.

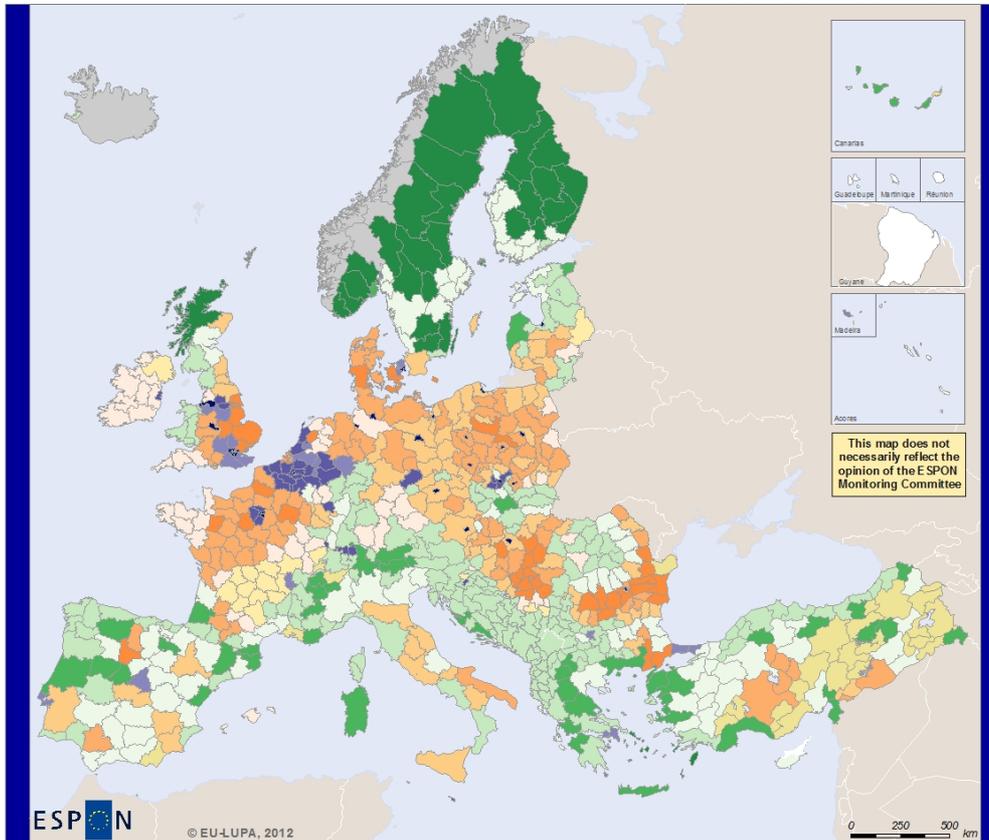
Stable land use types – regionalized into prevailing regional land use types

The gridded stable land use types were transformed into a regionalized classification using a basic clustering procedure (Ward’s method). This clustered regions according to similarities in the distribution of over land cover. The result was an initial identification of 13 clusters showing distinct characteristics as well as sensible group sizes. In addition, however, an algorithm emphasizing the urban component by providing an additional category of urban sprawl into predominantly rural areas was introduced. This category emphasize regions with urban and infrastructural land (Corine classes 1-11) above a threshold of ½ a standard deviation above the European mean.

Based on this total of 14 distinct types a subjective naming has been provided by means of the composition of the CLC classes in each cluster. In practice it means that the descriptions of the land use characteristics

generalized as stable types at the Nuts2/3 level and presented on the map above takes its starting point in the regional distribution of the different land types determined by the clusters. But as a means of interpretation both the typology at the gridded level (as presented in **¡Error! No se encuentra el origen de la referencia.**), as well as detailed information regarding the distribution of CLC data (as presented in Table 3 and in more detail for all CLC time periods in Appendix 5.4) have been useful for naming each of the generated types in **¡Error! No se encuentra el origen de la referencia..**

Prevailing Characteristics of Land Use 1990 - 2006



EUROPEAN UNION
Participates by the European Regional Development Fund
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Regional level: NUTS 2/3,X
Source: Nordregio, 2012
Origin of data: EEA, 2011

© EuroGeographics Association for administrative boundaries

Regional land use types

- Urban cores and metropolitan areas
- Suburban areas
- Suburban or peri-urban areas
- Arable land in peri-urban and rural areas
- Arable land and pastures in predominantly rural areas
- Rural arable land with permanent crops and some forest
- Rural mix dominated by pastures with some arable land
- Rural pastures and complex cultivation patterns
- Diverse land use in rural areas
- Diverse rural forest coverage with dispersed areas of permanent crops, pastures and arable land
- Arid mixed forest
- Rural forest
- Sparse vegetation with some forest and pasture
- Sparsely vegetated areas
- No Data

Map 3 Regional typology of the prevailing characteristics of land use

Table 3 The distribution of CLC 2006 within clustering, leading to the formation of prevailing regional land use types

CLC classes		#	Cluster Numbers													
Label 1	Label 3		CL15	CL16	CL20	CL02	CL07	CL03	CL-05	CL09	CL04	CL6	CL12	CL11	CL01	CL10
Artificial surfaces	Continuous Urban Fabric	1														
Artificial surfaces	Discontinuous urban fabric	2	52,41	18,15	13,38	4,78	4,23	3,99	4,05	2,51	3,15	3,07	1,94	1,17	0,63	0,32
Artificial surfaces	Industrial or commercial units	3														
Artificial surfaces	Roads and rail networks and associated land	4														
Artificial surfaces	Port areas	5														
Artificial surfaces	Airports	6														
Artificial surfaces	Mineral extraction sites	7	11,05	2,65	3,36	0,82	0,58	0,60	0,57	0,34	0,50	0,41	0,40	0,20	0,16	0,13
Artificial surfaces	Dump sites	8														
Artificial surfaces	Construction sites	9														
Artificial surfaces	Green urban areas	10														
Artificial surfaces	Port and leisure facilities	11														
Agricultural areas	Non-irrigated arable land	12														
Agricultural areas	Permanently irrigated land	13	11,75	32,98	27,53	71,61	52,66	40,29	24,94	6,99	28,23	12,32	15,40	16,97	2,36	0,71
Agricultural areas	Rice fields	14														
Agricultural areas	Vineyards	15														
Agricultural areas	Fruit trees and berry plantations	16														
Agricultural areas	Olive groves	17														
Agricultural areas	Pastures	18														
Agricultural areas	Annual crops ass. With permanent crops	19	9,97	23,81	27,99	10,22	20,17	19,54	41,85	55,77	17,22	26,95	18,59	16,78	2,65	3,29
Agricultural areas	Complex cultivation	20														
Agricultural areas	Agriculture with sign. Areas of natural vegetation	21														
Agricultural areas	Agro-forestry areas	22														
Forest and semi natural areas	Broad leaved forests	23														
Forest and semi natural areas	Coniferous forests	24														
Forest and semi natural areas	Mixed forests	25														
Forest and semi natural areas	Natural grasslands	26	9,57	18,74	25,36	9,26	18,69	33,14	22,19	32,36	44,46	53,53	54,31	31,67	75,34	42,78
Forest and semi natural areas	Moors and heathland	27														
Forest and semi natural areas	Sclerophyllous vegetation	28														
Forest and semi natural areas	Transitional woodland shrub	29														
Forest and semi natural areas	Beaches, dunes, sands	30														
Forest and semi natural areas	Bare rocks	31														
Forest and semi natural areas	Sparsely vegetated areas	32	0,10	0,10	0,25	0,09	1,32	0,50	0,23	0,03	3,47	2,24	7,94	28,73	3,42	42,66
Forest and semi natural areas	Burnt areas	33														
Forest and semi natural areas	Glaciers and perpetual snow	34														
Wetlands	Inland marshes	35														
Wetlands	Peat bogs	36														
Wetlands	Salt marshes	37														
Wetlands	Salines	38														
Wetlands	Intertidal flats	39	4,94	3,54	2,00	3,02	2,28	1,87	6,05	1,99	2,88	1,40	1,35	4,48	15,35	9,78
Water bodies	Water courses	40														
Water bodies	Water bodies	41														
Water bodies	Coastal lagoons	42														
Water bodies	Estuaries	43														
Water bodies	Sea and ocean	44	0,21	0,03	0,12	0,19	0,06	0,05	0,12	0,01	0,09	0,07	0,08	0,01	0,09	0,33
		Number of regions	29	32	21	41	97	81	52	18	97	171	56	56	30	27
		Percent of Europe	0,22	1,38	1,20	3,57	11,89	10,82	5,48	2,05	15,24	17,75	7,09	4,60	12,89	5,81
			Urban cores and metropolitan areas	Suburban areas												Rural forest

1. **Urban cores and metropolitan areas** – 29 regions – show a situation where almost 60% of regions have land characterized as urban cores and metropolitan areas in the grid-level typology. As such, their spatial distributions are quite similar. At the same time, when grid data are summarized at the administrative level, it becomes very evident that urban cores in larger regions are becoming overshadowed by more dominant (rural) land types. As a consequence regions in this type are generally smaller regions which can be characterized as regional city-states, where peri-urban areas and rural hinterland is accounted for in neighbouring regions. Thus, the urban land features in this type are influential not only for the social, economic and environmental performance of regions within this type but also those regions within near proximity.
2. **Suburban areas** – 32 regions – Urban land types have the dominating influence in these regions and that there is a clear connection to the gridded type “Suburban residential and economic land extending into peri-urban areas”. Urban and infrastructural related land typically consumes 15-20% of the region and as a result, activities related to urban and infrastructural settings are highly influential in characterizing overall land use in the region. The distribution of regions in this type – for instance, most of Belgium – reiterates a noteworthy characteristic when regionalizing grid level results.

The results of the cluster analysis emphasize the vast difference in the size of NUTS regions throughout Europe. Even though the NUTS 2/3 hybrid helps overcome some of the problems with disproportionate regional sizes it is quite clear that heterogeneity is an unavoidable factor influencing the cluster results. For example, relatively small regions (in terms of area), such as those around Brussels and especially city-states have proportionally shares of urban land covers compared to relatively large regions that may be endowed by larger cities as well; such as Regions in Spain, France, Italy and the Nordic countries. As a result even though a city such as Madrid has an extensive urban area and a huge regional (and even national) influence, it can only be characterized as a “suburban or peri-urban” region because rural land covers still dominate in a physical perspective.

3. **Suburban or peri-urban areas** – 21 regions – Regions in this cluster are either situated in near proximity to large urban centres – such as London or Paris – or are similar to the previous land type in the sense that they have a higher urban land component because

of the relatively small area of the region. The urban and infrastructural component typically covers around 15% (and up to 20%) of the land. Relatively high levels of artificial surfaces are also evident in certain regions where large urban areas are situated in relatively large regions (by physical size). For example, regions in Spain or those adjacent to city-states such as London fall into this group. Other examples include larger industrial areas, for instance in southern Poland, or further north in the UK where the region between Liverpool and Manchester serves as a densely populated hinterland for the city activities.

4. ***Arable land in peri-urban and rural areas*** is dominated by the very high content of arable land defined through CLC classes 12 to 15. These categories cover more than 70% of the land in the 41 regions characterized by this type. The historic role of the agricultural production potential of this land use type for Northern Europe, Central Europe and the Balkans is clearly indicated through its distribution as the immediate hinterland around the major urban centers in the Central-North, and the matrix which constitutes the core population areas along the rivers in the Balkan area.

In addition to what is indicated through the three previous land use types, it is also notable that this land use type is becoming swallowed up by the sprawl of urban and residential related activities; especially in Central Europe. Being among some of the more fertile areas in Europe, the high intensities of crop growth has demanded a process where intensification is supported through increasing land prices. This, in conjunction with better loaning opportunities has limited the options for more traditional land use approaches. As such, these regions are an object of continued speculation in relation to future development and policy related to non-agrarian production and reproduction land uses.

5. ***Arable land and pastures in predominantly rural areas*** includes 97 regions that share many similarities to the "Arable land in peri-urban and rural areas" type discussed above. Both types are structured by combinations of the two grid typologies of "Arable land in predominantly rural areas" and "Pastures and agricultural mosaics in peri-urban or rural community areas". They show a clear dominance of arable land in combination with permanent crops and some forest land. Both types also have CLC classes 1-3 covering over 4% of the regional area. The main difference however, is that while arable land covered more than 70% in the previous land use type it is down to 50% while pastures, permanent crops and forested areas make up for the remaining differential.

In a von Thünean perspective of concentric farming types around urban areas it is likely that, compared to the previous land use type, we are moving to the next intensity level of concentric circles around the major cities. It seems common that regions in this type could still be highly influenced by the major cities and their constant expansion, though.

Also, compared to the previous prevailing regional land use type, we are clearly moving into a situation where the land use mix is slightly more diverse and has a slightly lower production potential than strictly arable land. While this is a predominant characteristic of more peripheral areas in Northern Europe, it at the same time has occasional appearance in Southern Europe, for instance with coverage in Spain, Italy, Turkey and Greece, but especially in the Balkan region where it constitutes a natural continuum from the more fertile lowland towards toward the more mountainous parts of the countries. Nevertheless, it is clear that agricultural activity is still quite prevalent in these regions, but the relatively arid climate for many of the regions means that agriculture is often dominated by less intensive permanent crops.

6. ***Rural arable land with permanent crops and some forest*** is characterized by a mix of arable land, pastures, mosaics and some forest in the 81 regions covered by this regional type. Even with the risk of stretching the von Thünen analogy too long, these regions seem to add a further step in the von Thünen intensity ladder as it is very much a continuation of the trend noted in the previous types (where the dominance of agriculture is waning toward increased presence of agricultural mosaics, often associated with permanent crops, pastures and dispersed forest areas). Compared to the previous regional type, this one shows an increased reduction in arable land - even though it is still dominant with a percentage of around 40, followed by forest areas above 30% while permanent crops are around 20%.

This prevailing regional type has a very diverse extent in Europe; stretching from southern Sweden and Finland through eastern, central and western Europe, while also playing an important role in the south. Its coverage is notable throughout Spain, in central as well as in northern Italy, Romania, Greece and Turkey.

This type of diverse spatial coverage adds credence to the notion of it being a very diverse land structure, both in terms of rural land covers, but especially in relation to the mixed role of urban and rural landscapes.

7. ***Rural mix dominated by pastures with some arable land*** show a diverse land cover throughout its 52 regions. Again, this is a continuation of the trend in the previous three types where arable land, pastures, agricultural mosaics and sporadic forest are being replaced by first and foremost the permanent crops and forest land covers. However, given that no land type accounts for more than 43% of the areas in these regions it is safe to assume a quite diverse land mix in these regions.

Spatially, regions in this type are situated together with the following regional type in the border zone between northern and southern land production types. This seems to indicate a production zone where on-going changes in climate could result in important changes both positively and negatively.

What is even more interesting is the connection to the land situated in coastal areas stretching from Ireland through south-western England, Normandy, northwest coastal areas in The Netherlands and Germany, as well as down to the Spanish isles in the Mediterranean. It also appears to have relations to inland water and watercourses in central Europe. In both cases the interaction between land and water are important as they generate challenges as well as new opportunities. For example, opportunities exist in relation to tourism and possibilities for different types of renewable energy production.

8. ***Rural pastures and complex cultivation patterns*** is a relatively small but distinct type which to some extent covering 18 regions. It resembles the previous regional type by having a very high component of permanent crops in combination with some arable land as well as pastures, some agricultural mosaics and mixed forest. Its absolute dominance in south-central France and more occasional appearance in Latvia, Northern Ireland, Romania as well as in a few regions in central Balkan show that land is dominated by pastures, agricultural mosaics and mixed forest, while the presence of arable land is significantly diminished compared to the previous regional land types. This seems to point toward a few conditions that could be influencing the rural consumption of land. It is quite clear that pasturing is likely the dominant form of rural land use and the presence of forest may not be as high as compared to Estonia, Latvia or Romania where mix between forest and pasture activities is evident.
9. ***Diverse land use in rural areas*** is among the three major types encompassing a total of 97 regions, but actually represented through two distinctly different types – a northern and a southern

type. These show similar overall coverage characteristics, but representing very different landscapes. Being one of the major categories represented in southern Europe and Turkey, it depicts what best can be characterized as typical Mediterranean landscapes. There is a diverse mix of land cover types with statistically significant levels of arable land (25-30%), permanent crops (15-20%) and forests (40-50%).

Similar characteristics account for the distribution of this type in the Balkans, primarily in Romania and Bulgaria. The northern landscape encompassing this type is characterized by the same mix of land cover, but with arable and grazing land being the dominant characteristic compared to forest and scrub coverage in the southern regions. Furthermore, from southern Scotland, across Norway, Sweden, and Finland, as well as into the Baltic States this type is connected to the expansion of more urban activities into former rural areas previously dominated by forestry.

10. ***Diverse rural forest coverage with dispersed areas of permanent crops, pastures and arable land*** is by far the largest type represented by a total of 171 regions in Europe, and mainly related to mountainous regions dominated by forest. More than 50% of the land is forested, but substantial input of permanent crops (25-30%) and arable land (10-15%) provide a basis for other economic input. However, such a large number of regions in a single clustering with such large variation in terms of landscapes and accessibility make it difficult for further generalization.
11. ***Arid mixed forest*** - represented through 56 regions, this type is in many ways a continuation of the southern type of the diverse land use in rural areas, but with a higher percentage of forest (50-60%) and it is situated in areas with more mountainous characteristics. It stretches across the whole Mediterranean area from Portugal in west to the most eastern regions in Turkey.
12. ***Sparse vegetation with some forests and pastures*** has been identified throughout mountainous parts of Europe, and with a major part of the 56 regions situated in Turkey, while the others are dispersed over most of Europe. The regions are characterized by a mixture of forests (30-35%) in combination with sparse vegetation (25-30%) and with scattered areas of arable land (15-20%) and permanent crops (15-20%). It seems safe to assume the land-based production potential could be quite low in terms of traditional rural activities.

13. **Rural forest** typifies 30 regions with a clear northern orientation and where forest covers more than 75% of the areas, while water and sparsely vegetated areas constitutes the rest. In a Nordic setting these areas are responsible for a major part of forestry in the north stretching from Scotland through Norway, Sweden and Finland.
14. **Sparsely vegetated areas** constitute a total of 27 regions, mainly situated in Norway and Iceland, being characterized by a split between sparse vegetation and forest.

3.2 Connecting socio-economic parameters and intensities to the the prevailing characteristics of land use at the regional level

Generalizing the socio-economic characteristics

As already mentioned in chapter 1 of this report two major socio-economic characteristics – population density and GDP – are useful indicators in relation to the two major dimensions of human activities. On one hand the presence of greater concentrations of people is quite clearly indicative of higher land use intensity, not the least through the development of artificial surfaces in order for people to establish their everyday lives and routines in space, but also through the desire for increased living and recreation space reiterates that increased population in a given area creates more intensive land use. GDP, on the other hand, show another dimension of human activities as increasing economic output is equal to situations of greater land intervention.

In many cases the two indicators can be considered as measures basically showing the same issue – intensity of human activities. There is, however, an important potential territorial distinction between them. While population density directly show a continuous presence of humans involved in the use of the land either for production or reproduction related activities, the GDP indicates human exploitation of land which does not necessarily require such a continuous presence, or showing that even a low level of population density may result in an intensive use of the land. This is for instance shown in rural areas where high levels of GDP are maintained in situations with declining population because a continuous intensification in land use is taking place through the replacement of manpower by technology.

As emphasized in chapter 1 there are problems connected to both indicators. In relation to population density each individual is only

registered in one location, usually the place characterized as place of residence. But for most people their activities are not only related to the land in and around this place. Residents in suburbs and within commuting distance to larger towns or cities have their daily activities tied to different places. And in connection with vacations, second homes, visits to national parks, to the beach etc. several locations are involved. A similar problem exists in relation to GDP being a perfect indicator of intensity is that economic outcome of the land use activities may not always be registered where the economic activity takes place. For instance, the registration of the economic outcome of production from a factory may depend on the accounting system, i.e. whether it is registered where the production takes place, where the workforce is living, or where the central office of the factory is situated. Similarly the energy outcome of a windmill may be registered where it is situated or where the owner of the mill is residing.

But even with these constraints in mind, both population density and GDP are presumed as robust indicators of the two major dimensions in relation to land use intensity.

Overall intensity relations

Based on the distribution of CLC categories for each of the grid cells in each of the NutsX regions an average measure of intensity for each of the regions has been calculated. Calculating a simple correlation between these intensities and the GDP and Population Densities in 2000 and 2006 respectively results in the correlation coefficients shown in the first row of Table 4 below.

Table 4 Correlation between intensities and GDP and Population Density in 2000 and 2006

Pearson Correlation Coefficients			
Prob> r under H0: Rho=0			
	Correlation Coefficient between intensities and:	Probability of rejection	Number of regions
GDP 2000	-0,2113	<0,0001	674
GDP 2006	-0,23137	<0,0001	604
Population Density 2000	-0,38166	<0,0001	618
Population density 2006	-0,38012	<0,0001	648

It is important to emphasize that this correlation, even the numbers may be seen as low, are significant (p<.0001).

Not all regions did provide values for GDP and Population density in all years so only regions providing aggregated data on intensity, GDP and Population density have been included in the analysis, and explain the differences in number of regions included between the years and parameters. In all cases the correlations are clearly statistical significant ($p < .001$), and the differences between the two years, 2000 and 2006, are very small, showing that it is not so much the absolute levels – GDP in 2006 considerably larger compared to 2000 – but the regional differentiation that counts. And the correlation coefficients are negative due to high values for intensities indicate low level of intensities, while low levels indicate high intensities, as explained in the methodology.

Population Density: The level of correlation is generally much higher in relation to population density compared to GDP, for instance being at a level of -0,38012 for Population density in 2006 while it is -0,23137 for GDP in 2006. This relates to the fact that even changes in demographic parameters may differ across regions, they are much more stable over time, and in this context primarily influenced by the territorial characteristics connected to urban versus rural structures. Even though mobility influences the population densities the changes are rarely short term and abrupt to an extent that will be able to result in marked changes within the time frames we are talking about here. Consequently regional variations are less tied to national settings and more to regional characteristics, which obviously show through a higher regional correlation.

Gross Domestic Product: In contrast, regional economic performance is fluctuating much more because it is influenced by long term as well as short term changes where only a portion of capital is fixed, and therefore is less bound to specific territories. As a consequence the national setting – and thereby the more recent history – results in differences between nations which tend to fluctuate to a greater degree than population density. This results in differences in national levels which in the end show as lower level of correlation at the regional level.

Elimination of national differences

As a consequence of the latter – the influence of differences in GDP between EU countries – the elimination of these differences is necessary in order to enable a more precise comparison between regions. And a simple way to do this is by calculating national indexes for the parameters where such national differences exist. National averages of for instance regional GDP in 2006 has been calculated, and by dividing each of the regional GDP values in 2006 by the national average an index value is

generated. These index values are then used instead of the original GDP values as they instead of national differences show more comparable regional variations in GDP which can be applied in the analysis.

A transformation procedure has been applied in relation to Population density as well. Due to the very large differences in population density between urban dominated and rural dominated regions which resembles an exponential relation, the densities have been re-calculated by a logarithmic function (log10) whereby a data structure resembling a linear structure is achieved.

Table 5 Overview of intensities and original and re-calculated values for GDP and Population Density in 2000 and 2006

Intensity and regional socio-economic parameters - GDP and Population density - in 2000 and 2006											
	Intensity	GDP in 2000	Regional Index GDP in 2000	GDP in 2006	Regional Index GDP in 2006	Population density 2000	Log10. Pop density 2000	Regional Index Pop. Density 2000	Population density 2006	Log10. pop density 2006	Regional Index Pop. Density 2006
01, Urban cores and metropolitan areas	3,80	23.874	1,75	31.621	1,74	5.207	3,72	11,26	5,077	3,71	10,37
02, Suburban areas	4,51	19.707	1,05	24.600	1,07	638	2,80	1,56	657	2,82	1,55
03, Suburban or peri-urban areas	4,80	22.228	1,24	29.037	1,20	856	2,93	4,47	832	2,92	4,02
04, Arable land in peri-urban and rural areas	4,43	10.019	0,96	15.150	0,87	122	2,08	0,36	120	2,08	0,34
05, Arable land and pastures in predom, rural	4,69	11.035	0,91	15.752	0,92	115	2,06	0,40	115	2,06	0,37
06, Rural arable with perm, crops and forest	5,01	9.115	0,91	12.079	0,91	107	2,03	0,55	108	2,03	0,55
07, Rural mix dom, by pastures with arable	5,03	19.184	0,95	24.120	0,93	121	2,08	0,31	129	2,11	0,34
08, Rural pastures and complex cult, patterns	5,36	16.919	0,86	20.650	0,87	62	1,80	0,16	63	1,80	0,15
09, Diverse land use in rural areas	5,29	12.067	1,04	18.795	1,01	103	2,01	0,87	105	2,02	0,84
10, Diverse rural forest intersected by other	5,55	10.427	0,98	14.801	0,96	109	2,04	0,59	110	2,04	0,57
11, Arid mixed forest	5,46	11.355	0,97	18.818	0,99	73	1,86	0,50	105	2,02	0,56
12, Sparse vegetation with forest and pasture	4,48	5.081	0,80	20.120	1,05	72	1,86	0,51	79	1,90	0,49
13, Rural (Northern) forest	5,22	25.044	1,01	30.904	1,02	17	1,23	0,40	17	1,23	0,38
14, Sparsely vegetated areas	3,47	na	na	na	na	13	1,10	0,14	13	1,12	0,14

Besides the calculated intensities for each of the prevailing characteristics of regional land use in column 1, the original averages in GDP in 2000 and 2006 are shown in columns 2 and 4, just as the original averages of population densities in 2000 and 2006 are shown in columns 6 and 9, the calculated index values for all four values are shown in columns 3, 5, 8 and 11. In the description above the emphasis has been on the need of indexing the GDP values, but in order to see the impact of a similar procedure for the population densities similar calculations have been conducted for both population densities in 2000 and 2006. And finally the logarithmic re-calculation of the population densities is shown in columns 7 and 9.

In order to take advantage of the adjusted data and the distribution of values on the prevailing characteristic types, a more detailed correlation analysis is required.

Correlations of intensities of Types of Prevailing Characteristics and the socio-economic parameters.

The resulting correlation matrix is shown below:

Table 6 Overview of intensities and original and re-calculated values for GDP and Population Density in 2000 and 2006

	Intensity	GDP in 2000	Regional Index GDP in 2000	GDP in 2006	Regional Index GDP in 2006	Population density 2000	Log. Pop density 2000	Regional Index Pop. Density 2000	Population density 2006	Log pop density 2006	Regional Index Pop. Density 2006
Intensity	1,000										
GDP in 2000	-0,185	1,000									
Regional Index GDP in 2000	-0,576	0,617	1,000								
GDP in 2006	-0,346	0,888	0,639	1,000							
Regional Index GDP in 2006	-0,652	0,521	0,945	0,674	1,000						
Population density 2000	-0,473	0,481	0,944	0,552	0,956	1,000					
Log. Pop density 2000	-0,226	0,389	0,838	0,413	0,810	0,791	1,000				
Regional Index Pop. Density 2000	-0,435	0,525	0,971	0,609	0,974	0,975	0,836	1,000			
Population density 2006	-0,472	0,481	0,944	0,552	0,956	1,000	0,793	0,975	1,000		
Log pop density 2006	-0,212	0,374	0,834	0,409	0,812	0,787	0,998	0,831	0,789	1,000	
Regional Index Pop. Density 2006	-0,434	0,524	0,971	0,607	0,976	0,977	0,838	1,000	0,977	0,834	1,000

As shown in the table some very substantial improvements in correlations have been the result of the new calculations.

First and foremost: The correlation between Intensity and the indexed GDP in 2000 and 2006 has increased to -0,576 and -0,652 respectively, which is very substantial. The indexing procedure has eliminated the fact that national levels of GDP in both years have differed substantially due to many reasons, for instance level of industrialization, technological development, level and time of involvement in EU etc. And the higher value in 2006 compared to 2000 is probably due to that regional policies during the 6 year period – first and foremost in an EU setting, and primarily in relation to recent members - has eliminated some of the regional differences which are not related to land use intensities.

In relation to Population density an indexing of the national values does not really change anything. For population density in 2000 the correlation was -0,473 while a correlation based on indexed values actually drops to -0,435. And in 2006 the correlation changes from a correlation value based on the absolute data of -0,472 to an indexed correlation of -0,434. Again a small drop in correlation, and in both cases an illustration of what has been emphasized before, namely that settlement and population structures are changing much more slowly, so when they are aggregated at the regional level they are pretty persistent in relation to the factors which have been shaping the overall population structures during many centuries, and mostly based on production potentials of land. Only the last century has contributed to a process where land use potentials have become less decisive in relation to the localization of human activities.

The re-calculation of population densities by means of a logarithmic seems to indicate a substantial drop in correlation with intensities, but this is due to the fact that correlations in this context are based on linear relations between the parameters. And this is of course not the case when we are dealing with logarithmic functions a simple linear correlation relation is not to be expected, which will be shown below:

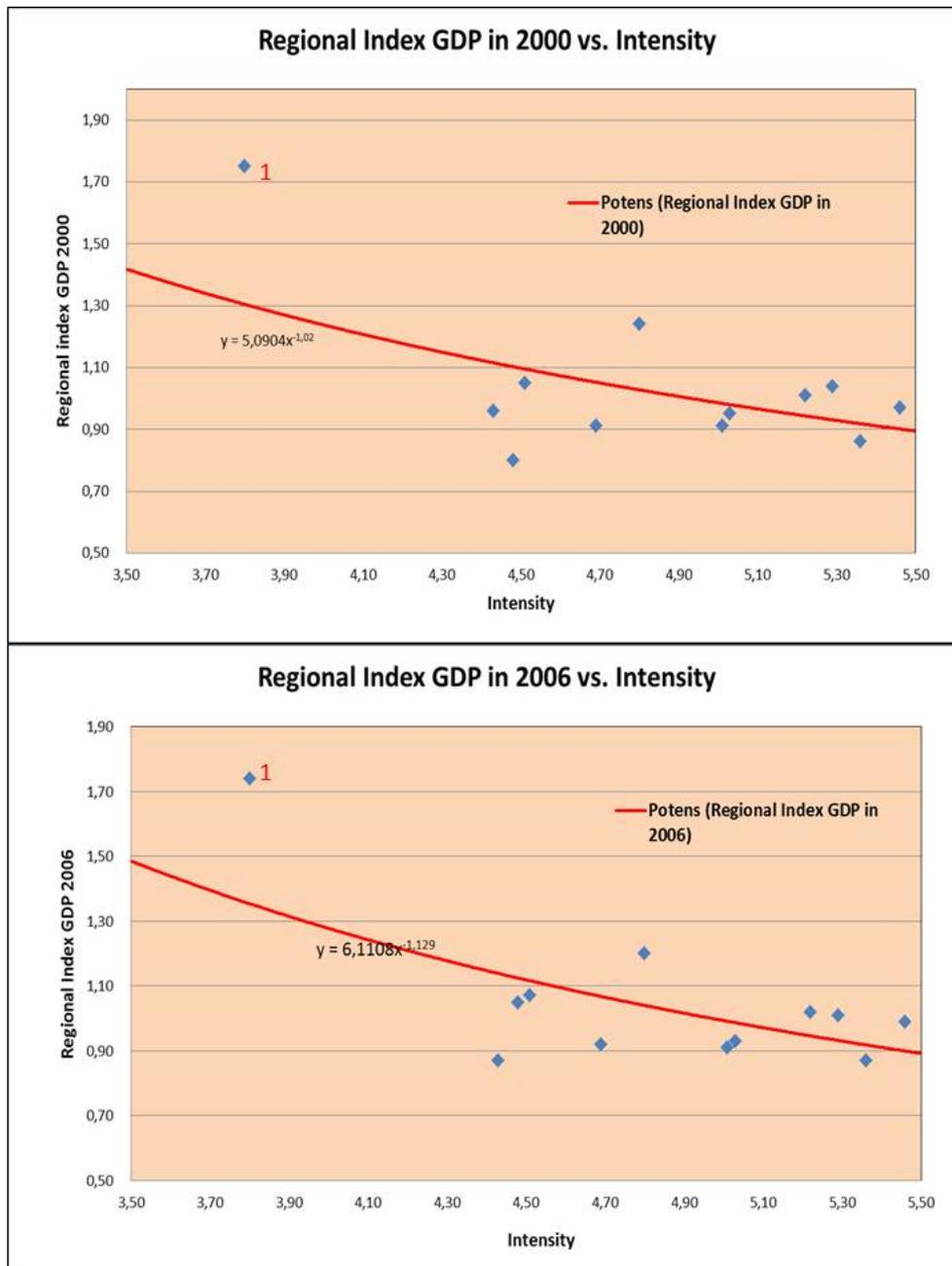


Figure 6 Graph showing relationship between Regional Index of GDP in 2000 and 2006 and calculated intensities for the types of prevailing characteristics.

As indicated by the graph there is a very clear relationship between the two components: regional indexes and intensities. And furthermore that that the line best describing the regional trend is a power function of

intensity. In both years only one outlier appears, marked on the graph by the number 1. It is the Urban cores and metropolitan areas where the level of GDP deviating so much from the other land use categories that it is difficult to make it fit into the general trend. The other categories relating to urban sprawl are situated very well in the graph.

At the same time, however, the change in trend from 2000 to 2006 shows that the gap to the Urban cores and metropolitan areas is minimizing. This relates to a situation where greening of city cores and urban sprawl into adjacent areas are contributing to a more even distribution of the population in relation to land cover characteristics. While former urban sprawl has been characterized by replacement of one mono-function – typically agriculture – is replaced by another mono-function – residential areas – the present trend in relation to urban sprawl is increasingly characterized by co-existence of different land uses, which in practice means multi-functionality.

In relation to population density the graphs on Figure 7 clearly show how the logarithmic relationship between intensity and population density generates the best fit, and the trend line therefore is exponential. There are only minor differences between 2000 and 2006, and the outliers are showing the same structure. A total of 5 points indicated by the numbers 1 to 5 are noted, but basically only two of these have significant influence on the structure. It is the regional land use types with maximum (outlier number 1) and minimum (outlier number 2) population density respectively represented by regional land use type 1 (Urban cores and metropolitan areas) and type 14 (Sparsely populated areas). The reason behind outlier 1 is similar to what was described by the GDP graphs, while outlier 2 has to do with the fact that even these regions are sparsely vegetated substantial economic activities actually takes place. Many regions in both Iceland and Norway are situated in this category, and the reason for as well high economic performance and high population density relates to the fact that a substantial part of the population are situated in the coastal regions and depending on non-land based activities. Outlier 3 is in many ways defined by the same characteristics described above, i.e. non land based activities being the major reason for both a high level of economic activities and a population density considerably lower than what would be expected due to the GDP performance.

As mentioned above it can be discussed whether the dots marked as outlier 4 and 5 actually are outliers. Both relate to urban characteristics, outlier 4 to regional land use type 2 (Suburban areas) and outlier 5 to land use type 3 (Suburban or peri-urban areas). Presently they deviate from the trend generated by the other regional land use types, but as discussed above the present trend of urban sprawl characterized by co-

existence of parallel uses of land may result in a situation where the two outliers becomes parts of a general trend.

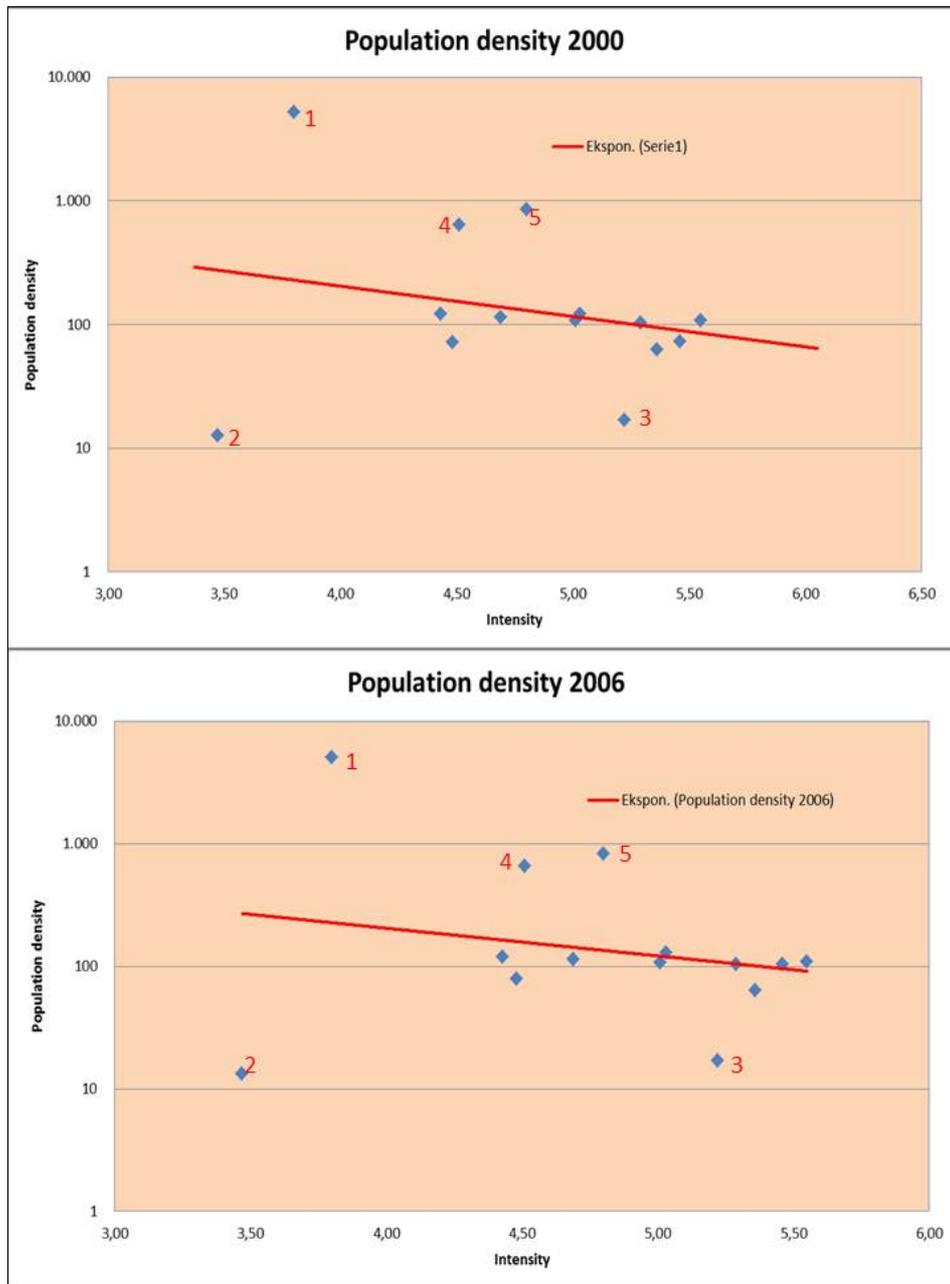


Figure 7 Graph showing relationship between Population Density in 2000 and 2006 and calculated intensities for the types of prevailing characteristics. Please note that the y-axis is logarithmic.

The two dimensions of intensity

As has been discussed above, GDP and Population density reflects two characteristic of intensities in relation to the use of land. It has been documented above that the intensities of land use reflected through the Regional land use types are clearly correlated to both population density and to GDP. It appears also that it may be relevant in situations to

differentiate between them, and use the differences as an important indicator. In the following table 7 the intensity has been subdivided in three categories (Low – 33%, Medium – 33%, High – 33%) where it is important to remember that low intensity means high levels of population density and economic activities. The two components Population Density and GDP have been subdivided in two categories (Low – 50%, High – 50%), and are organized in the following table:

Table 7 Relations between intensity, population density, and GDP and the 14 Regional land use types.

Regional Land Use type	Intensity	Population density	GDP	Description of regional land use types
1	1. low	2. High	2. High	01, Urban cores and metropolitan areas
	2 1. low	2. High	2. High	02, Suburban areas
	4 1. low	2. High	1. Low	04, Arable land in peri-urban and rural areas
	12 1. low	1. Low	2. High	12, Sparse vegetation with forest and pasture
14	1. low	1. Low	2. High	14, Sparsely vegetated areas
3	2. Medium	2. High	2. High	03, Suburban or peri-urban areas
	5 2. Medium	2. High	1. Low	05, Arable land and pastures in predom, rural
	7 2. Medium	2. High	1. Low	07, Rural mix dom, by pastures with arable
	6 2. Medium	1. Low	2. High	06, Rural arable with perm, crops and forest
10	3. High	2. High	1. Low	10, Diverse rural forest intersected by other
	11 3. High	1. Low	2. High	11, Arid mixed forest
	13 3. High	1. Low	2. High	13, Rural (Northern) forest
	8 3. High	1. Low	1. Low	08, Rural pastures and complex cult, patterns
	9 3. High	1. Low	1. Low	09, Diverse land use in rural areas

By means of this table it is possible to see which of the two main socio economic categories are dominant in explaining the intensities determined for the Regional land use types. This is an exercise that may be very useful not only in characterizing the Regional land use types, but also to locate the major socio-economic functions influential on the regional changes.

3.3 Patterns of land use and land use change in Europe

Land change and their drivers

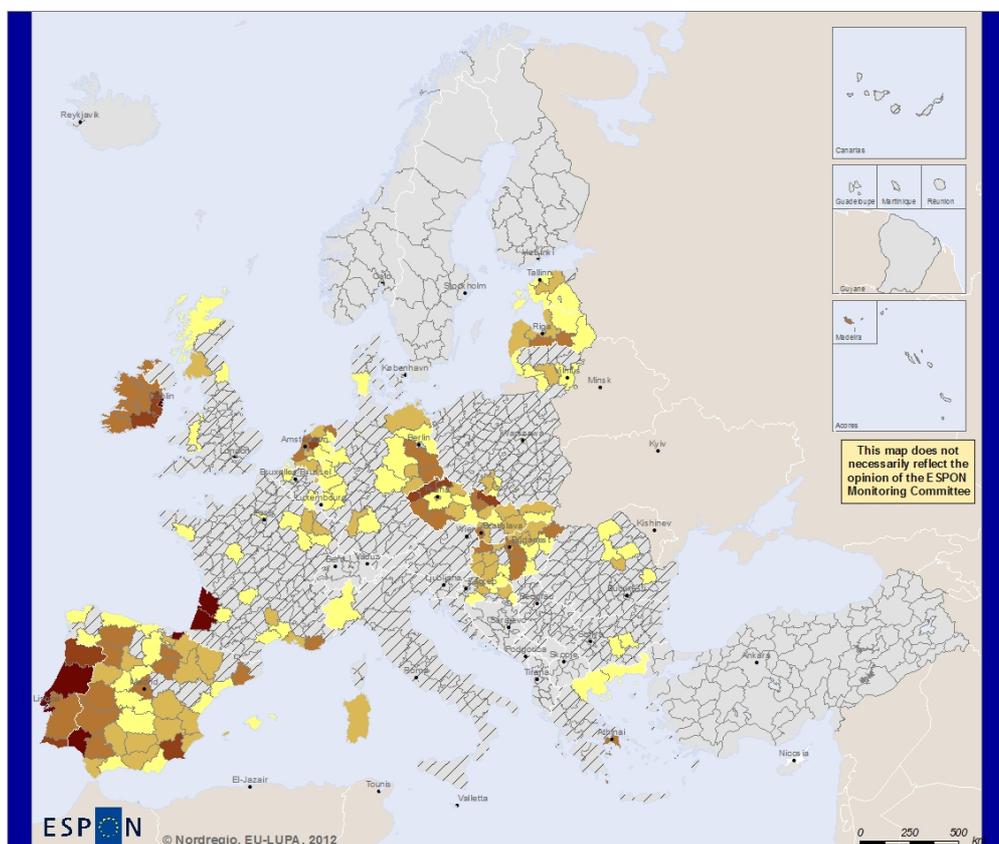
It is not the intention here to provide a general analysis related to patterns of land use change in Europe. Instead, a preliminary set of results of the analysis in this project provides a starting point for discussions later on in the report.

These first three maps show the percentage of each NUTS2/3 region that has undergone land cover change within the given years. Even though changes have taken place in all European countries throughout the whole time period, it is advantageous to emphasize the major changes. As such, the maps below show the regional distribution of land change as a share of the regional area. Regions with changes that total less than the European average for each time period are presented with a hatched signature, while a natural breaks colour scale indicates the levels of change for those regions over the European average.

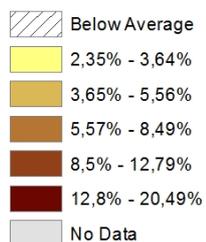
When scrutinizing the maps it is important to keep in mind that not all countries and regions are represented throughout the 16 year time span from 1990 to 2006. This limits the opportunities for general interpretations regarding changes between the two time periods 1990-2000 and 2000-2006. It should, however, not prevent the generation of some general observation regarding the change patterns. It is also notable that the levels of change during the two time series are not equal. This has to do with the fact that the first time series covers a ten year period (which in reality is a 13-14 year window), while the time span between the most recent CORINE time series is only six years. The 1990-2000 time period therefore has significant impact on the total overview for 1990-2006.

In the first case it is notable that within the entire 16-year time period there have been some very significant levels of land change taking place, where in some cases almost 30% of an individual region has reported some form of change. Here, the spatial distribution of these changes is also quite territorialized, where vast changes are especially evident in areas such as Spain, Portugal, the Czech Republic, The Netherlands and Ireland. What will be very interesting is to determine the socio-economic

Amount of Regional Land Change: 1990 - 2000 Regions Above European Average

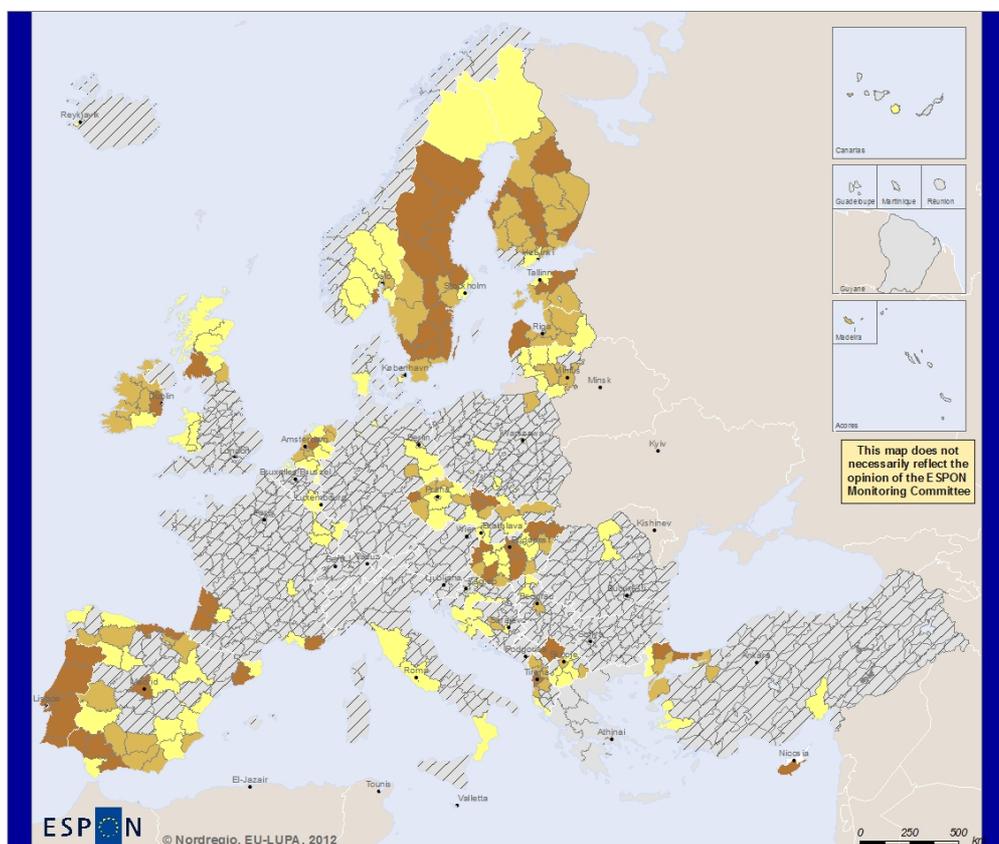


Percentage of regions undergoing changes

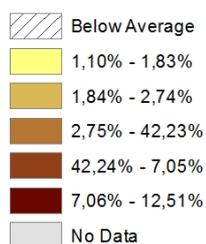


Map 4 Regions with cumulative land cover change that is above the European Average – 1990-2000

Amount of Regional Land Change: 2000 - 2006 Regions Above European Average

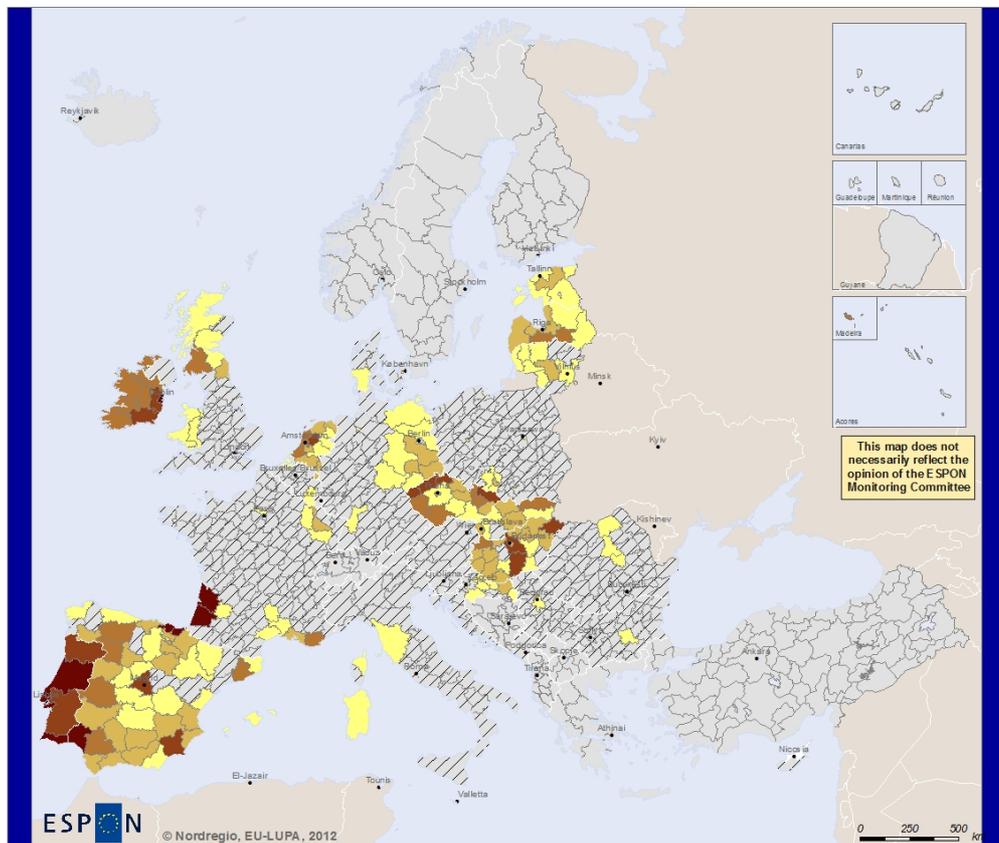


Percentage of region undergoing changes

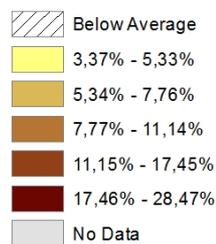


Map 5 Regions with cumulative land cover change that is above the European Average – 2000-2006

Amount of Regional Land Change: 1990 - 2006 Regions Above European Average



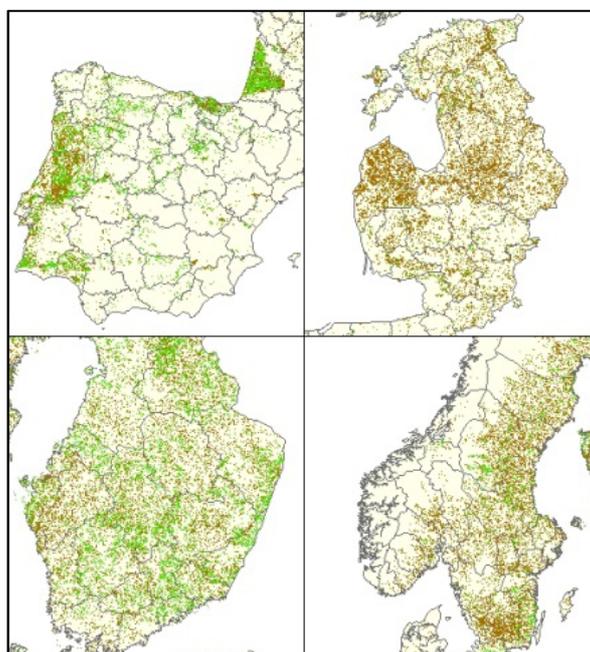
Percentage of regions undergoing changes



Map 6 Regions with cumulative land cover change that is above the European Average – 1990-2006

and environmental contexts of changes in these different national and regional contexts. This will be drawn out by investigating the intensity and types of changes that define these volumes.

Some of the most significant changes between 1990 and 2000 takes place on the Iberian Peninsula. In part, this is likely due to the ascension of Spain and Portugal to the EU in 1986, which resulted in a process where the former agricultural structure was broken up and in many places turned into more intensive forms of production. Also the land ownership reforms in Eastern Central Europe during the 1990s resulted in marked changes, a process which was further fuelled by the expectations regarding future membership of EU in the period up to and after the membership in 2004. These are important observations because they highlight the types of changes that can be expected by current or future candidate countries.



Map 7 Selected areas showing land forest land cover changes. Areas in green reflect afforestation while areas in brown reflect recent felling. Clockwise from top-left: Iberian Peninsula and Latvia/Estonia (CLC 1990-2006), as well as Sweden/Norway and southern Finland (CLC 2000-2006)

Similar changes are not yet observed regarding the Balkan countries as discussions and uncertainties regarding membership in 2007 did not provide the same expectations. Therefore more limited changes during the 2000-2006 period are noted.

Returning the Iberian Peninsula, the conversion of agricultural and forest land are the primary drivers of land change. Forest conversions are particularly notable throughout Portugal and in northern Spain where a steady balance of land into and out-of forested land covers is notable (EEA, 2011). This is in fact an essential element to consider when investigating overall land cover changes in Europe.

As reflected in Map , the overwhelmingly dominant driver of land cover changes by area is related to the transition of forests. This is mainly due to on-going logging activities, but also includes land being set aside for a return to natural land cover. In terms of the former, forest areas are classed as CLC 23-25 (Forests), however after they are logged they become CLC 29 (Transitional Woodland and Shrub) before eventually return to forested areas. Without such and understanding of this formidable driver of land change, regions in countries where forest

activities are present would appear to have a dynamic, less-stable land cover situation. As a consequence, an otherwise continuous land use process will appear as regions showing significant change during individual snapshots of time.

As shown in Map , the production cycle of many decades or even centuries related to forestry is responsible for a substantial part of the major changes registered in for instance Sweden and Finland, but also the in Latvia, Estonia, Portugal, Spain and southwest France (See 2000-2006 time period below). It is also very interesting to see the different stages of the felling-afforestation-re-felling transformation cycle the four regions appear to be situated. While a relative dominance of afforestation appears to be taking place on the Iberian Peninsula and in southern Finland, recent felling appears as dominant in southern Sweden and especially in Latvia. It is clear that situations with continued felling without a balance of afforestation are an unsustainable land cover trend.

Yet all things considered, the most dramatic land change processes taking place in Europe continue to be predominantly driven by Europe's path of socio-economic development, which is taking place due to the effects of globalization and its effect on the global division of labour. The result has been a two-fold dynamic; on one hand, the continued decline of land-based economic production – i.e. agriculture, forestry, mining and quarrying, etc. – in favour of knowledge-intensive, innovation-driven and service-based economies on the other hand.

The former process has led to processes of extensification that result from the abandonment of former production areas when natural conditions or other constraints limit competitiveness. In terms of agricultural withdrawal, abandonment processes have been most pronounced in the central-south and north-east regions of Hungary (between 2000 and 2006), on the Italian island of Sardinia (between 1990-2000), and in Ireland southern Portugal to differing degrees throughout the 1990-2006 period.

The latter process has led to the incredible intensification of land use, toward increased property values and growth of urban areas (artificial surfaces)⁶. This is reflected in the fact that in 1990, 4.1 % of the EU territory was classified as artificial surface – share that increased to 4.4 % (an 8.8 % increase) by 2006. Even more telling is that the European population grew by only 5 % in the same time period (Prokop et al. 2011). This 3.8% differential represents an increased per capita land take

⁶ Artificial surfaces and soils surfaces are taken to be synonymous with urban or settlement areas. The only difference is that the former is determined by remote sensing while the latter is defined by spatial planners (Prokop et al. (2011).

as a result of the demand for newer and bigger housing, more roads, and growth of business locations; each of which represents the effect of development on the European landscape.

However, national or regional performance for limiting the extent of artificial surfaces cannot simply be judged based on total area or percentage of growth, especially over such a short window of time as 1990-2006. One issue is that the development of sealed surfaces is path dependent on socio-economic positioning and comparing rapidly developing regions against already established ones would be short-sighted and unfair to those regions that are “catching-up”. Established regions have already undergone this process, it’s just that they have done so in the decades or centuries prior to 1990.

Another issue is that the percentage of artificial surfaces in a given region is highly contingent on both population and size of the region; or more simply, population density. It is not surprising that Member States with the highest rates are Malta, the Netherlands, Belgium, Germany and Luxembourg.

Thus, the main driver of total urban land take is the amount of people living in a given region. But in terms of per capita urban land take – which is a much more relevant indicator in terms of measuring efficiency or performance of land - the main influences are the existence of second homes, large touristic infrastructures and a dispersed settlement structure. Relatively large shares of second homes are notable to varying degrees in the Mediterranean regions, as well as in Finland, Estonia, Denmark and Sweden. Meanwhile, extensive touristic infrastructure coupled with a very high average population density is the driver of such a high degree of urban land take in Malta.

3.4 Land Change as Processes of Land Use Intensification

Access to CLC data provides an unparalleled amount of information on the characteristics of land use in Europe, including the patterns and processes and quantities of land change. While the quantity of land change was introduced in Section 1.1, the advent of the land use intensity concept allows for a basic characterization how land change processes affect the magnitude of human intervention on the landscape; or in other words, how intensively the land is being used.

Each of the three maps below show the regional change of land use intensity caused by averaging all land changes by their intensity score. The explanation on the method behind this approach is described in more detail above, in Section 2.4. change of intensity accrued by the shows

the average change the Using this matrix, regions in white are considered to have relatively stable land use intensities during the identified periods while regions in deepening shades of green are undergoing land changes that cause increases in the socio-economic intensity with which land is being used. In contrast, shades of brown indicate regions where reductions of the intensity of land use are incurred by land changes. In reality, this situation could be due to economically driven processes where activities are no longer profitable, or where policies have had an effect on land use.

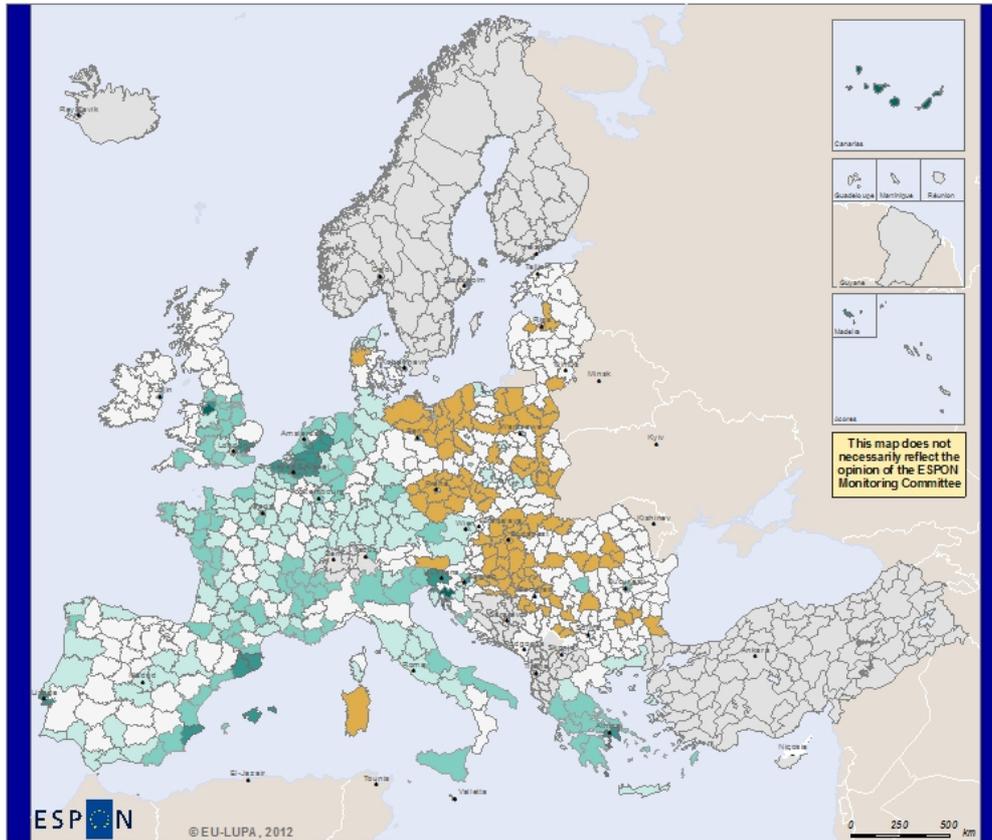
One map for each CLC time series is presented below along with notes on the key spatial characteristics that are taken from the maps. Some of the highlights identified in these maps include:

- There is a clear east-west dimension in each of the maps. Large volumes of land use extensification are almost exclusively found in Eastern European member states; particularly in Poland, The Czech Republic and Hungary.
- High volumes of land use intensification are especially notable in countries such as The Netherlands, Brussels, Spain, Portugal and Croatia. In Spain, this is especially evident for regions along the south and east coast as well as the island regions. On regional/territorial level it is evident that intensification is associated with the growth (sprawl) of urban areas and their associated artificial surfaces. Intensification is also appears to take place in a greater degree for coastal regions (cf. in Spain, France, Croatia). It is possible that this pattern is related to the growth of the coastal tourism in these regions, but additional validation is necessary.
- In the Czech situation it is interesting to point out the seemingly high degree of rural extensification being countered by urban-related intensification in the capital region of Prague. Further, when comparing the 1990-2000 and the 2000-2006 results (Map 7 and Map 8), even while taking into account the much larger time span in the former time period) it appears that extensification processes have slowed for the country as a whole. EEA country analyses show that the main driver of extensification has been the conversion of different crop areas into land for pasture. This is a process which has been driven by national policy that uses subsidies to encourage the grassing of arable and extensive grassland management.
- In the 2000-2006 (Map 8) time series from very significant intensification is especially notable in particular regions of Norway. These are regions that, based on Maps 1-3, we know have undergone relatively little amounts of land change (by area); however the

changes that have taken place were very intensive. This is due to the development on intensive mining and other heavy industrial activities in rural and remote locations. Interestingly, these intensifications are not taking place in parallel with extensification of other land covers in these areas, which indicate that these are “new” economic activities that are taking place on previously stable and unchanged land.

- Quite high rates intensification are notable for many regions in Spain in all three time series. The highest levels of intensification have taken place for coastal regions along the Mediterranean and for the island regions. This is clearly related to the growth of artificial surfaces in urban areas. CLC flow data and EEA land cover analysis (EEA, 2011) indicates that much of this intensification is due to the sprawl of economic sites and infrastructures (which both construction areas and transport infrastructure are grouped).

Land Use Intensity Change 1990 - 2000




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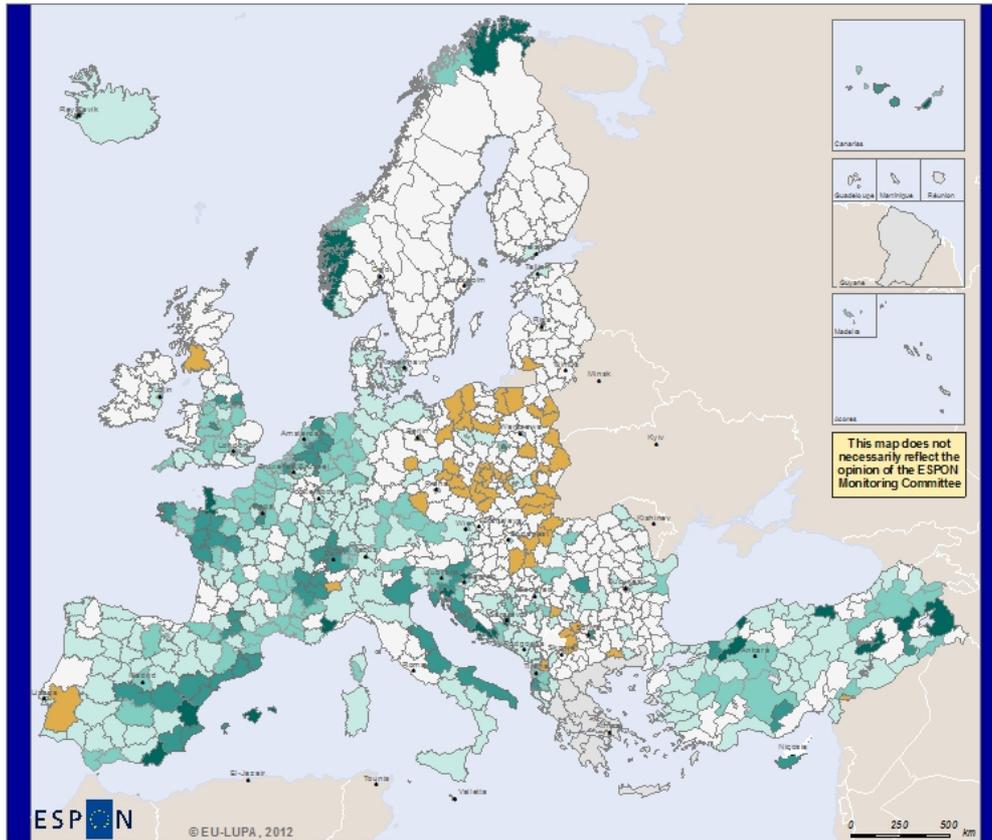
Regional level: NUTS 2/3/4
 Source: Nolting et al., 2012
 Origin of data: EEA, 2011
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Average intensity change of all land changes per region

-  extensification (-0,68 - -0,01)
-  low intensification (0,0 - 0,49)
-  medium intensification (0,5 - 0,99)
-  medium-high intensification (1,00 - 1,49)
-  high intensification (1,50 - 1,99)
-  very high intensification (1,99 - 4,50)
-  No Data

Map 7 Land use intensity change – 1990-2000

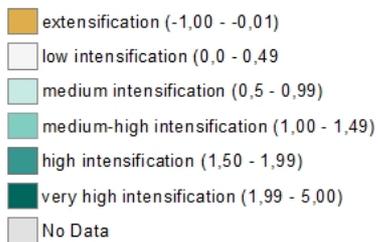
Land Use Intensity Change 2000 - 2006




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 sustainable development.

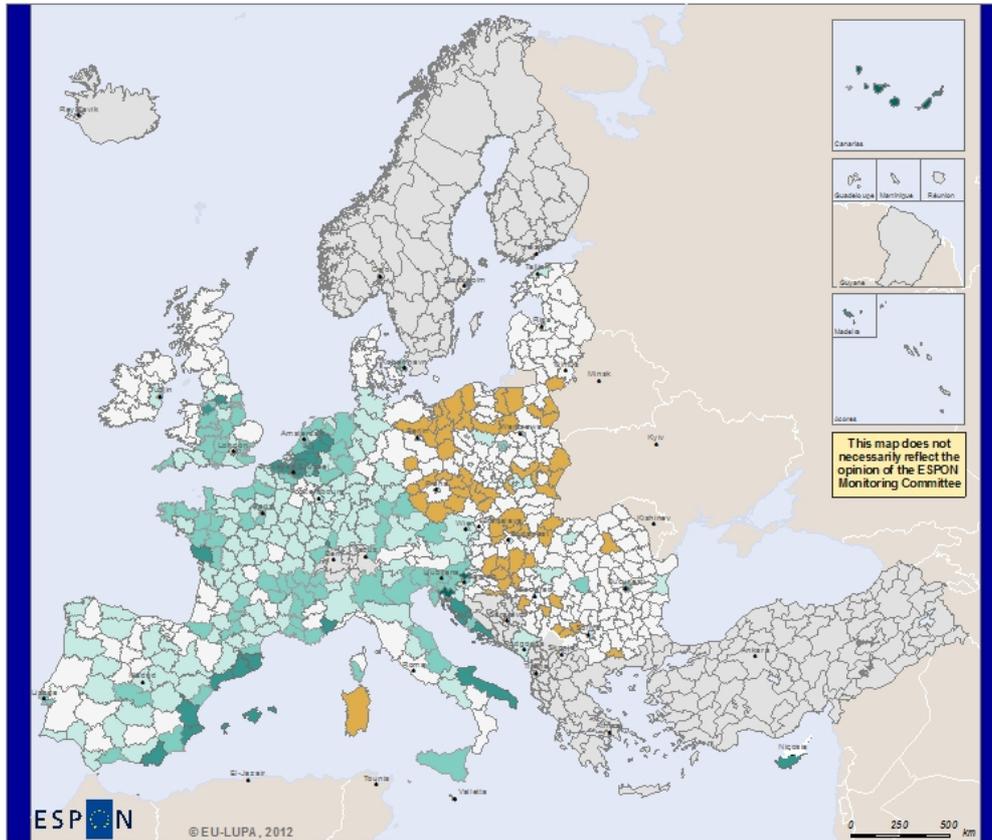
Regional level: NUTS 2/3/4
 Source: Nolting et al., 2012
 Origin of data: EEA, 2011
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Average intensity change of all land changes per region



Map 8 Land use intensity change – 2000-2006

Land Use Intensity Change 1990 - 2006




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Regional level: NUTS 2/3/4
 Source: Nolting et al., 2012
 Origin of data: EEA, 2011
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Average intensity change of all land changes per region

-  extensification (-0,47 - -0,01)
-  low intensification (0,0 - 0,49)
-  medium intensification (0,5 - 0,99)
-  medium-high intensification (1,00 - 1,49)
-  high intensification (1,50 - 1,99)
-  very high intensification (1,99 - 4,50)
-  No Data

Map 9 Land use intensity change – 1990-2006

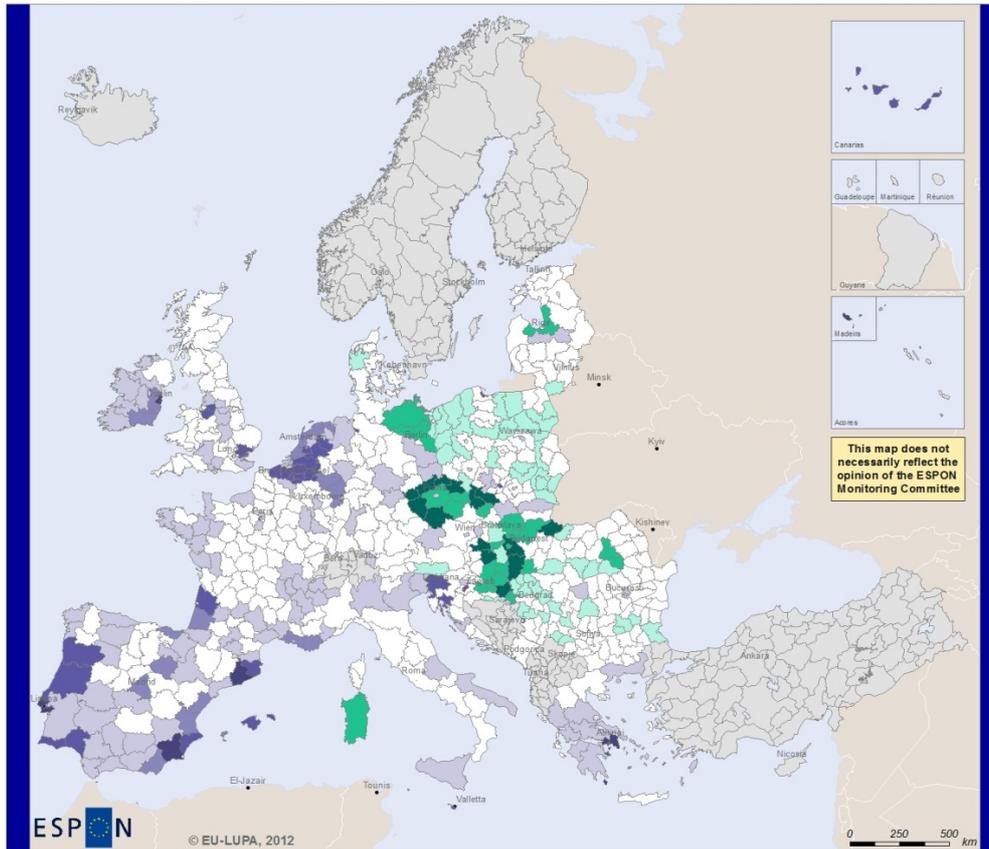
3.5 Hotspots of Land Change

As reported on each of the maps below, the method used to determine the hotspots was to create a 5x5 matrix where the regional land use intensification due to land changes is classed in five groups on the y-axis and percentage of regional change is classed in 5 groups on the x-axis. Using this matrix, regions in white are considered to have relatively stable land use characteristics while increasingly darker shades of green or purple identify “hotspots” of change where high intensifications or extensifications are coupled with increasing levels of overall land change. The scales of intensification and physical change were selected based on the wish to have a simple and consistent classification.

One map for each CLC time series is presented below along with notes on the key spatial characteristics that are taken from the maps. Further characterization is available using the maps showing Land Change Volume and Land Use Intensity Change individually. As such, these are presented in Annex 6.2. Nevertheless, some of the highlights identified in the maps below include:

- All regions in Portugal are identified as hotspots – albeit to differing degrees – in all of the time series’. Consultation with the maps showing total land change by area (Appendix 6.1) shows that this is mainly due to the fact that all regions show very high levels of overall change. This is by the high levels of ongoing changes related to forest management. Conversely, the intensity maps in Appendix 6.2 show more stable patterns with the exception of two regions. Lisbon and Alentejo. In the former, intensification is predominantly related to residential sprawl between 1990-2000; a process that has slowed considerably since then (EEA, 2011). In Alentejo, relatively high land change is characterized as an extensification process. This is due to the fact that land abandonment due to the withdrawal of farming activities (EEA, 2011).
- The immediate effects of the inclusion of East-Central European countries - previously part of the “East Block” mostly characterized by state and cooperative ownerships - are immediately reflected through a drastic decline in intensity over substantial areas in the period from 1990 to 2000. The reforms in ownership from the former state and cooperative ownerships forms has had some immediate consequences in relation to intensity due to that the new private farms did not have the necessary means to ensure a high intensity in land use. The situation in Poland being different in this respect because of a dominance of private land use activities, and as a consequence effects as described above only relating to the relatively smaller areas owned by cooperatives and a few state holdings as well.

1990 - 2000 Land Change Hotspots



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Regional level: NUTS 2/3.X
Source: Nordregio, 2012
Origin of data: EEA, 2011
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Matrix of land change hotspots

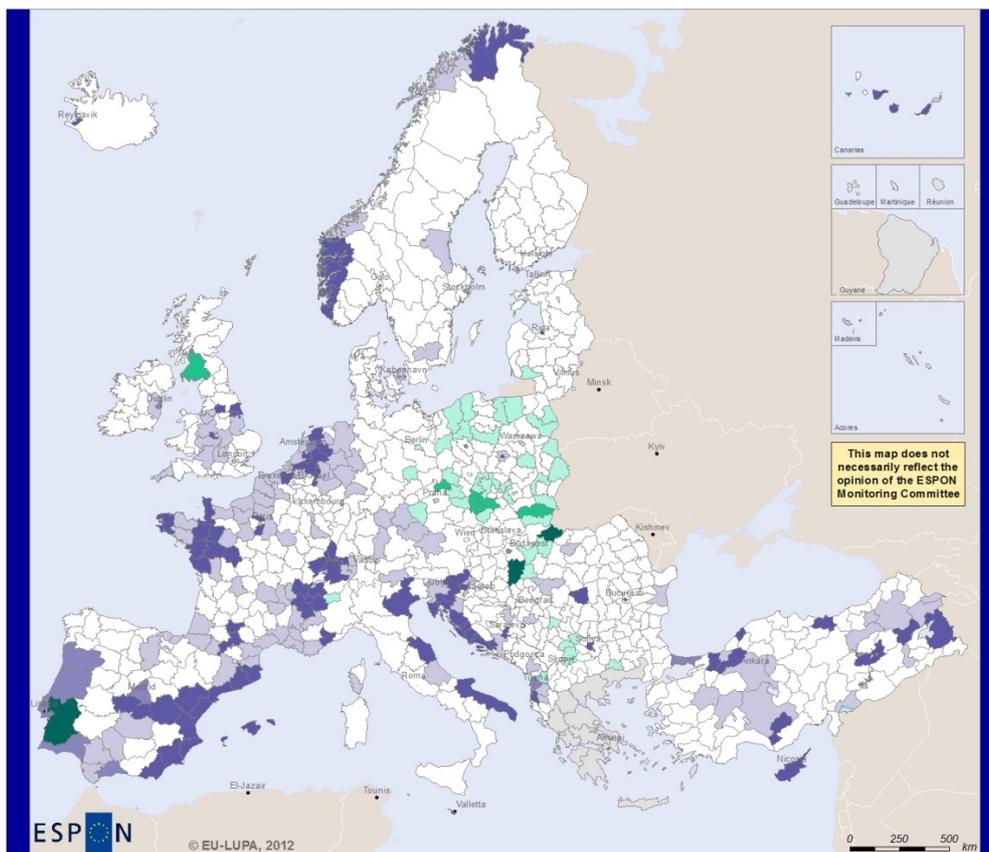
The x-axis shows the percentage of land that has undergone change between the given years, while the y-axis indicates the intensity of those changes. Therefore, regions in white represent regions with relatively stable land cover characteristics while increasingly darker shades of green or purple identify "hotspots" of change where high intensifications or extensifications are coupled with increasing levels of overall land change.

No Data

Intensity of Changes	Above 1,50					
	1,00 to 1,49					
	0,50 to 0,99					
	0 to 0,49					
	Below 0					
		Below 2,5%	2,5-5%	5-10%	10-20%	20% and above
		Percent of Regional Change				

Map 10 Hotspots of land change – 1990-2000

2000 - 2006 Land Change Hotspots



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Regional level: NUTS 2/3.X
Source: Nordregio, 2012
Origin of data: EEA, 2011
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Matrix of land change hotspots

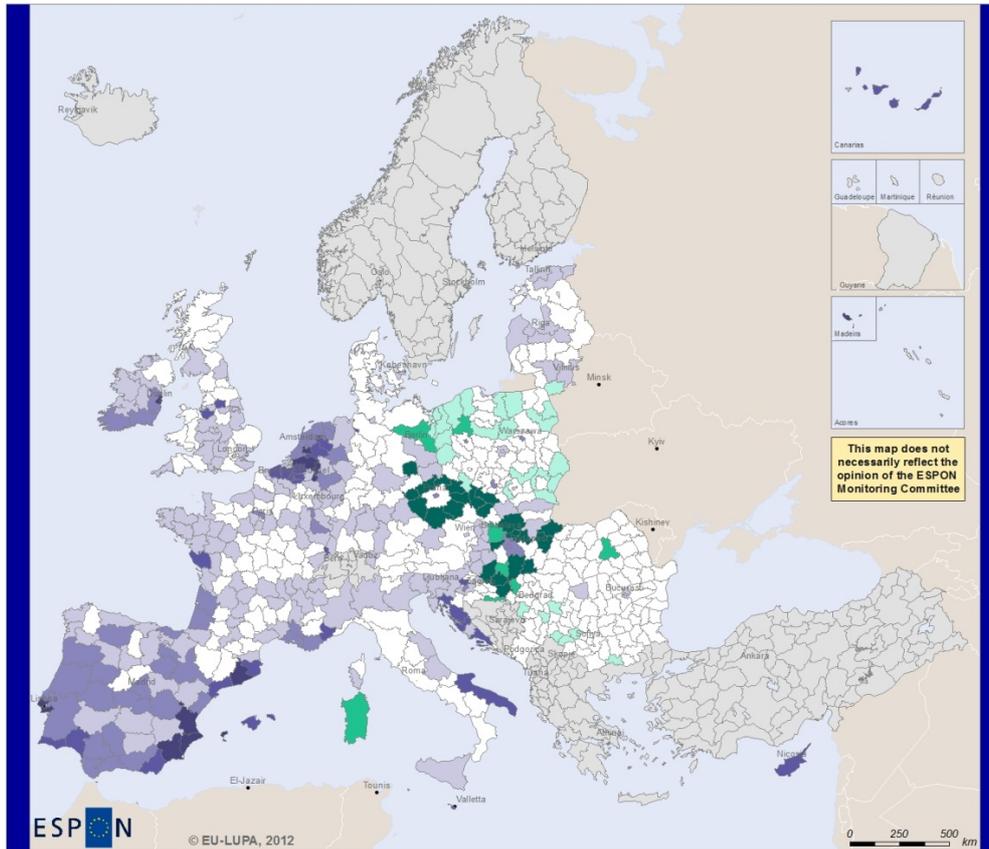
The x-axis shows the percentage of land that has undergone change between the given years, while the y-axis indicates the intensity of those changes. Therefore, regions in white represent regions with relatively stable land cover characteristics while increasingly darker shades of green or purple identify "hotspots" of change where high intensifications or extensifications are coupled with increasing levels of overall land change.

No Data

Intensity of Changes	Above 1,50					
	1,00 to 1,49					
	0,50 to 0,99					
	0 to 0,49					
	Below 0					
		Below 2,5%	2,5-5%	5-10%	10-20%	20% and above
		Percent of Regional Change				

Map 11 Hotspots of land change – 2000-2006

1990 - 2006 Land Change Hotspots



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Regional level: NUTS 2/3.X
Source: Nordregio, 2012
Origin of data: EEA, 2011
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Matrix of land change hotspots

The x-axis shows the percentage of land that has undergone change between the given years, while the y-axis indicates the intensity of those changes. Therefore, regions in white represent regions with relatively stable land cover characteristics while increasingly darker shades of green or purple identify "hotspots" of change where high intensifications or extensifications are coupled with increasing levels of overall land change.

No Data

Intensity of Changes	Above 1,50					
	1,00 to 1,49					
	0,50 to 0,99					
	0 to 0,49					
	Below 0					
		Below 2,5%	2,5-5%	5-10%	10-20%	20% and above
		Percent of Regional Change				

Map 12 Hotspots of land change – 1990-2006

- The situation in Poland was, however also affected through the lack of funding for investments in many of the small farms functioning more as subsistence bases for a still older population, and several of the regions where this has been the dominating characteristic have continued being regions of decreasing intensity through the 2000-2006 period as well. One important element in this connection has been the small size of a substantial part of the already private farms. The advantage in other parts of East-central Europe has been that in the aftermath of the first round of extensification the new private farms were able to establish themselves not as subsistence activities but as professional and capital intensive farms on previous state or cooperative owned large scale farms. And similar situations have appeared in relation to other types of land use.
- Ireland being a “hotspot” for IT development during the 1990’s had some spin-off in relation to increased intensification of activities related to land use. Partly because the attraction of labour force away from direct land use to industrial activities required adjustment in land related activities requiring technology to replace the missing workforce. With a partly collapse of the IT-adventure after 2000 the process described above came to a halt, and the shift is apparent when comparing the 1990-2000 and the 2000-2006 situations.
- While missing data for Sweden, Finland and Norway for the period 1990-2000 does not allow a comparison between the two periods, an important issue of the effects of increasing activities related to resource extraction, especially in relation to oil and gas development, is very apparent for the 2000-2006 period shown for Norway. While fisheries used to be a mainstay for coastal communities in Norway the picture today is a high degree of dependency on the sea, but in relation to energy resource extraction. This leads to the inclusion of large areas for on-shore production facilities, but requires at the same time related economic activities – processing, investigation, planning, education etc., which shows through inclusion of still larger areas for housing.
- European tourism is an activity requiring still larger areas, and the development of the Spanish coastline illustrates that it is not only a question of short term changes, but seems to have been a consistent development process throughout the whole period from 1990 to 2006.

While the hotspots enables us to identify places in Europe where marked changes have been taking place during the last 16 years, the development

of a typology which is able to capture these changes and provide a connection between types and processes of change, an important planning instrument will be at hand. So the next step is to turn the focus on such a typology.

3.6 Land Use Change Typology

Land Use Change Types	Average Intensity			Cluster Number		
	2000-2006	1990-2000	1990-2006	2000-2006	1990-2000	1990-2006
Very high intensification with artificial surfaces mainly replacing natural areas	4,69	4,29	4,17	10	10	10
Very high intensification due to specific areas of residential and economic sprawl	2,11-2,81	3,08	2,45	7 and 9	7	9
High intensification due to residential and economic sprawl surrounding urban internal conversions	N/A	1,98	1,68		9	8
High intensification due to residential and economic sprawl	1,75	N/A	N/A	5		
High intensification due to residential and economic sprawl combined with forest conversions	N/A	1,52	N/A		8	
Medium-high intensification due to diverse urban processes	1,30	1,09	1,09 - 1,40	6	2	1 and 4
Medium intensification due to some urban sprawl combined mainly with forest conversions	0,95	0,72	0,85	4	3	5
Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl	0,64	0,44	0,62	3	6	7
Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl	N/A	N/A	0,35			3
Low intensification mainly due to agriculture and forest changes	0,32	0,20	0,05	2	4	2
Low intensification dominated by forest conversions	0,05	N/A	N/A	1		
Extensification due to agricultural processes and forest changes	N/A	0,00	N/A		1	
High extensification due to forest and agricultural changes but specifically the withdrawal of farming	-0,35	-0,35	-0,29	8	5	6

Figure 8 Legend of all Land use change types, their associated cluster value from the clustering procedures and the average change of land use intensity incurred by regions in each type

The method of developing the 13 land use change types is explained in Section 3.5. It tells how a clustering process was completed using regionalized CLC flow data as well as a normalized indicator of change in Land Use Intensity. Ten clusters were produced for each of the time series and the 30 clusters have been classified into 13 Land use change types, as shown in Figure 8. This classification is based on tables showing the average change for each LCF in the regions of each cluster as well as the average change of intensity due to land changes. These are shown for each of the time period in Table 21 Table 22 Table 23.

Using the tables showing the statistical breakdown, each of the Land use change types are introduced below. The naming of the types has sought to be descriptive of the changes themselves without pursuing the causality of those changes beyond what is provided by the names of the LCF classes themselves. The list of the types below is in order of appearance in Figure 8 above.

Table 8 Very high intensification with artificial surfaces mainly replacing natural areas

	2000-2006	1990-2000	1990-2006
Cluster number	10	10	10
Number of regions	2	2	2
Average change of intensity	4,69	4,29	4,17

Table 8 shows that regions in this cluster are very unique. In each time series, both the area and the total number of land change are very small. However, the changes that are taking place relate exclusively to urban land management and residential, economic and infrastructure development. The very high level of intensification indicates the formation of these land uses results from the consumption of very low intensity land covers; most likely natural landscapes. Presence of this Land Use Change Type is limited to the Canary Islands and northern Norway.

Table 9 Very high intensification due to specific areas of residential and economic sprawl

	2000-2006	1990-2000	1990-2006
Cluster number	7 and 9	7	9
Number of regions	26	4	9
Average change of intensity	2,11-2,81	3,08	2,45

Regions in this type are experiencing land use changes that are dominated by urbanization process. The term "specific" is used because, like the previous type, the level of change by area is low (for example, the average amount of land change for the 1990-2006 period was only 1.1%). The reason for such a low level of changes is that these regions are exclusive to the existing large urban centres in Europe; in particular, NUTS3city-states, as shown by the typology maps below. Urban form in these regions is already well-established and changes tend to further to the amount of urbanized area.

The summary table above shows that clusters 7 and 9 have been merged in the 2000-2006 time series. Table 22 shows these clusters as statistically similar, with only minor variations in terms of LCFs 4, 5 and 7.

Table 10 High intensification due to residential and economic sprawl surrounding urban internal conversions

	2000-2006	1990-2000	1990-2006
Cluster number		9	8
Number of regions		17	31
Average change of intensity		1,98	1,68

The next three types have very similar statistical characteristics. For example, the average regional change in land use intensity is between 1.50 and 1.99. However, small variations have led to their separation in the clustering process.

Each type reflects the high level of economic and residential sprawl, but each type is somewhat distinct based on the land use change processes that accompany the sprawl. For this particular type urban sprawl is coupled with relatively high levels of internal urban change. When comparing the distribution of LCF 1 for the three time periods it is clear that the 2000-2006 time period is excluded from this type because LCF 1 changes are distributed among each of the clusters. Regions in this type are concentrated in Belgium, The Netherlands, The Mediterranean coast in Spain and Croatia.

Table 11 High intensification due to residential and economic sprawl

	2000-2006	1990-2000	1990-2006
Cluster number	5		
Number of regions	48		
Average change of intensity	1,75		

As shown in Map 14, regions in this typology are predominantly located in western European countries where many regions in each country appear to be undergoing the same urbanization processes. Many of the regions are either located along the coast or in close proximity to large urban centres. For example, **¡Error! No se encuentra el origen de la referencia.** shows that inland regions surrounding Madrid, Geneva, Zurich, Paris and Brussels are a part of this type, along with coastal regions in Spain, France, Italy and Croatia.

Table 12 High intensification due to residential and economic sprawl combined with forest conversions

	2000-2006	1990-2000	1990-2006
Cluster number		8	
Number of regions		32	

Average change of intensity		1,52	
-----------------------------	--	------	--

The same basic characteristics describe this type as do the previous type except there is higher levels of residential sprawl in this type compared to higher levels of sprawl of economic sites and infrastructures in type 4.

Table 13 Medium-high intensification due to diverse urban processes

	2000-2006	1990-2000	1990-2006
Cluster number	6	2	1 and 4
Number of regions	107	103	107
Average change of intensity	1,30	1,09	1,09 - 1,40

This type characterizes over 100 regions in all three of the time series', each with average levels of intensification between 1 and 1.5. Therefore, as its name implies, it reflects regions that are undergoing very typical types of land change – moderate levels of urbanization processes are coupled with diverse forest and agricultural changes. Like each of the high and very high intensification types above there is a very strong western dimension to this type.

Table 14 Medium intensification due to some urban sprawl combined mainly with forest conversions

	2000-2006	1990-2000	1990-2006
Cluster number	4	3	5
Number of regions	72	70	42
Average change of intensity	0,95	0,72	0,85

Unlike the previous clusters, it appears that a threshold has been crossed where the average level of land use intensity change is now less than 1. As such, the reference tables below indicate that regions in this type are undergoing relatively stable land processes with comparatively low levels of regional change (by area) in each time series. While there is still a western orientation to the regions in this type, the appearance of regions in Eastern Europe (for instance Poland in the 1990-2000 time series) is evident. This trend extends to regions in Romania and Serbia in the 2000-2006 time period.

Table 15 Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl

	2000-2006	1990-2000	1990-2006
Cluster number	3	6	7
Number of regions	148	88	87
Average change of intensity	0,64	0,44	0,62

The land use change characteristics in this type are similar to the previous type except the rural land processes related LCF 4 -7 increase in their role of defining regional changes. The same east west pattern is evident as in the previous type, but additional regions in selected Eastern European member states are notable, especially in the 2000-2006 time period (e.g. Romania, Serbia and especially Turkey).

Table 16 Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl

	2000-2006	1990-2000	1990-2006
Cluster number			3
Number of regions			86
Average change of intensity			0,35

Regions in the next three types are characterized by land changes that have resulted in a neutral level of intensification (between 0.00 and 0.40). Rural land changes dominate in these regions with the main difference between the three is that "dynamic mix between agricultural and forest changes with limited urban sprawl" has an increased level of change related to LCF4 (sprawl of economic sites and infrastructures) compared to the types "Low intensification mainly due to agriculture and forest changes" and "Low intensification dominated by forest conversions".

Table 17 Low intensification mainly due to agriculture and forest changes

	2000-2006	1990-2000	1990-2006
Cluster number	2	4	2
Number of regions	123	102	178
Average change of intensity	0,32	0,20	0,05

Table 18 Low intensification dominated by forest conversions

	2000-2006	1990-2000	1990-2006
Cluster number	1		
Number of regions	198		
Average change of intensity	0,05		

Table 19 Extensification due to agricultural processes and forest changes

	2000-2006	1990-2000	1990-2006
Cluster number		1	
Number of regions		111	
Average change of intensity		0,00	

Regions in two “extensification” types are unique in that they show regions where cumulative land changes in each of the time series’ have resulted in an extensification of socio-economic activities taking place on the landscape. For a majority of the regions a dominant trend has been the replacement of agricultural activities in favour of pastures or forest land covers. As such, land use changes seem to reveal a socio-economic trend of rural stagnation; as rural land-based activities are being replaced by growth that is concentrated in urban areas. Regions in these two types are exclusive to Eastern European and new member states, with notable distributions in Poland and the Czech Republic; particularly in the 1990-2000 time series.

Table 20 High extensification due to forest and agricultural changes but specifically the withdrawal of farming

	2000-2006	1990-2000	1990-2006
Cluster number	8	5	6
Number of regions	17	43	19
Average change of intensity	-0,35	-0,35	-0,29

Table 21 Distribution of average change for each LCF in the regions of each cluster – 1990-2000

1990-2000	Average land change per region per cluster									
	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL8	CL9	CL10
Land Cover Flows										
Lcf1 urban land management	0,010	0,088	0,053	0,018	0,017	0,050	0,008	0,091	0,256	0,043
Lcf2 urban residential sprawl	0,024	0,245	0,141	0,049	0,025	0,095	0,072	0,633	0,512	0,114
Lcf3 sprawl of economic sites and infrastructures	0,057	0,329	0,250	0,082	0,049	0,169	0,278	0,524	0,676	0,031
Lcf4 agricultural internal conversions	0,598	0,395	0,423	0,721	1,590	0,831	0,008	0,261	0,162	0,000
Lcf5 conversion from forested & natural land to agriculture	0,042	0,087	0,141	0,076	0,038	0,174	0,041	0,094	0,109	0,006
Lcf6 withdrawal of farming	0,126	0,058	0,094	0,100	0,262	0,172	0,000	0,079	0,058	0,000
Lcf7 forests creation and management	1,079	0,445	0,812	1,526	1,163	1,372	0,000	0,621	0,114	0,000
Average intensity change per plot of land change	-0,005	1,085	0,717	0,199	-0,346	0,437	3,083	1,519	1,977	4,293
Percent of region recording land change	1,998	1,777	2,045	2,681	3,208	3,002	0,407	2,527	1,984	0,196
Number of regions	111	103	70	102	43	88	4	32	17	2

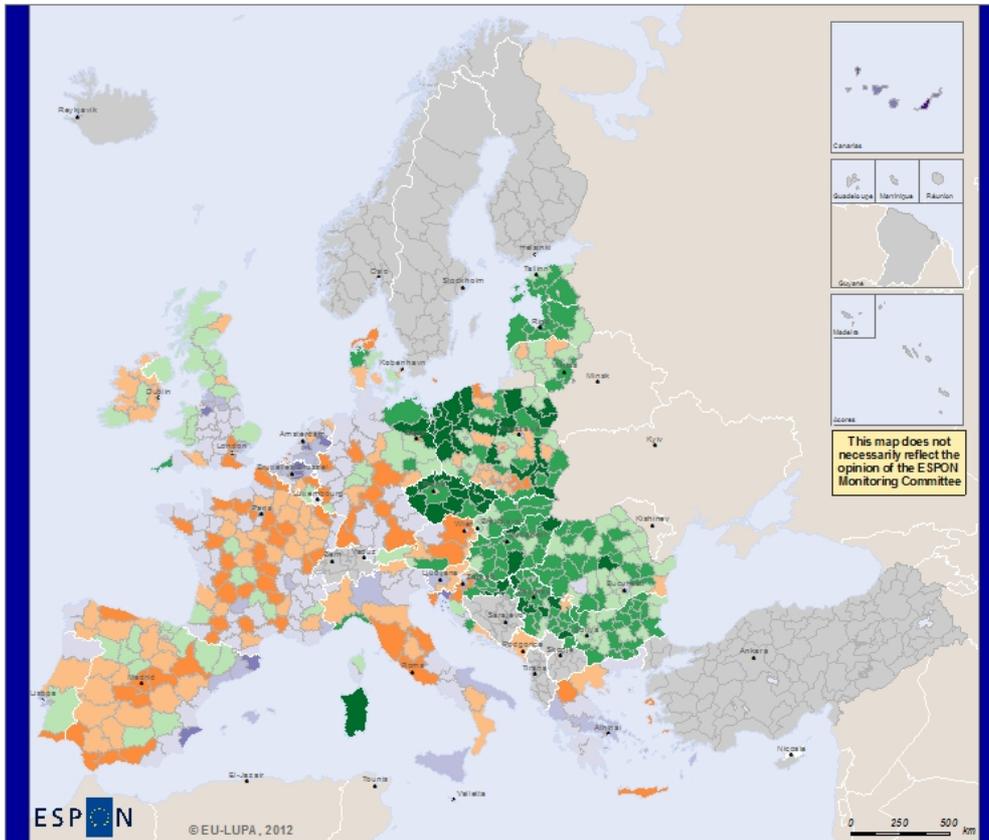
Table 22 Distribution of average change for each LCF in the regions of each cluster – 2000-2006

2000-2006	Average land change per region per cluster									
Land Cover Flows	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL8	CL9	CL10
Lcf1 urban land management	0,015	0,020	0,040	0,044	0,057	0,116	0,051	0,094	0,052	0,000
Lcf2 urban residential sprawl	0,009	0,031	0,047	0,082	0,107	0,220	0,112	0,010	0,070	0,000
Lcf3 sprawl of economic sites and infrastructures	0,043	0,080	0,107	0,165	0,273	0,283	0,222	0,063	0,375	0,015
Lcf4 agricultural internal conversions	0,132	0,077	0,101	0,068	0,056	0,043	0,045	0,347	0,005	0,000
Lcf5 conversion from forested & natural land to agriculture	0,016	0,044	0,050	0,033	0,030	0,024	0,064	0,022	0,000	0,000
Lcf6 withdrawal of farming	0,043	0,031	0,022	0,023	0,021	0,022	0,006	0,316	0,000	0,000
Lcf7 forests creation and management	1,246	0,795	0,456	0,311	0,136	0,161	0,092	0,716	0,013	0,000
Average intensity change per plot of land change	0,055	0,320	0,640	0,952	1,750	1,304	2,106	-0,350	2,814	4,688
Percent of region recording land change	1,528	1,116	0,879	0,815	0,784	0,920	0,631	1,775	0,519	0,015
Number of regions	198	123	148	72	48	107	16	17	10	2

Table 23 Distribution of average change for each LCF in the regions of each cluster – 1990-2006

1990-2006	Average land change per region per cluster									
Land Cover Flows	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL8	CL9	CL10
Lcf1 urban land management	0,118	0,019	0,091	0,191	0,169	0,014	0,108	0,366	0,062	0,073
Lcf2 urban residential sprawl	0,522	0,033	0,121	0,364	0,292	0,021	0,173	0,614	0,257	0,248
Lcf3 sprawl of economic sites and infrastructures	0,535	0,101	0,267	0,580	0,546	0,092	0,369	1,063	0,441	0,276
Lcf4 agricultural internal conversions	0,264	0,804	0,917	0,500	0,400	2,882	0,816	0,339	0,127	0,000
Lcf5 conversion from forested & natural land to agriculture	0,115	0,061	0,131	0,099	0,142	0,046	0,251	0,184	0,153	0,006
Lcf6 withdrawal of farming	0,092	0,191	0,152	0,061	0,119	0,520	0,200	0,141	0,002	0,000
Lcf7 forests creation and management	0,557	2,231	1,968	0,560	0,929	2,046	1,512	0,462	0,075	0,000
Average intensity change per plot of land change	1,395	0,054	0,352	1,091	0,855	-0,289	0,618	1,682	2,451	4,172
Percent of region recording land change	2,297	3,519	3,885	2,576	2,831	5,681	3,607	3,565	1,134	0,605
Number of regions	36	178	86	71	42	19	87	31	9	2

Land Use Change Typology 1990 - 2000




 EUROPEAN UNION
 The European Union is committed to the principles of
 sustainable development.

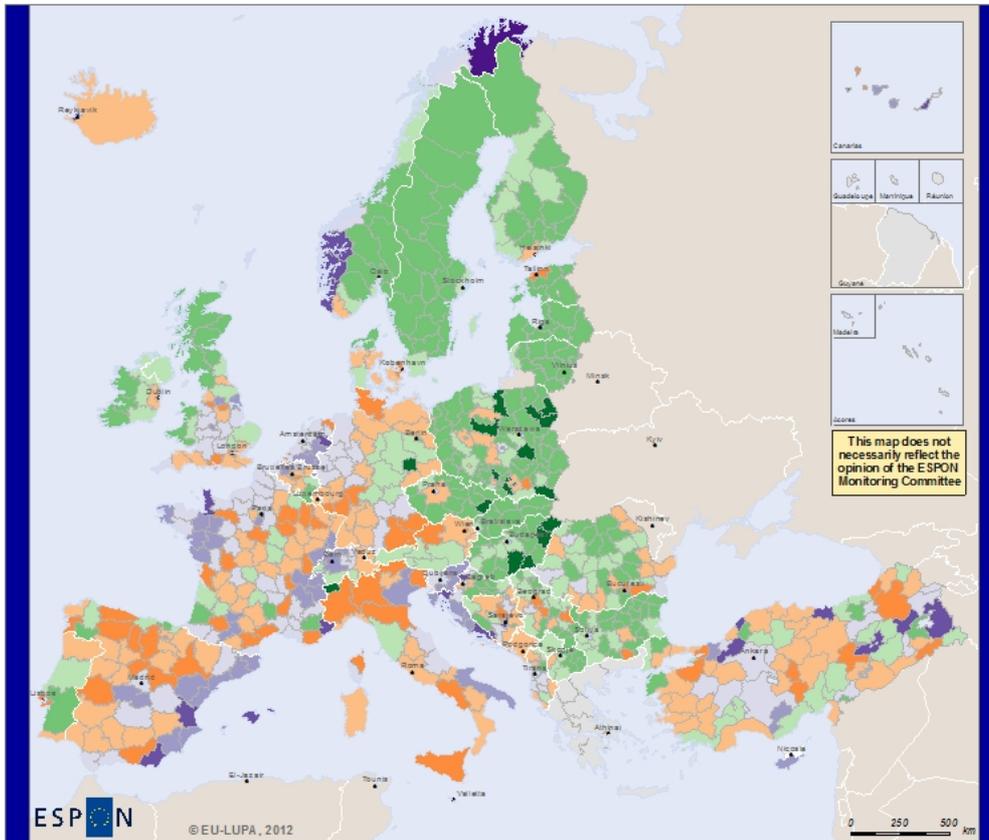
Regional level: NUTS 2/3/4
 Source: Noding et al., 2012
 Origin of data: EEA, 2011
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Land Use Change Types ¹	
	Very high intensification with artificial surfaces mainly replacing natural areas
	Very high intensification due to specific areas of residential and economic sprawl
	High intensification due to residential and economic sprawl surrounding urban internal conversions
	High intensification due to residential and economic sprawl
	High intensification due to residential and economic sprawl combined with forest conversions
	Medium-high intensification due to diverse urban processes
	Medium intensification due to some urban sprawl combined mainly with forest conversions
	Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl
	Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl
	Low intensification mainly due to agriculture and forest changes
	Low intensification dominated by forest conversions
	Bifurcification due to agricultural processes and forest changes
	High intensification due to forest and agricultural changes but specifically the withdrawal of farming

¹ The process of developing the land change typology is based on the account for all land changes taking place in each region during each time series. A cluster procedure was run for each time series and a total of 13 land change types have been identified. However, due to the varied nature of land processes taking place throughout the 1990 - 2006 time period, not all types are evident in each time series. Those types that are not applicable to this time period are shaded grey.

Map 13 Land Use Change Typology – 1990-2000

Land Use Change Typology 2000 - 2006



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Regional level: NUTS 2/3/4
 Source: Noding et al., 2012
 Origin of data: EEA, 2011

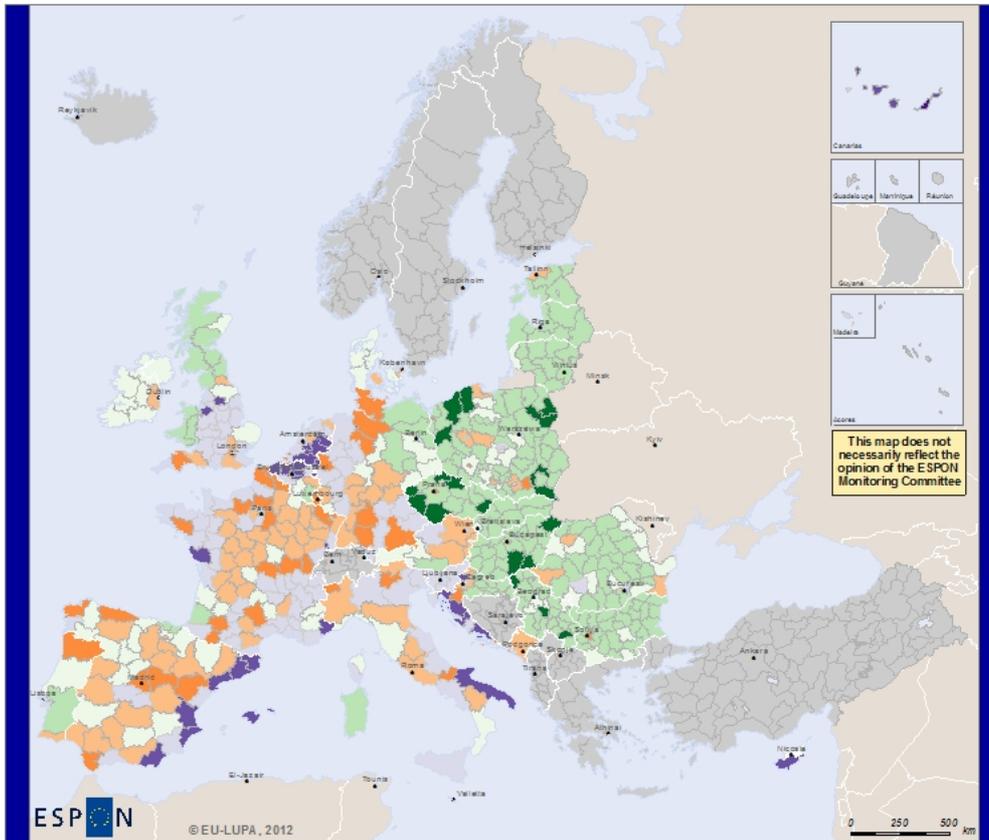
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Land Change Types ¹	
	Very high intensification with artificial surfaces mainly replacing natural areas
	Very high intensification due to specific areas of residential and economic sprawl
	High intensification due to residential and economic sprawl surrounding urban internal conversions
	High intensification due to residential and economic sprawl
	High intensification due to residential and economic sprawl combined with forest conversions
	Medium-high intensification due to diverse urban processes
	Medium intensification due to some urban sprawl combined mainly with forest conversions
	Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl
	Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl
	Low intensification mainly due to agriculture and forest changes
	Low intensification dominated by forest conversions
	Extensification due to agricultural processes and forest changes
	High extensification due to forest and agricultural changes but specifically the withdrawal of farming

¹ The process of developing the land change typology is based on the account for all land changes taking place in each region during each time series. A cluster procedure was run for each time series and a total of 13 land change types have been identified. However, due to the varied nature of land processes taking place throughout the 1990 - 2006 time period, not all types are evident in each time series. Those types that are not applicable to this time period are shaded grey.

Map 14 Land Use Change Typology – 2000-2006

Land Use Change Typology 1990 - 2006



ESPON
© EU-LUPA, 2012

Regional level: NUTS 2/3, X
Source: Nohrstedt, 2012
Origin of data: BEA, 2011
© EuroGeographics Association for administrative boundaries

Land Use Change Types ¹	
	Very high intensification with artificial surfaces mainly replacing natural areas
	Very high intensification due to specific areas of residential and economic sprawl
	High intensification due to residential and economic sprawl surrounding urban internal conversions
	High intensification due to residential and economic sprawl
	High intensification due to residential and economic sprawl combined with forest conversions
	Medium-high intensification due to diverse urban processes
	Medium intensification due to some urban sprawl combined mainly with forest conversions
	Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl
	Low intensification - dynamic mix between agricultural and forest changes with limited urban sprawl
	Low intensification mainly due to agriculture and forest changes
	Low intensification dominated by forest conversions
	Extensification due to agricultural processes and forest changes
	High extensification due to forest and agricultural changes but specifically the withdrawal of farming

¹ The process of developing the land change typology is based on the account for all land changes taking place in each region, during each time series. A cluster procedure was run for each time series and a total of 13 land change types have been identified. However, due to the varied nature of land processes taking place throughout the 1990 - 2006 time period, not all types are evident in each time series. Those types that are not applicable to this time period are shaded grey.

Map 15 Land Use Change Typology – 1990-2006

4 Discussion

4.1 Connecting Land use change types to changing Land Use Function

Now that Land use change types have been generated, it is interesting to compare these results with the LUFs analysis showing regions where changing land use functions are taking place. From a socio-economic perspective – where the Land use change typology has incorporated the notion of land use intensity – it is particularly interesting to compare the typology results to the LUF analysis of land use for provision of work. This seeks to further extend the analysis of the drivers of land use change by analyzing land use changes vis-à-vis changing socio-economic and activities taking place within European regions.

A cornerstone in the LUF categorization is the connection between the performance of European regions in relation to the functions under consideration. Furthermore, the ability to measure the performance across the same time series as the most recent CLC data allows us to analyze changes in land use functions in relation to changes in land cover - as presented by the land change typology. This is an opportunity that allows us to significantly expand the manner in which socio-economic and environmental activities are analyzed in relation to land cover data.

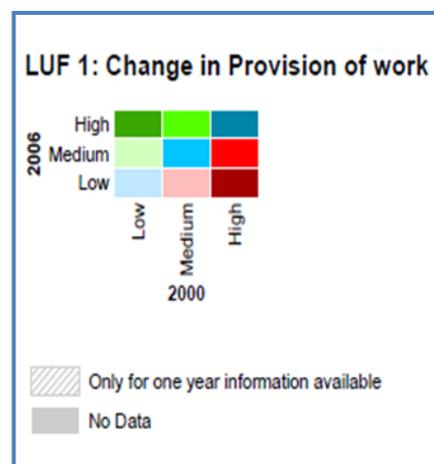


Figure 9 The LUF 3x3 performance matrix generated during the LUFs analysis

The 3x3 matrix in Figure 9 shows the different levels of change used in the LUFs analysis; going from low/low in the lower left corner to high/high in the upper right corner, indicated by a color scale with increasing intensity of change. According to this matrix, there is an increase in the performance related to the given land use function along the two axes respectively. To identify each of these groups as a unique performance

attribute, the reference table in **¡Error! No se encuentra el origen de la referencia.** allocates a unique index number for each of the nine LUF changes within each land use function.

LUF performance 2006	High	31	32	33
	Med	21	22	23
	Low	11	12	13
		Low	Med	High
LUF performance 2000				

Figure 10 Reference table for comparing the LUFs analysis and the Land Use Change Typology

With a numerical distribution of the performance for all outputs of the LUF analysis it becomes possible to compare the distribution of the LUF analysis (based on the matrix of performance values for each LUF) with the Land use change types for each region. As such, Table 24 compares the 2000-2006 Land Use Change Typology and LUF 1 – Provision of work. The left-hand column in the lists the 10 Land use change types for 2000-2006 and to the right this the 9 LUF categories are listed according to the three situations: categories showing a neutral performance over time (categories 11, 22 and 33), those showing decreasing performance (categories 12, 13 and 23); and those showing an increase in performance (categories 21, 31, and 32).

Table 24 Overview of relations between LUF1 – Provision of Work – and the types of flows

Land Use Change Types	LUF1 - Provision of work									Sum	Intensity	Regions
	Neutral			Decrease			Increase					
	LUF11	LUF22	LUF33	LUF12	LUF13	LUF23	LUF21	LUF31	LUF32			
Very high intensification with artificial surfaces mainly replacing natural areas	10	0,0000	-	-	-	-	-	-	-	0,000	4,375	1
Very high intensification due to specific areas of residential and economic sprawl	9	-	0,0395	0,0053	-	-	-	-	-	0,045	2,910	6
High intensification due to residential and economic sprawl surrounding urban internal conversions	7	0,0001	0,0181	-	0,0215	-	0,0135	-	0,0122	0,065	2,077	9
High intensification due to residential and economic sprawl combined with forest conversions	5	-	0,1639	0,0344	-	-	0,0052	-	0,0456	0,249	1,756	41
Medium-high intensification due to diverse urban processes	6	0,0074	0,3395	0,2186	0,0266	-	0,0256	0,0018	0,0477	0,667	1,309	83
Medium intensification due to some urban sprawl combined mainly with forest conversions	4	0,0018	0,2264	0,1909	0,0092	-	0,0091	0,0008	0,0077	0,446	0,957	59
Medium intensification - dynamic mix between agricultural and forest changes with urban sprawl	3	0,0156	0,5579	0,1709	0,1562	-	0,0267	0,0114	-	0,939	0,643	107
Low intensification mainly due to agriculture and forest changes	2	0,0375	0,7759	0,1038	0,0242	-	0,0586	0,0058	0,0170	1,023	0,319	86
Extensification due to agricultural processes and forest changes	1	0,1231	2,1613	0,0500	0,3250	-	0,0218	0,0506	0,0058	2,738	0,052	171
High extensification due to forest and agricultural changes but specifically the withdrawal of farming	8	0,0980	0,1298	0,0009	0,0212	-	0,0166	-	-	0,267	(0,350)	17
Sum		0,28360	4,41232	0,77496	0,58404	-	0,17724	0,07044	-	0,13604	6,439	580
Average Intensity		0,3275	0,6354	0,8775	0,3357	-	0,9222	0,4429	-	1,1819		
Number of Regions		46	348	100	39	-	18	15	-	14		580

The number of regions characterized by the different Land use change types is shown on the right hand side of the table and the number of regions in each LUF class is shown on the lowest row of the table. A total of 580 regions in Europe are able to contribute to the analysis as this is the maximum number of regions where data for both the LUFs and the typology is available. The number of regions is therefore fixed for the

entire analysis, as is the amount of total land change, which is 6.439% for these regions.

The main body of Table 24 distributes this change among the LUF rankings and the Land use change types. For example, at 4.41% (out of a total of 6.439%) the neutral-neutral score for LUF 1 (score 22 in the table) dominates the coverage.

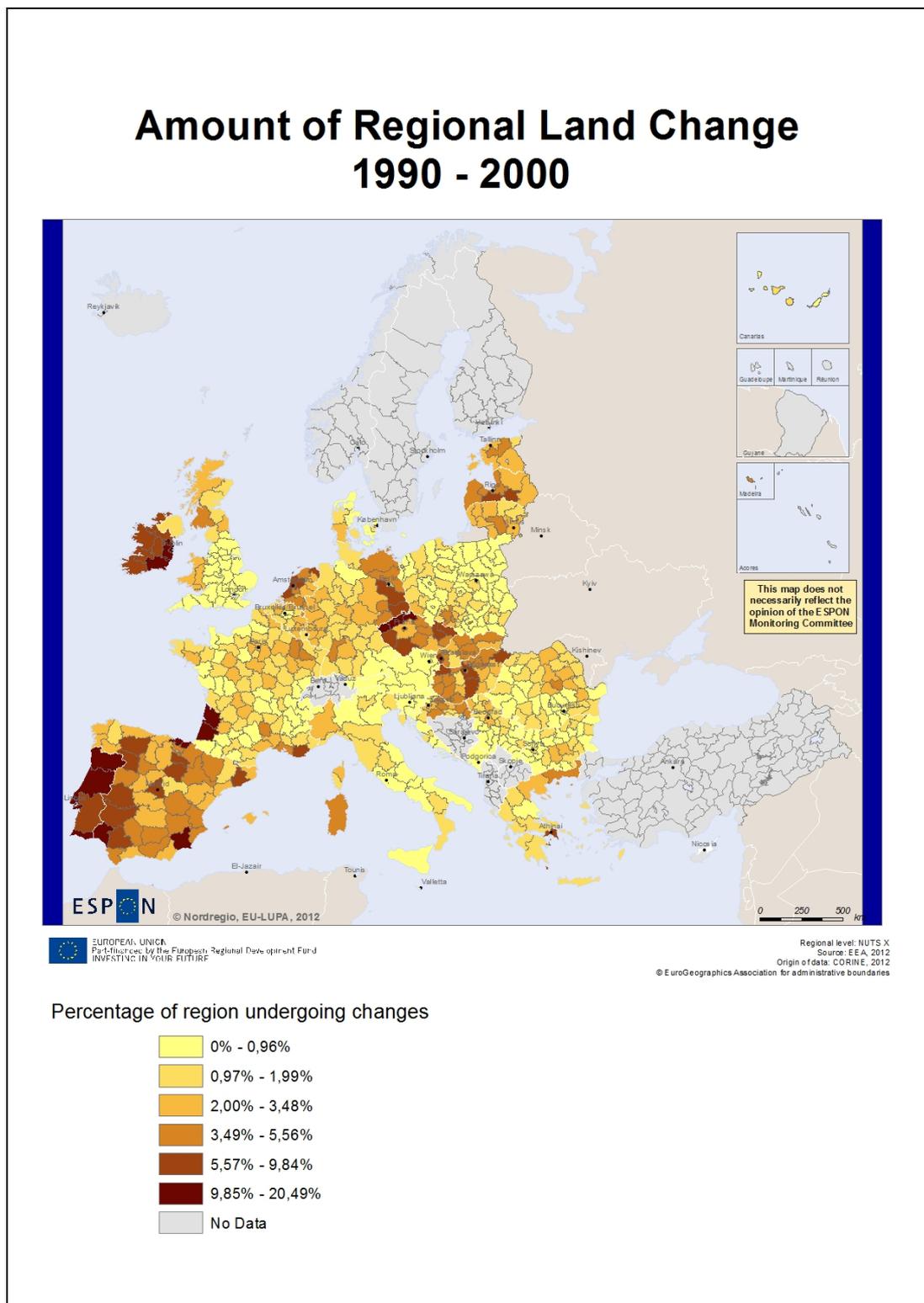
The use of color ramps highlights “hotspots” where large contributions are included in relation to specific land use change types. This allows an immediate interpretation of the role of the different land use change types in describing the LUF categories. For example, it is very easy to see that at 2.16% (out of the 6.439% total), a majority of land changes (calculated by area of change) are taking place in regions where extensification is taking place due to agricultural and forest change. And where this is taking place, a vast majority of the regions are characterized as having a neutral performance in terms of provision of work in both 2000 and 2006.

However, the most interesting element of comparing the LUFs to the typology is to see where changes in relation to each LUF (either increases or decreases) match up against the Land use change types. Therefore as another example, it is clear in **¡Error! No se encuentra el origen de la referencia.** that decreasing functionality in terms of provision of work is most likely to take place in regions that falling under the “Extensification due to agricultural processes and forest changes”. In fact this supports the notion of both the typologies and the LUFs (where extensification can often lead to a loss of job opportunities), which is a very common trend for instance in the rural and sparsely populated parts of the Nordic countries. This seems to show that land use patterns are indicative of the economic processes taking place in these regions.

When it comes to increases in performance (LUF 21, 31 and 32) it is obvious that types 4 and 5 (High intensification due to residential and economic sprawl combined with forest conversions, and Medium-high intensification due to diverse urban processes) are characteristic of regions undergoing an increase in provision of work.

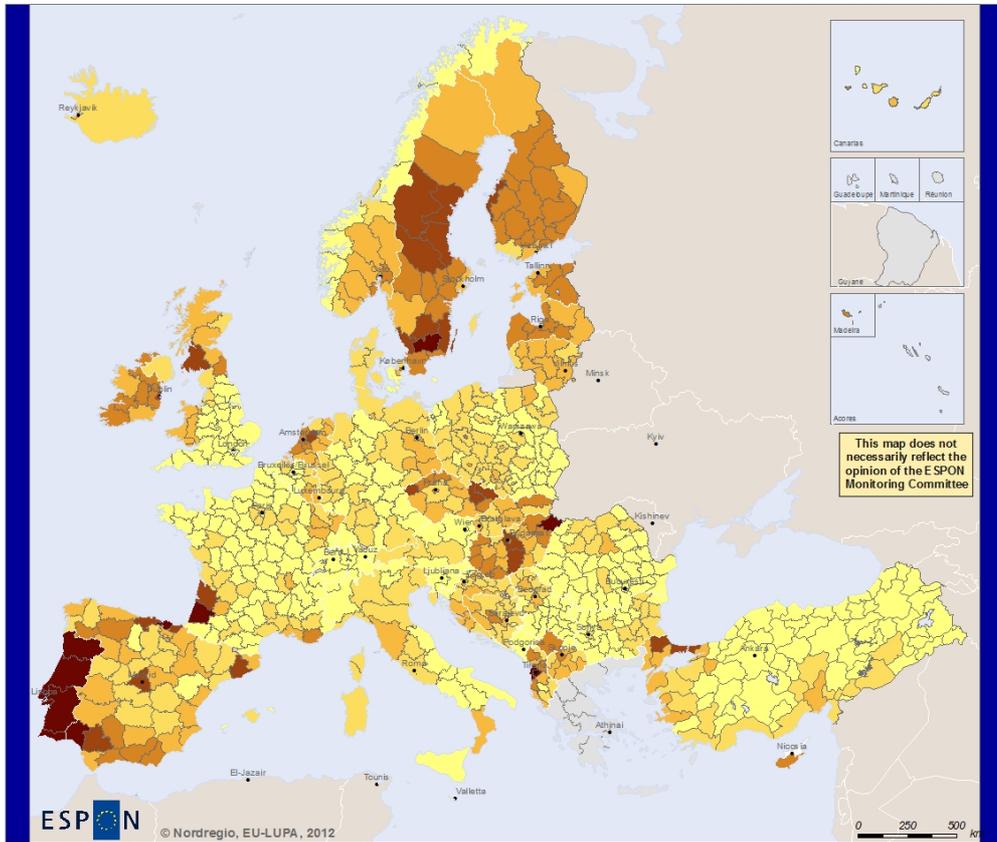
5 Appendix

5.1 Amount of land change per region

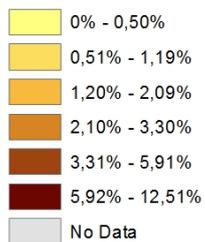


Map 16 Amount of land change per region 1990-2000

Amount of Regional Land Change 2000 - 2006

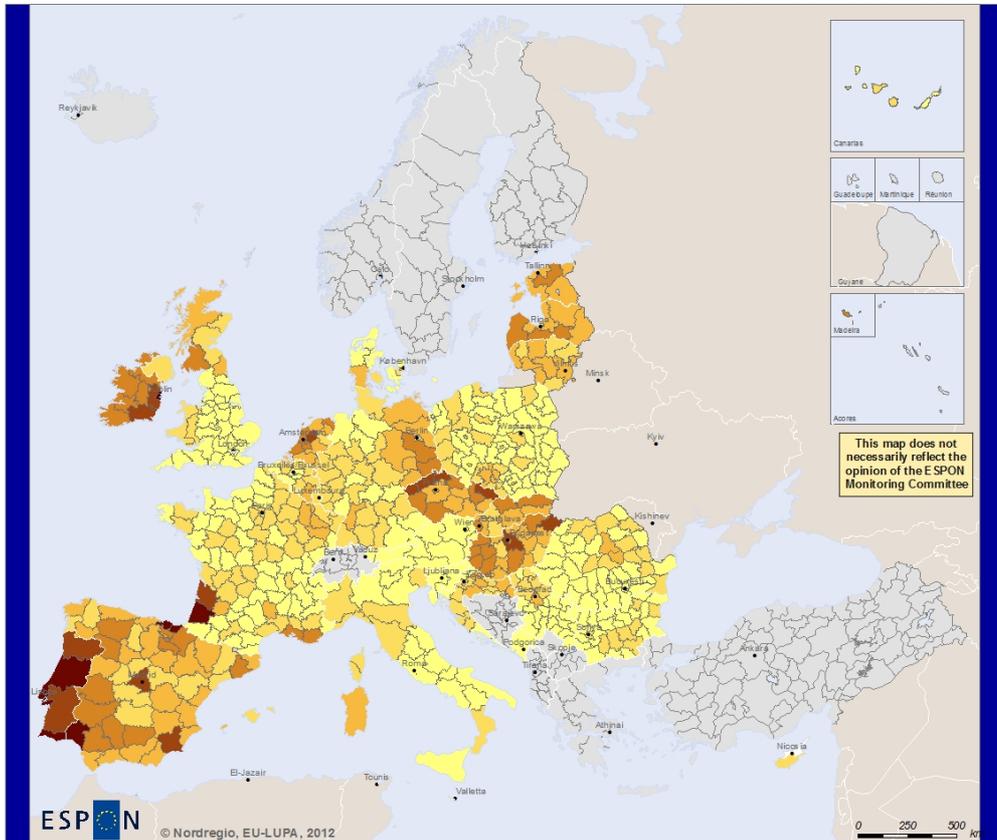


Percentage of region undergoing changes

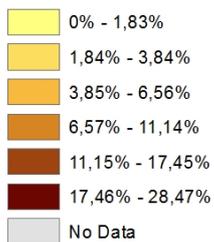


Map 17 Amount of land change per region 2000-2006

Amount of Regional Land Change 1990 - 2006



Percentage of region undergoing changes



Map 18 Amount of land change per region 1990-2006

5.2 CLC characteristics of the Prevailing characteristics of land use types – grid level

Table 25 The Distribution of the 44 CLC classes in 1990 among the Stable Land use types

Corine 1990														
Corine land cover classes	#	Distribution of Corine land cover classes amongst the Stable Land Types												
		U4: Urban cores and metropolitan areas	U3: Suburban residential and economic areas	U5: Special urban areas with relationships to the marine environment	R14: 1 & R14:2: Arable land in predominantly rural areas	U2: Pastures and agricultural mosaics in peri-urban areas	U6: Forested areas and agricultural mosaics in peri-urban areas	R12: Pastures, agricultural mosaic and mixed forest in predominantly rural areas	R15: 1 & R15:2 Rural Forest	R13: Transitional woodland or sparsely vegetated areas	R11: Lands primarily associated with water courses	R: 17: Sparse vegetation, wetlands, water bodies and snow or arctic conditions		
Continuous urban fabric	1	4 600	849	1 239	0	0	0	14	0	0	0	0	0	0
Discontinuous urban fabric	2	80 325	45 930	18 684	0	0	31	277	0	0	0	0	0	0
Industrial or commercial units	3	11 025	4 965	3 369	0	0	17	60	0	0	0	0	1	0
Road and rail networks and associated land	4	601	513	198	0	0	3	10	0	0	0	0	0	0
Port areas	5	108	32	730	0	0	0	84	0	0	0	0	5	0
Airports	6	2 046	1 114	232	0	0	3	16	0	0	0	0	0	0
Mineral extraction sites	7	1 247	3 783	646	0	0	301	515	0	0	0	0	46	0
Dump sites	8	298	606	135	0	0	79	56	0	0	0	0	0	0
Construction sites	9	433	511	175	0	0	56	126	0	0	0	0	44	0
Green urban areas	10	1 678	598	512	0	0	5	19	0	0	0	0	1	0
Sport and leisure facilities	11	1 116	1 747	705	0	0	78	37	0	0	0	0	1	0
Arable land	12	76 040	120 615	10 589	794 885	239 783	5 520	586	30 067	1 033	29	17	23	0
Arable land	13	4 213	3 844	547	59 823	18 759	268	78	1 474	134	4	1	0	0
Arable land	14	476	276	45	5 645	1 428	22	6	168	39	0	1	0	0
Permanent crops	15	416	1 104	388	22 671	7 594	6 783	83	3 904	140	3	2	3	0
Permanent crops	16	259	483	438	11 200	5 742	6 747	175	4 656	154	66	0	2	0
Permanent crops	17	53	151	204	16 754	7 805	4 039	165	14 716	542	136	0	1	0
Pastures	18	1 129	2 642	1 065	55 664	24 847	55 958	4 731	239 197	12 881	2 836	82	35	16
Heterogeneous agricultural areas	19	33	170	27	340	240	1 565	301	7 197	136	276	0	0	0
Heterogeneous agricultural areas	20	1 211	2 543	644	16 244	5 875	53 655	8 547	208 285	8 816	16 564	37	35	1
Heterogeneous agricultural areas	21	142	643	340	9 312	3 068	27 503	8 739	153 516	20 333	71 889	282	48	13
Heterogeneous agricultural areas	22	2	21	0	15	42	194	163	10 464	676	20 649	28	1	0
Forests	23	30	175	71	377	824	20 703	13 255	184 967	48 052	296 813	328	44	501
Forests	24	15	199	65	18	243	4 574	25 013	153 518	149 482	444 851	898	94	2 363
Forests	25	10	103	44	4	141	2 649	15 479	62 277	48 064	198 893	1 033	37	1 749
Scrub and/or herbaceous vegetation associations	26	38	172	28	33	137	691	5 787	29 648	8 570	164 768	6 637	159	598
Scrub and/or herbaceous vegetation associations	27	6	33	35	0	10	116	1 156	2 406	33 880	121 272	7 692	236	8 445
Scrub and/or herbaceous vegetation associations	28	5	74	34	1	36	211	4 015	7 436	4 715	64 416	26 741	458	637
Scrub and/or herbaceous vegetation associations	29	3	108	27	10	106	363	8 679	13 846	21 325	133 213	113 279	588	14 651
Open spaces with little or no vegetation	30	0	2	4	0	1	9	329	351	657	277	1 977	249	3 520
Open spaces with little or no vegetation	31	0	0	0	0	0	6	194	116	262	380	20 206	179	71 335
Open spaces with little or no vegetation	32	1	2	6	0	5	25	1 069	1 177	721	359	84 681	1 932	142 255
Open spaces with little or no vegetation	33	0	2	0	0	0	1	98	41	13	282	889	12	256
Open spaces with little or no vegetation	34	0	0	5	0	0	18	504	0	0	0	4	715	16 705
Inland wetlands	35	0	1	5	0	33	1	61	198	221	24	5 931	353	6 439
Inland wetlands	36	0	0	2	0	2	2	27	14	159	8	31 580	358	60 777
Maritime wetlands	37	0	0	0	0	0	0	2	2	25	0	1 326	146	1 562
Maritime wetlands	38	0	0	0	0	0	0	19	0	0	0	204	925	456
Maritime wetlands	39	0	0	11	0	0	0	294	0	14	0	1 162	2 327	9 118
Inland waters	40	0	0	14	0	0	3	179	2	69	0	4 588	5 091	2 361
Inland waters	41	0	0	1	0	2	0	6	44	137	0	23 137	326	92 722
Marine waters	42	0	0	1	0	0	0	5	0	0	0	636	534	5 001
Marine waters	43	0	0	12	0	0	0	13	0	9	0	355	583	2 291
Marine waters	44	0	0	0	0	0	0	0	0	13	0	604	0	2 827
Total (km ²)		187 559	194 011	41 277	992 996	316 714	192 200	100 972	1 129 687	361 272	1 538 008	334 338	15 592	446 599
Percent		3,20	3,31	0,70	16,96	5,41	3,28	1,72	19,29	6,17	26,26	5,71	0,27	7,63

Table 26 The Distribution of the 44 CLC classes in 2000 among the Stable Land use types

Corine 2000														
Corine land cover classes	#	Distribution of Corine land cover classes amongst the Stable Land Types												
		U4: Urban cores and metropolitan areas	U3: Suburban residential and economic areas	U5: Special urban areas with relationships to the marine environment	R14.1 & R14.2: Arable land in predominantly rural areas	U2: Pastures and agricultural mosaics in peri-urban areas	U6: Forested areas and agricultural mosaics in peri-urban areas	R12: Pastures, agricultural mosaics and mixed forest in predominantly rural areas	R15.1 & R15.2: Rural Forest	R13: Transitional woodland or sparsely vegetated areas	R11: Lands primarily associated with water courses	R17: Sparse vegetation, wetlands, water bodies and snow or arctic conditions		
Continuous urban fabric	1	4 711	951	1 259	0	0	3	15	0	0	0	0	0	0
Discontinuous urban fabric	2	81 923	48 264	18 994	0	0	66	307	0	0	0	0	2	0
Industrial or commercial units	3	12 098	6 118	3 542	0	0	33	80	0	0	0	2	0	0
Road and rail networks and associated land	4	661	665	219	0	0	11	20	0	0	0	0	0	0
Port areas	5	114	36	764	0	0	0	90	0	0	14	0	0	0
Airports	6	2 070	1 138	233	0	0	1	19	0	0	0	0	0	0
Mineral extraction sites	7	1 461	4 281	732	0	0	323	293	0	0	0	0	0	0
Dump sites	8	307	644	135	0	0	43	30	0	0	0	0	0	0
Construction sites	9	422	667	166	0	0	126	127	0	0	0	1	0	0
Green urban areas	10	1 674	607	514	0	0	15	19	0	0	0	1	0	0
Sport and leisure facilities	11	1 163	1 898	731	0	0	129	47	0	0	0	1	0	0
Arable land	12	74 019	119 724	10 356	789 419	237 038	3 786	442	42 401	1 433	281	267	3	4
Arable land	13	4 179	3 857	538	59 810	18 691	281	82	1 712	139	37	30	0	2
Arable land	14	469	277	47	5 803	1 478	23	6	191	35	0	7	0	0
Permanent crops	15	377	1 035	384	22 008	7 434	6 771	77	3 943	139	25	4	2	0
Permanent crops	16	140	327	418	11 501	5 815	6 784	162	5 124	157	144	10	0	0
Permanent crops	17	34	74	206	17 137	7 926	4 033	161	14 572	536	147	13	1	0
Pastures	18	682	1 676	977	55 554	24 205	56 916	4 728	235 042	12 114	3 989	447	19	34
Heterogeneous agricultural areas	19	7	36	16	447	264	1 523	296	6 896	127	301	0	0	0
Heterogeneous agricultural areas	20	938	1 340	533	15 966	5 854	54 182	8 572	198 928	8 605	16 861	104	25	5
Heterogeneous agricultural areas	21	77	261	290	10 013	3 228	27 637	8 690	148 338	20 004	72 775	573	35	36
Heterogeneous agricultural areas	22	0	1	0	328	172	189	170	10 656	660	21 128	4	0	0
Forests	23	22	48	54	651	1 024	20 755	13 410	183 200	48 047	293 852	512	35	522
Forests	24	2	23	50	270	457	4 505	24 782	151 697	145 652	433 027	1 350	87	2 399
Forests	25	2	13	40	86	396	2 624	15 510	64 301	49 302	202 040	1 432	36	1 790
Scrub and/or herbaceous vegetation associations	26	5	18	16	166	256	662	5 744	30 881	8 375	163 062	7 764	158	1 220
Scrub and/or herbaceous vegetation associations	27	0	4	19	13	17	117	1 148	2 630	33 026	115 073	5 091	234	7 264
Scrub and/or herbaceous vegetation associations	28	1	4	8	12	81	175	3 989	7 268	4 678	64 118	26 659	463	685
Scrub and/or herbaceous vegetation associations	29	1	22	15	177	460	404	8 952	18 170	23 911	145 950	113 648	598	14 991
Open spaces with little or no vegetation	30	0	0	4	2	14	9	326	348	740	282	1 899	248	3 531
Open spaces with little or no vegetation	31	0	0	0	0	0	5	193	93	249	582	18 955	179	70 886
Open spaces with little or no vegetation	32	0	1	0	2	22	43	1 195	1 176	811	2 173	83 875	1 934	142 455
Open spaces with little or no vegetation	33	0	0	0	1	1	0	42	44	24	550	461	11	62
Open spaces with little or no vegetation	34	0	0	1	0	0	22	508	0	0	4	710	16 280	
Inland wetlands	35	0	0	0	9	62	1	53	166	323	36	5 559	352	6 357
Inland wetlands	36	0	0	1	1	7	1	24	62	992	1 356	33 549	358	61 672
Maritime wetlands	37	0	0	0	0	19	0	3	6	78	1	1 379	147	1 651
Maritime wetlands	38	0	0	0	0	0	0	19	0	0	0	140	921	439
Maritime wetlands	39	0	0	10	0	2	0	308	0	74	0	1 238	2 337	9 040
Inland waters	40	0	1	4	1	31	2	315	149	189	15	4 569	5 261	2 371
Inland waters	41	0	0	0	10	67	0	4	155	542	59	23 181	327	92 375
Marine waters	42	0	0	0	0	0	0	6	0	3	1	623	530	5 009
Marine waters	43	0	0	1	0	2	0	8	0	9	0	232	560	1 781
Marine waters	44	0	0	0	0	2	0	0	2	101	0	728	0	3 735
Total (km ²)		187 559	194 011	41 277	989 387	315 025	192 200	100 972	1 128 151	361 075	1 537 865	334 307	15 592	446 596
Percent		3,20	3,31	0,70	16,89	5,38	3,28	1,72	19,26	6,17	26,26	5,71	0,27	7,63

Table 27 The Distribution of the 44 CLC classes in 2006 among the Stable Land use types

Corine 2006														
Corine land cover classes	#	Distribution of Corine land cover classes amongst the Stable Land Types												
		U4: Urban cores and metropolitan areas	U3: Suburban residential land economic areas	U5: Special urban areas with relationships to the marine environment	R14, 1 & R14.2: Arable land in predominantly rural areas	U2: Pastures and agricultural mosaics in per-urban areas	U6: Forested areas and agricultural mosaics in per-urban areas	R12: Pastures, agricultural mosaics and mixed forest in predominantly rural areas	R15, 1 & R15.2: Rural Forest	R13: Transitional woodland or sparsely vegetated areas	R11: Lands primarily associated with water courses	R17: Sparse vegetation, wetlands, water bodies and snow or arctic conditions		
Continuous urban fabric	1	4 604	978	1 234	0	0	35	23	0	0	0	0	3	0
Discontinuous urban fabric	2	82 659	49 650	19 172	0	0	1 501	511	0	0	0	0	36	0
Industrial or commercial units	3	12 866	6 691	3 632	0	0	285	152	0	0	0	0	6	0
Road and rail networks and associated land	4	693	730	216	0	0	74	40	0	0	0	0	0	0
Port areas	5	118	36	777	0	0	5	99	0	0	0	0	16	0
Airports	6	2 102	1 115	240	0	0	29	35	0	0	0	0	0	0
Mineral extraction sites	7	1 474	4 057	668	0	0	366	287	0	0	0	0	6	0
Dump sites	8	285	601	138	0	0	42	37	0	0	0	0	7	0
Construction sites	9	310	392	152	0	0	183	104	0	0	0	0	4	0
Green urban areas	10	1 575	509	496	0	0	156	34	0	0	0	0	1	0
Sport and leisure facilities	11	1 303	2 054	800	0	0	368	106	0	0	0	0	2	0
Arable land	12	71 949	115 001	10 150	795 323	240 398	9 697	768	33 713	1 136	264	136	15	7
Arable land	13	4 113	3 809	507	57 561	18 027	262	84	1 358	122	1	7	0	1
Arable land	14	472	275	45	5 647	1 340	20	5	163	40	12	0	0	0
Permanent crops	15	386	922	376	22 691	7 583	6 470	86	3 929	137	8	4	1	0
Permanent crops	16	126	340	389	11 214	5 620	6 602	189	4 400	150	60	2	0	0
Permanent crops	17	28	58	202	16 345	7 710	3 949	170	14 553	543	130	13	2	0
Pastures	18	1 306	3 042	907	57 775	24 687	54 849	4 835	237 492	12 902	2 916	187	60	20
Heterogeneous agricultural areas	19	6	38	13	348	257	1 412	271	7 307	144	290	4	0	0
Heterogeneous agricultural areas	20	984	2 237	524	16 339	5 957	50 400	8 580	207 458	8 740	16 504	59	46	5
Heterogeneous agricultural areas	21	156	782	294	9 347	3 183	26 071	8 647	153 446	20 359	72 143	346	60	29
Heterogeneous agricultural areas	22	0	0	0	59	55	187	164	10 375	660	20 174	56	0	3
Forests	23	11	208	83	372	833	20 344	13 228	183 708	47 902	295 397	475	65	509
Forests	24	2	115	46	32	277	4 414	24 320	153 837	149 488	447 257	1 536	93	2 381
Forests	25	5	63	43	4	171	2 756	15 650	62 332	48 093	198 633	1 266	52	1 752
Scrub and/or herbaceous vegetation associations	26	6	51	17	127	364	626	5 386	29 801	8 557	165 405	6 805	171	650
Scrub and/or herbaceous vegetation associations	27	2	10	15	1	12	112	1 030	2 448	33 893	121 593	7 808	217	8 452
Scrub and/or herbaceous vegetation associations	28	1	19	8	25	151	149	3 959	7 520	4 743	65 111	26 981	454	670
Scrub and/or herbaceous vegetation associations	29	14	210	43	10	131	651	9 258	13 907	21 216	130 467	111 089	595	14 307
Open spaces with little or no vegetation	30	0	1	7	0	4	11	279	352	661	291	1 985	238	3 508
Open spaces with little or no vegetation	31	0	0	0	0	0	1	179	116	264	392	20 227	119	71 247
Open spaces with little or no vegetation	32	3	2	2	7	43	45	1 003	1 236	730	515	84 605	1 944	142 212
Open spaces with little or no vegetation	33	0	0	0	0	2	0	40	31	22	357	1 068	2	385
Open spaces with little or no vegetation	34	0	3	6	0	0	43	398	0	0	0	5	653	16 805
Inland wetlands	35	0	3	0	1	42	3	66	200	251	21	5 920	346	6 440
Inland wetlands	36	0	0	0	0	8	1	29	25	277	49	32 164	384	61 043
Maritime wetlands	37	0	0	0	0	0	0	3	4	30	0	1 322	95	1 558
Maritime wetlands	38	0	0	2	0	0	0	19	0	0	0	202	939	442
Maritime wetlands	39	0	4	27	0	0	19	385	0	13	0	1 178	2 312	9 026
Inland waters	40	0	5	37	0	13	62	481	6	72	0	4 581	5 221	2 362
Inland waters	41	0	0	0	0	5	0	5	24	107	2	22 706	330	92 557
Marine waters	42	0	0	2	0	0	0	0	6	1	0	637	374	5 003
Marine waters	43	0	0	7	0	0	0	21	0	8	0	354	723	2 291
Marine waters	44	0	0	0	0	0	0	0	1	22	16	612	0	2 954
Total (km ²)		187 559	194 011	41 277	993 228	316 873	192 200	100 972	1 129 742	361 283	1 538 008	334 340	15 592	446 599
Percent		3,20	3,31	0,70	16,96	5,41	3,28	1,72	19,29	6,17	26,26	5,71	0,27	7,63

5.3 CLC characteristics of the Prevailing characteristics of land use types – regional level

Table 28 The Distribution of the 44 CLC classes in 1990 among the Stable Land use types

CLC classes		Cluster Numbers														
Label 1	Label 3	#	CL15	CL16	CL20	CL02	CL07	CL03	CL-05	CL09	CL04	CL6	CL12	CL11	CL01	CL10
Artificial surfaces	Continuous Urban Fabric	1	3,03	0,18	1,05	0,05	0,09	0,16	0,06	0,06	0,18	0,10	0,15	0,04	0,00	0,00
Artificial surfaces	Discontinuous urban fabric	2	40,99	15,05	9,18	3,83	3,29	3,03	3,11	1,97	2,39	2,37	1,30	0,94	0,55	0,28
Artificial surfaces	Industrial or commercial units	3	6,63	1,74	1,44	0,59	0,39	0,44	0,30	0,24	0,38	0,29	0,18	0,13	0,07	0,04
Artificial surfaces	Roads and rail networks and associated land	4	0,84	0,21	0,11	0,03	0,02	0,03	0,01	0,02	0,02	0,02	0,02	0,01	0,00	0,00
Artificial surfaces	Port areas	5	0,82	0,22	0,05	0,03	0,02	0,01	0,01	0,00	0,01	0,01	0,01	0,01	0,00	0,00
Artificial surfaces	Airports	6	0,95	0,24	0,29	0,10	0,07	0,08	0,06	0,04	0,06	0,04	0,04	0,03	0,02	0,02
Artificial surfaces	Mineral extraction sites	7	0,15	0,43	0,40	0,09	0,14	0,19	0,11	0,09	0,12	0,11	0,10	0,06	0,03	0,02
Artificial surfaces	Dump sites	8	0,24	0,15	0,08	0,02	0,03	0,04	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,00
Artificial surfaces	Construction sites	9	0,29	0,13	0,16	0,03	0,03	0,02	0,02	0,01	0,03	0,02	0,02	0,03	0,00	0,00
Artificial surfaces	Green urban areas	10	4,05	0,35	0,27	0,06	0,05	0,05	0,04	0,03	0,04	0,03	0,01	0,00	0,02	0,01
Artificial surfaces	Port and leisure facilities	11	3,22	0,73	1,23	0,35	0,18	0,14	0,17	0,09	0,11	0,08	0,08	0,04	0,06	0,06
Agricultural areas	Non-irrigated arable land	12	11,58	33,43	27,29	69,94	49,68	38,96	22,25	7,81	23,25	11,08	10,66	11,41	2,21	0,71
Agricultural areas	Permanently irrigated land	13	0,02	-	0,65	0,87	2,18	0,82	0,06	-	3,31	0,46	3,68	5,04	-	-
Agricultural areas	Rice fields	14	-	-	0,06	0,51	0,19	-	-	0,41	0,06	0,12	0,12	-	-	
Agricultural areas	Vineyards	15	0,08	0,01	0,85	0,99	0,71	1,20	0,47	0,31	1,71	0,54	0,99	0,38	0,00	-
Agricultural areas	Fruit trees and berry plantations	16	0,32	0,26	0,31	0,26	0,44	1,09	0,29	0,14	0,68	0,66	0,74	0,54	0,00	-
Agricultural areas	Olive groves	17	-	-	0,28	-	0,82	1,10	0,02	-	1,71	0,89	1,50	0,03	0,02	-
Agricultural areas	Pastures	18	6,18	12,46	12,82	5,12	10,60	5,72	28,72	33,28	2,28	8,10	2,94	1,41	0,73	0,78
Agricultural areas	Annual crops ass. With permanent crops	19	-	-	0,01	-	0,10	0,30	0,38	-	0,07	0,46	0,28	-	-	-
Agricultural areas	Complex cultivation	20	3,90	8,65	10,71	2,54	5,12	5,29	10,94	15,70	4,78	9,09	5,65	5,48	0,21	0,40
Agricultural areas	Agriculture with sign. Areas of natural vegetation	21	1,74	3,55	3,90	2,14	3,60	4,84	4,44	5,38	6,23	7,62	6,73	9,31	1,91	2,11
Agricultural areas	Agro-forestry areas	22	-	-	0,40	0,02	0,20	1,04	-	-	1,29	0,64	1,26	0,00	-	-
Forest and semi natural areas	Broad leaved forests	23	4,46	6,38	8,29	5,02	7,05	11,28	7,54	15,31	8,75	17,81	9,58	2,05	3,95	11,73
Forest and semi natural areas	Coniferous forests	24	2,09	5,40	6,37	1,49	5,52	11,25	8,34	6,95	14,27	11,19	12,49	3,34	39,75	6,79
Forest and semi natural areas	Mixed forests	25	1,96	5,44	2,95	0,58	2,11	4,31	3,01	5,46	5,50	8,77	6,01	1,97	12,06	0,87
Forest and semi natural areas	Natural grasslands	26	0,75	0,38	2,49	0,82	2,20	1,62	0,81	2,36	5,05	5,34	8,66	13,65	0,98	0,86
Forest and semi natural areas	Moors and heathland	27	0,29	0,45	0,61	0,07	0,14	0,70	0,59	0,87	0,64	1,92	1,29	0,08	8,08	21,78
Forest and semi natural areas	Sclerophyllous vegetation	28	-	0,06	2,74	0,07	0,17	1,54	0,11	-	3,79	2,68	7,25	1,20	0,20	-
Forest and semi natural areas	Transitional woodland shrub	29	0,29	0,55	2,80	1,15	1,26	2,37	1,24	1,81	6,41	6,04	8,66	9,39	10,89	0,77
Forest and semi natural areas	Beaches, dunes, sands	30	0,05	0,12	0,03	0,08	0,04	0,05	0,09	0,01	0,11	0,08	0,14	0,19	0,01	0,93
Forest and semi natural areas	Bare rocks	31	-	-	0,07	-	0,23	0,08	0,07	0,02	0,70	0,67	2,77	5,58	0,67	13,32
Forest and semi natural areas	Sparsely vegetated areas	32	0,02	0,02	0,14	0,06	1,05	0,42	0,11	0,01	2,70	1,34	4,84	22,77	2,58	24,35
Forest and semi natural areas	Burnt areas	33	0,01	-	0,00	-	0,00	0,01	0,00	-	0,07	0,05	0,16	0,04	0,00	-
Forest and semi natural areas	Glaciers and perpetual snow	34	-	-	-	-	0,00	-	-	-	0,02	0,06	0,28	0,27	0,03	4,08
Wetlands	Inland marshes	35	0,21	0,18	0,06	0,59	0,31	0,25	0,24	0,05	0,21	0,14	0,18	1,13	0,06	0,12
Wetlands	Peat bogs	36	0,35	0,26	0,17	0,04	0,12	0,15	3,91	0,72	0,32	0,20	0,08	-	6,86	6,24
Wetlands	Salt marshes	37	0,08	0,00	0,11	0,14	0,07	0,01	0,07	-	0,08	0,06	0,10	0,11	0,00	0,01
Wetlands	Salines	38	-	-	0,04	-	0,04	0,01	0,01	-	0,02	0,01	0,02	0,02	-	-
Wetlands	Intertidal flats	39	1,82	0,59	0,18	0,47	0,52	0,01	1,05	0,06	0,03	0,08	0,00	-	0,02	0,28
Water bodies	Water courses	40	0,93	0,48	0,17	0,46	0,15	0,18	0,15	0,15	0,13	0,11	0,05	0,16	0,19	0,25
Water bodies	Water bodies	41	1,24	1,81	0,67	0,97	0,76	0,91	0,92	0,99	1,87	0,67	0,81	2,66	7,66	2,78
Water bodies	Coastal lagoons	42	-	-	0,01	0,12	0,23	0,19	0,01	-	0,11	0,03	0,07	0,36	0,00	0,08
Water bodies	Estuaries	43	0,36	0,05	0,50	0,29	0,05	0,02	0,16	0,02	0,05	0,02	0,00	-	0,06	0,02
Water bodies	Sea and ocean	44	0,08	0,04	0,08	0,03	0,05	0,02	0,08	0,05	0,08	0,05	0,08	0,01	0,07	0,33
Number of regions			29	32	21	41	97	81	52	48	97	171	56	56	30	27
Percent of Europe			0,22	1,38	1,20	3,57	11,89	10,82	5,48	2,05	15,24	17,75	7,09	4,60	12,89	5,81
			Urban cores and metropolitan areas	Suburban areas												Rural forest

Table 29 The Distribution of the 44 CLC classes in 2000 among the Stable Land use types

CLC classes		Cluster Numbers														
Label 1	Label 3	#	CL15	CL16	cl20	CL02	CL07	CL03	CL-05	CL09	CL04	CL6	CL12	CL11	CL01	CL10
Artificial surfaces	Continuous Urban Fabric	1	3,03	0,18	1,08	0,05	0,10	0,16	0,06	0,06	0,11	0,16	0,18	0,04	0,00	0,00
Artificial surfaces	Discontinuous urban fabric	2	41,35	15,43	9,80	3,89	3,38	3,11	3,32	2,00	2,44	1,37	2,43	0,95	0,55	0,28
Artificial surfaces	Industrial or commercial units	3	6,89	2,08	1,79	0,63	0,45	0,49	0,36	0,27	0,32	0,21	0,42	0,14	0,07	0,04
Artificial surfaces	Roads and rail networks and associated land	4	0,86	0,23	0,14	0,04	0,02	0,04	0,02	0,03	0,02	0,02	0,02	0,01	0,00	0,00
Artificial surfaces	Port areas	5	0,83	0,24	0,06	0,03	0,02	0,01	0,01	0,00	0,01	0,01	0,01	0,01	0,00	0,00
Artificial surfaces	Airports	6	0,95	0,24	0,31	0,10	0,07	0,08	0,06	0,04	0,04	0,04	0,06	0,03	0,02	0,02
Artificial surfaces	Mineral extraction sites	7	0,15	0,44	0,45	0,10	0,14	0,19	0,13	0,10	0,12	0,14	0,14	0,06	0,03	0,02
Artificial surfaces	Dump sites	8	0,23	0,14	0,08	0,02	0,03	0,04	0,01	0,00	0,02	0,01	0,01	0,01	0,01	0,00
Artificial surfaces	Construction sites	9	0,23	0,10	0,24	0,03	0,03	0,03	0,02	0,04	0,02	0,03	0,03	0,03	0,00	0,00
Artificial surfaces	Green urban areas	10	4,05	0,36	0,29	0,06	0,05	0,05	0,04	0,03	0,03	0,01	0,04	0,00	0,02	0,01
Artificial surfaces	Port and leisure facilities	11	3,24	0,85	1,30	0,37	0,19	0,15	0,21	0,09	0,10	0,08	0,12	0,04	0,06	0,06
Agricultural areas	Non-irrigated arable land	12	11,04	32,94	26,65	69,84	49,47	38,23	22,67	7,92	10,88	10,43	23,08	11,41	2,21	0,71
Agricultural areas	Permanently irrigated land	13	0,02	-	0,75	0,97	2,21	1,04	0,06	-	0,47	3,81	3,36	5,07	-	-
Agricultural areas	Rice fields	14	-	-	0,07	0,44	0,19	0,09	-	-	0,06	0,13	0,43	0,11	-	-
Agricultural areas	Vineyards	15	0,08	0,01	0,84	0,94	0,70	1,19	0,47	0,31	0,55	0,99	1,70	0,38	0,00	-
Agricultural areas	Fruit trees and berry plantations	16	0,32	0,27	0,30	0,24	0,43	1,09	0,28	0,14	0,67	0,74	0,69	0,55	0,00	-
Agricultural areas	Olive groves	17	-	-	0,27	-	0,83	1,10	0,02	-	0,88	1,50	1,78	0,03	0,02	-
Agricultural areas	Pastures	18	6,21	12,10	12,60	5,07	10,54	5,99	27,99	33,14	8,21	2,91	2,24	1,41	0,73	0,78
Agricultural areas	Annual crops ass. With permanent crops	19	-	-	0,02	-	0,10	0,29	0,37	-	0,43	0,28	0,07	-	-	-
Agricultural areas	Complex cultivation	20	3,86	8,59	10,37	2,53	5,12	5,30	10,89	15,67	9,09	5,64	4,79	5,48	0,21	0,40
Agricultural areas	Agriculture with sign. Areas of natural vegetation	21	1,69	3,53	3,83	2,15	3,59	4,81	4,41	5,38	7,60	6,67	6,23	9,30	1,92	2,11
Agricultural areas	Agro-forestry areas	22	-	-	0,41	0,01	0,21	1,03	-	-	0,67	1,25	1,32	0,00	-	-
Forest and semi natural areas	Broad leaved forests	23	4,49	6,40	8,27	5,11	7,11	11,33	7,56	15,33	17,83	9,73	8,85	2,06	3,95	11,73
Forest and semi natural areas	Coniferous forests	24	2,09	5,32	6,11	1,41	5,51	11,21	8,22	6,76	11,02	12,27	14,28	3,35	39,75	6,79
Forest and semi natural areas	Mixed forests	25	1,97	5,45	2,92	0,56	2,12	4,30	3,01	5,39	8,72	6,01	5,55	1,98	12,06	0,87
Forest and semi natural areas	Natural grasslands	26	0,71	0,40	2,40	0,80	2,17	1,58	0,82	2,36	5,34	8,52	4,99	13,64	0,98	0,86
Forest and semi natural areas	Moors and heathland	27	0,29	0,45	0,59	0,07	0,15	0,69	0,59	0,86	1,88	1,27	0,64	0,08	8,08	21,78
Forest and semi natural areas	Sclerophyllous vegetation	28	-	0,06	2,74	0,06	0,16	1,53	0,12	-	2,59	7,33	3,72	1,19	0,20	-
Forest and semi natural areas	Transitional woodland shrub	29	0,29	0,62	3,06	1,24	1,28	2,52	1,69	2,03	6,29	8,81	6,31	9,40	10,90	0,77
Forest and semi natural areas	Beaches, dunes, sands	30	0,07	0,11	0,03	0,08	0,04	0,05	0,08	0,01	0,08	0,14	0,11	0,19	0,01	0,93
Forest and semi natural areas	Bare rocks	31	-	-	0,06	-	0,23	0,08	0,07	0,02	0,67	2,78	0,70	5,58	0,67	13,32
Forest and semi natural areas	Sparsely vegetated areas	32	0,02	0,01	0,13	0,06	1,06	0,43	0,10	0,01	1,33	4,84	2,70	22,74	2,58	24,35
Forest and semi natural areas	Burnt areas	33	-	-	0,03	-	-	0,01	0,00	-	0,04	0,15	0,04	0,01	0,00	-
Forest and semi natural areas	Glaciers and perpetual snow	34	-	-	-	-	0,00	-	-	-	0,05	0,27	0,02	0,27	0,03	4,08
Wetlands	Inland marshes	35	0,20	0,19	0,07	0,58	0,31	0,25	0,25	0,05	0,14	0,18	0,21	1,13	0,06	0,12
Wetlands	Peat bogs	36	0,35	0,26	0,17	0,04	0,12	0,15	3,60	0,71	0,20	0,08	0,32	-	6,86	6,24
Wetlands	Salt marshes	37	0,08	0,00	0,10	0,14	0,07	0,01	0,07	-	0,06	0,10	0,08	0,11	0,00	0,01
Wetlands	Salines	38	-	-	0,04	-	0,04	0,01	0,01	-	0,01	0,02	0,02	0,02	-	-
Wetlands	Intertidal flats	39	1,80	0,58	0,16	0,47	0,53	0,01	1,06	0,07	0,08	0,00	0,03	-	0,02	0,28
Water bodies	Water courses	40	0,93	0,48	0,17	0,46	0,15	0,18	0,15	0,15	0,11	0,05	0,13	0,16	0,19	0,25
Water bodies	Water bodies	41	1,24	1,87	0,70	0,98	0,79	0,92	1,00	0,68	0,83	1,90	2,66	7,66	2,78	-
Water bodies	Coastal lagoons	42	-	-	0,01	0,12	0,23	0,19	0,01	-	0,03	0,07	0,11	0,36	0,00	0,08
Water bodies	Estuaries	43	0,36	0,05	0,49	0,29	0,05	0,02	0,16	0,02	0,02	0,00	0,05	-	0,06	0,02
Water bodies	Sea and ocean	44	0,08	0,03	0,08	0,03	0,03	0,02	0,08	0,01	0,05	0,08	0,08	0,00	0,07	0,33
Number of regions		29	32	21	41	97	81	52	18	97	171	56	56	30	27	
Percent of Europe		0,22	1,38	1,20	3,57	11,89	10,82	5,48	2,05	15,24	17,75	7,09	4,60	12,89	5,81	
		Urban cores and metropolitan areas	Suburban areas													Rural forest

Table 30 The Distribution of the 44 CLC classes in 2006 among the Stable Land use types

CLC classes		#	Cluster Numbers													
Label 1	Label 3		CL15	CL16	CL20	CL02	CL07	CL03	CL-05	CL09	CL04	CL6	CL12	CL11	CL01	CL10
Artificial surfaces	Continuous Urban Fabric	1	2,98	0,17	1,09	0,04	0,10	0,15	0,06	0,05	0,12	0,16	0,19	0,04	0,00	0,00
Artificial surfaces	Discontinuous urban fabric	2	41,95	15,75	10,28	4,05	3,64	3,30	3,56	2,15	2,60	1,54	2,50	0,97	0,55	0,28
Artificial surfaces	Industrial or commercial units	3	7,48	2,23	2,01	0,70	0,50	0,53	0,43	0,31	0,35	0,25	0,46	0,15	0,08	0,04
Artificial surfaces	Roads and rail networks and associated land	4	0,89	0,24	0,20	0,04	0,03	0,04	0,03	0,04	0,03	0,03	0,03	0,01	0,00	0,00
Artificial surfaces	Port areas	5	0,80	0,26	0,06	0,03	0,02	0,01	0,01	0,00	0,01	0,01	0,02	0,01	0,00	0,00
Artificial surfaces	Airports	6	0,98	0,25	0,34	0,12	0,08	0,08	0,06	0,04	0,04	0,05	0,06	0,03	0,02	0,02
Artificial surfaces	Mineral extraction sites	7	0,15	0,41	0,50	0,10	0,14	0,18	0,15	0,10	0,13	0,14	0,16	0,06	0,03	0,02
Artificial surfaces	Dump sites	8	0,22	0,14	0,09	0,02	0,03	0,03	0,02	0,00	0,02	0,01	0,01	0,01	0,01	0,00
Artificial surfaces	Construction sites	9	0,12	0,10	0,28	0,04	0,03	0,03	0,02	0,01	0,03	0,04	0,04	0,04	0,00	0,01
Artificial surfaces	Green urban areas	10	4,08	0,37	0,33	0,05	0,04	0,04	0,04	0,02	0,03	0,01	0,04	0,01	0,02	0,01
Artificial surfaces	Port and leisure facilities	11	3,81	0,88	1,56	0,41	0,22	0,18	0,24	0,12	0,12	0,10	0,14	0,04	0,07	0,07
Agricultural areas	Non-irrigated arable land	12	11,68	32,97	25,91	69,22	49,58	37,93	24,47	6,68	11,24	10,49	22,83	11,41	2,36	0,71
Agricultural areas	Permanently irrigated land	13	-	-	0,69	0,97	2,24	1,08	0,05	-	0,48	3,82	3,32	5,08	-	-
Agricultural areas	Rice fields	14	-	-	0,09	0,44	0,19	0,09	-	-	0,06	0,13	0,44	0,11	-	-
Agricultural areas	Vineyards	15	0,07	0,01	0,83	0,99	0,65	1,20	0,41	0,31	0,54	0,96	1,64	0,38	0,00	-
Agricultural areas	Fruit trees and berry plantations	16	0,29	0,20	0,15	0,26	0,50	1,11	0,27	0,12	0,68	0,74	0,71	0,56	0,00	-
Agricultural areas	Olive groves	17	-	-	0,27	-	0,84	1,07	0,02	-	0,86	1,49	1,85	0,04	0,02	-
Agricultural areas	Pastures	18	6,42	11,85	15,78	5,70	10,29	6,16	26,70	34,28	7,95	2,65	2,25	1,49	0,66	0,78
Agricultural areas	Annual crops ass. With permanent crops	19	-	-	0,02	-	0,10	0,26	0,36	-	0,44	0,27	0,07	-	-	-
Agricultural areas	Complex cultivation	20	2,03	8,31	8,47	2,19	4,74	4,96	10,09	16,23	8,86	5,52	4,82	5,41	0,17	0,40
Agricultural areas	Agriculture with sign. Areas of natural vegetation	21	1,23	3,45	2,92	2,06	3,47	4,86	4,41	5,14	7,50	6,67	6,15	9,28	1,80	2,12
Agricultural areas	Agro-forestry areas	22	-	-	0,40	0,01	0,21	1,14	-	-	0,66	1,24	1,38	0,00	-	-
Forest and semi natural areas	Broad leaved forests	23	4,08	6,36	7,43	4,98	7,09	11,13	7,39	15,02	17,77	9,62	8,80	2,05	3,99	11,73
Forest and semi natural areas	Coniferous forests	24	2,09	5,39	6,02	1,41	5,51	11,33	8,11	6,60	10,83	11,80	13,85	3,30	38,57	6,69
Forest and semi natural areas	Mixed forests	25	1,96	5,50	3,29	0,65	2,22	4,35	3,26	5,38	8,80	5,70	1,99	12,56	0,87	-
Forest and semi natural areas	Natural grasslands	26	0,81	0,41	2,18	0,74	2,14	1,40	0,72	2,25	5,17	8,86	5,09	13,60	1,35	0,86
Forest and semi natural areas	Moors and heathland	27	0,25	0,42	0,63	0,13	0,15	0,51	0,64	0,87	1,71	1,25	0,62	0,07	7,06	21,76
Forest and semi natural areas	Sclerophyllous vegetation	28	-	0,06	2,66	0,06	0,16	1,53	0,12	-	2,55	7,26	3,73	1,22	0,22	-
Forest and semi natural areas	Transitional woodland shrub	29	0,37	0,59	3,15	1,29	1,41	2,90	1,95	2,24	6,70	9,73	6,67	9,45	11,59	0,87
Forest and semi natural areas	Beaches, dunes, sands	30	0,09	0,09	0,09	0,07	0,03	0,04	0,08	0,01	0,08	0,14	0,10	0,21	0,03	0,93
Forest and semi natural areas	Bare rocks	31	-	-	0,05	-	0,23	0,05	0,06	0,01	0,63	2,65	0,65	5,57	0,66	13,36
Forest and semi natural areas	Sparsely vegetated areas	32	0,01	0,01	0,10	0,03	1,05	0,40	0,09	0,01	1,43	4,82	2,68	22,68	2,70	24,35
Forest and semi natural areas	Burnt areas	33	-	-	0,02	-	0,00	0,01	0,00	-	0,04	0,08	0,04	0,00	0,00	-
Forest and semi natural areas	Glaciers and perpetual snow	34	-	-	-	-	0,00	-	-	-	0,05	0,24	0,01	0,27	0,03	4,02
Wetlands	Inland marshes	35	0,20	0,16	0,09	0,58	0,30	0,22	0,23	0,05	0,13	0,18	0,21	1,15	0,06	0,12
Wetlands	Peat bogs	36	0,41	0,37	0,28	0,04	0,11	0,27	3,46	0,71	0,28	0,08	0,35	-	7,34	6,23
Wetlands	Salt marshes	37	0,12	0,01	0,10	0,16	0,09	0,01	0,07	-	0,06	0,09	0,08	0,11	0,00	0,01
Wetlands	Salines	38	-	-	0,04	-	0,02	0,01	0,01	-	0,01	0,02	0,02	0,02	-	-
Wetlands	Intertidal flats	39	1,80	0,59	0,17	0,51	0,53	0,01	1,04	0,07	0,07	0,00	0,03	-	0,03	0,28
Water bodies	Water courses	40	0,90	0,48	0,18	0,52	0,16	0,19	0,16	0,15	0,11	0,05	0,13	0,16	0,20	0,26
Water bodies	Water bodies	41	1,24	1,89	0,69	0,99	0,80	0,95	0,92	1,00	0,69	0,84	1,91	2,68	7,66	2,78
Water bodies	Coastal lagoons	42	-	-	0,01	0,11	0,22	0,19	0,01	-	0,04	0,08	0,11	0,36	0,00	0,08
Water bodies	Estuaries	43	0,27	0,05	0,46	0,11	0,04	0,01	0,14	0,01	0,01	0,00	0,04	-	0,04	0,02
Water bodies	Sea and ocean	44	0,21	0,03	0,12	0,19	0,06	0,05	0,12	0,01	0,07	0,08	0,09	0,01	0,09	0,33
Number of regions		29	32	21	41	97	81	52	18	97	171	56	30	27		
Percent of Europe		0,22	1,38	1,20	3,57	11,89	10,82	5,48	2,05	15,24	17,75	7,09	4,60	12,89	5,81	
		Urban cores and metropolitan areas	Suburban areas												Rural forest	

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European Land Use Patterns

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CHAPTER 2

Land Use Functions and their linked land use performance and /efficiency

Methodology for assessment of regional land use performance
and efficiency based on Land Use Functions

Draft Final Report Part C Scientific report | Version 00June/2012



This report presents the draft final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

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C Scientific report

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Land Use Functions and their linked land use performance and efficiency

Marta Pérez-Soba, Matthijs Danes, Michiel van Eupen, Sander Múcher and Gerard Hazeu, Alterra Wageningen UR

1. Why using Land Use Functions in LUPA?

The main objective of the EU LUPA project is to *provide a consistent methodology to analyse comparable information about European regions based on data from different sources and different levels [...] integrating physical dimension (land cover) with social-economic (land use) and environmental, in order to understand and obtain a clear view on land use changes [...] identifying main challenges [...] and defining policy options to cope with those challenges.*

An **integrated assessment** of land use policies implies simultaneous consideration of all spatially relevant aspects of economic sectors and human activities that are linked to land (Helming et al. 2008). These include agriculture and forestry as the main traditional economic sectors, nature conservation and rural tourism as mainly land conserving activities, and settlement, transport and energy infrastructure as mainly urbanised land uses. All of these sectors and activities compete for land resources, so any policy change affecting one land use has the potential to induce changes in the others (Plummer 2009).

Sustainable land use implies a balanced consideration of the range of social, economic, and environmental goods and services provided by the land uses in a certain region/landscape (Wiggering et al., 2006; Pérez-Soba et al., 2008). It also implies a careful consideration of long term attributes of resilience and robustness that are to maintain underlying ecosystem processes. In an attempt to operationalize sustainable development for the case of land use, the concept of multifunctionality was introduced (Wiggering et al., 2006). The underlying rationale for **multifunctional land use** is to consider effects of any land use action interactively. Commodity production is analysed in the context of its negative and positive externalities in a spatial system.

The Land Use Functions (LUFs) conceptual framework is a functional analysis on how changes in land use (partly driven by policies) impact on the multiple functions attached to land use, which in turn affect sustainability and stock and quality of natural resources. The LUFs concept responds to the EU policy need for integrated impact assessment considering the three main dimensions of sustainability, i.e. economic, environmental and social. The LUFs concept enables the translation of a broad range of economic, environmental and social indicators into an integrated regional assessment.

The LUFs concept was developed in the FP6 SENSOR project (Pérez-Soba et al., 2008; Paracchini et al. 2011) and it has been implemented in other projects since then (König et al., 2010; Reidsma et al., 2011).

The main objectives of the LUFs framework in EU LUPA are:

- To assess quantitatively the degree of multifunctionality of regions by assessing the performance of the land use functions present;
- To assess the impacts of land use change in a comprehensive way and not based on the partial views provided by individual indicators;
- To estimate the impact of land use changes on the economic, social and environmental dimensions, addressing in this way the interface between socio-economic development and the environment, i.e. sustainable development.

This document describes the adaptation of the original LUFs methodology to the specific EU- LUPA objectives.

2. Definition of Land Use Functions

Land Use Functions (LUFs) express the goods and services that the use of the land provides to human society, which are of economical, ecological and socio-cultural value and are likely to be affected by policy changes.

In EU-LUPA six LUFs have been identified considering the following criteria:

- The main uses of the land in Europe are represented (agriculture and forestry as the main production sectors, nature conservation and rural tourism as land conserving activities, and settlement, transport and energy infrastructure as urbanised land uses);
- Ensure that relevant economic, environmental and societal key issues in land use have an equal representation;
- The functions are likely to be affected by European policies.

The six functions proposed by LP3 were reviewed by an expert panel during the ESPON seminar on 'Evidence on European Land Use' that was held on 24 May 2011 in Brussels. The panel found that the six LUFs provided a good compromise between the number of functions and the topics covered, i.e. the six LUFs considered key functions of land use, they could be assessed by the set of indicators currently available at a NUTS 2/3 level, and they were easy to communicate main messages to policy and decision makers. It was also concluded that many different classification of the functions could be made, if needed, since the approach is very flexible. The LUFs have been defined considering main links to the economic, environmental and social dimensions, and are listed in Table 1. It should be noted that the LUFs do not refer uniquely to a dimension of sustainability, but have a "prevalent" social, economic or environmental character, acknowledging that the pillars of sustainability are not isolated, but involve numerous cross-linkages. Consequently they are named as mainly economic, environmental and societal because the borders between the three dimensions are not sharp, e.g. provision of work is mainly societal but can be considered as well among the economic functions, provision of housing is considered economical (building areas are strongly linked with economic development), but it can be considered as well as social function.

Table 1 The six Land Use Functions in EU-LUPA

Sustainability dimension	LUF	Land Use Functions	Issues included
Mainly societal	LUF1	Provision of work	Employment provision for all in activities based on natural resources
	LUF2	Provision of Leisure	Recreational and cultural services, including cultural landscapes and green spaces in urban areas
Mainly economical	LUF3	Provision of land-based products	Land-dependent production of food, timber and biofuels
	LUF4	Provision of housing and infrastructure	Building of artificial surfaces: settlements (residential areas, offices, industries, etc.), transport infrastructure (roads, railways, airports and harbours)
Mainly environmental	LUF5	Provision of abiotic resources	Regulation of the supply and quality of air, water and minerals
	LUF6	Provision of biotic resources	Factors affecting the capacity of the land to support biodiversity (genetic diversity of organisms and habitats)

3. Methodology

The Land Use Functions (LUFs) methodology is described in this section. It consists of the following steps:

Step 1: Selection of indicators

In this step indicators are selected from an extensive survey of harmonised European datasets. Following this selection an indicator set is built that enables to measure quantitatively temporal changes in the performance of the six Land Use Functions defined in section 2.

Selection criteria

The selection of the indicators is based on the following criteria:

- a) Data availability: the indicators should be available at least for two time steps, being considered the first time step as the reference; in EU-LUPA the changes in land use will be mainly based on changes observed in CORINE Land Cover, and therefore the time period selected is 2000 - 2006;
- b) Data quality: the quality of the data should be checked avoiding datasets with large data gaps or poor quality;
- c) Spatial resolution: in principle preference is given to indicators available at a detailed administrative level. In agreement with Task 2.1 it was agreed to use the NUTS X level (a mixture of NUTS 2 and NUTS 3 to achieve a balanced size in the administrative regions; Renetzeder et al, 2008), as best option considering the data availability; it should be always possible to upscale the data to a lower resolution;
- d) Proper balance between the three sustainability pillars: the indicators should be associated to the three main dimensions of sustainability, e.g. economic, environmental and societal and their number should be approximately the same for each dimension to keep a balanced approach;

- e) Ability for assessment of changes in LUFs in the area of study: for example, the set of environmental indicators should reflect main trends regarding key environmental issues such as water, soil, air and biodiversity;
- f) Redundancy or correlation: it should be avoided selecting indicators that are redundant in some way, i.e. describing trends in the same issue or statistically correlated. For example, habitat eutrophication is directly caused by deposition of NH₃ and therefore habitat eutrophication and NH₃ are redundant;
- g) Spatial coverage: the indicators should be available for all EU-27 and if possible for the ESPON space countries.

Step 2: Definition of the links between indicators and the LUFs

The specific links between the selected indicators and the LUFs should be defined by a group of experts using a *generic table* similar to that shown in Table 4, which lists and quantifies the contribution of each indicator to each LUF, and justifies the scores.

Table 2 Indicators showing the change in performance in LUFs

Indicator code	Indicator name	Score	Justification for score

The relation between indicators and LUFs is measured as a score and is defined individually since the same indicator can have at the same time a positive relationship with one LUF while negative with other. For example, high cover of urban fabric, which is directly related to building, is given a positive score since it enhances the performance of LUF1 Provision of Work. On the contrary, high cover of urban fabric, which implies soil sealing, is given a negative score since it is associated with a decrease in the performance of LUF6 Provision of Biotic Resources. This is reflected in the direction the scale min-max is assigned to indicators in each LUF during the normalisation process. Therefore the maxima are attached to high urban fabric values in the first case and to low urban fabric values in the second.

The scores range from -1 to +1 as follows:

1 = the indicator shows a negative (-) or (+) performance of the land use function in a significant way. For example, the indicator 'nights spent in touristic accommodations' has a positive link with the LUF2 Provision of Leisure, because an increase in nights spent in touristic accommodations indicates a probable increase in leisure activities in the specific administrative region. On the other hand, the indicator 'area harvested' has a negative link with LUF5 Provision of abiotic resources, because an increase in area harvested means that the land used for agricultural activities is larger and therefore the provision of (abiotic) water and minerals resources is decreased.

0 = irrelevant, i.e. the relationship between the indicator and the LUF does not allow one to infer on the consequences that a change in the indicator value could have on the LUF, i.e. no direct link is known between the indicator and the LUF or maybe there are some impacts but they counterbalance each

other. For example, the indicator 'NH₃ emission' is irrelevant for LUF 1 Provision of work. This scoring principle has a second function in order to compensate for the number of indicators per LUF and is considered as weight 2, further explained at step 5 in this report.

Step 3: Assessment of the specific importance of each indicator for the economic, environmental and social dimensions of the region

The regional dimension of the assessment results from the recognition that not all indicators may be relevant in all regions, e.g. the indicator 'area harvested' is unlikely to be relevant in a region with small agricultural area. In effect, this step reflects the uncertainty and regional differences that need to be taken into account in the assessment.

This step provides the regional dimension to the framework by evaluating for each region considered in the analysis, the potential importance that each indicator may have on each of the economic, environmental and social dimensions. The regional dimension of sustainability assessment is at the heart of the of EU-LUPA. The approach reflects the considerable variety of situations that exist within the ESPON space and consists of a weighting of individual indicators within each of the regions considered. It combines information as to whether (i) the land use change actually does affect the region, (ii) if it does, are we likely to see impact in the land use functions of the region and finally (iii) if there is impact, does it affect the three dimensions of sustainability in the region.

It is well accepted that changes in indicators - that is measurements of something in the economy, environment or society – may be of different importance in relation to our efforts to assess the changes in phenomena (such as land use). In other words, it means that some 'things' are more important for the phenomena we are concerned than others. Therefore, weighting of different indicators is a normal procedure in Environmental Assessment and Strategic Environmental Assessment, and indeed finds its place in EU Impact Assessment. However, agreeing on the weighting is difficult. It can be imposed 'top-down' by policy makers/administrators and their advisory scientists, or generated 'bottom-up' by stakeholders. Ideally, one might have different weighting systems derived from different sources such as expert ('Delphi') panels, stakeholder valuation workshops, internet valuation, etc. and present them in final outcomes to assess the risk. We have chosen to limit ourselves to expert panels.

The description of the decision rules used by the experts is transparently done in individual fact-sheets, which include the 'importance' weighting showing how significant an issue (measured by the indicator) is in that region. It is an expert-based value judgment on what impact it would have on sustainability in the region if that indicator was to have an unacceptable value based on the current knowledge. The rule base determines the potential impact of change in an indicator for a particular region, and should be guided by supporting references describing the core bio-geographical (e.g. climate, altitude, relief, land use) and socio-economic (e.g. GDP, population, unemployment) characteristics of each region. For example, forest fire risk is deemed of low importance in a region with a small forest area, and a low population density, i.e. where the impact of a forest fire will be low. Conversely, Nitrogen and Phosphorus inputs are considered important in regions where

agriculture dominates land use, and where the level of nutrients is already high. The detailed description should not be exhaustive and therefore for some indicators other sources explicitly concerning the impact of the indicator have been used. For example, some indicators, particularly the economic ones, are considered of equal importance in all regions. Care should be taken to minimise co-correlation of factors determining the rule base and those from which the indicator values themselves were derived.

The scores take values between 1 and 3 as follows: 1 (not important at all, or very low importance), 2 (of some importance), 3 (of great importance). Indicators may show multiple potential impacts across LUFs, therefore the rule-base needs to be accommodated to potential impacts on a number of different sectors. The rules are defined such that importance scores of 1 are only assigned where it is clear that there is no current importance AND that this is not likely to become important in the future, in order to preserve the validity of the assessment framework to future change. The rule base could be independently validated by a group of external experts in a workshop. The panel of experts can be selected according to criteria from recent practice of impact assessments. The regional importance scores should be summarized in a table as shown in Table 3 below, while full description of the rule bases and the scientific justification should be given separately (example shown in section 4).

Table 3 Example table to showing how the regional importance scores (1 to 3) are indicated for each selected indicator in the regions of analysis.

Region code	Region name	ENV 01	ENV 02	ENV 03	ECO 01	ECO 02	ECO 03	SOC 01	SOC 02

Step 4: Normalization and equalizing of indicators values

One of the requirements for processing multiple indicators within an aggregation framework is that all are transformed into the same scale with common units (Nardo et al., 2005). Thus all indicators must be normalised, preferably to a continuous numerical scale, in order to allow mathematical procedures such as linear-additive aggregation to be performed. Within this aggregation framework it is considered to normalize the values towards a nominal scale of 0 (low performance) to 10 (high performance).

The equation used for normalisation of indicators is then the following:

$$I_{NORM} = \frac{x - \min}{\max - \min} * 10$$

where x is the value of the indicator under a given situation (e.g. the specific region studied), and min and max are the ends of the normalization range, corresponding to minimum and maximum of the indicator itself.

Even though normalization is frequently applied within an aggregation framework to combine different indicators, it does not resolve the problem of data stretching. Figure 1 shows an example of the histogram distribution of the percentage of area covered by soil sealing. As only a few regions are covered with an extreme low or high percentage of soil sealing they pull the normalization result to one side of the histogram. The result is that the majority of the cases are classified only in one or two classes and all the existing differentiation disappears. The final consequence will be that, when aggregating several indicators (to show the performance of one LUF, as we do in this analysis), the lack of differentiation in one of these indicators will strongly push towards a homogeneous result.

One way to avoid such a homogeneous result is to stretch the individual indicators before aggregating. A commonly accepted method to do this is called *histogram equalization*. One example of histogram equalization can be found in Figure 1. In principle the objective of this method is to reclassify the indicator in such a way, that a linear trend arises in the cumulated frequency histogram.

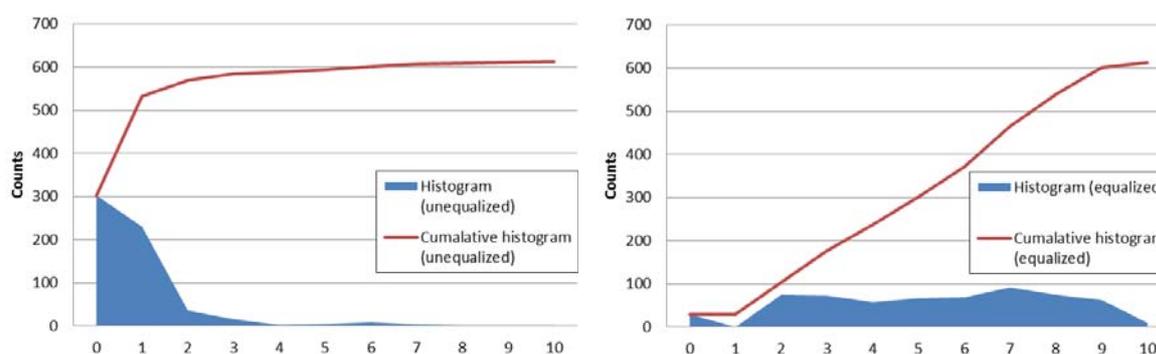


Figure 1 Example showing the effect of histogram equalization, for the normalized soil sealing information (percentage of CLC 111 + 112 + 121 +122 +123 + 124 + 125 within the NUTS X-regions).

In case one works with multi-annual data, like we do in this project, one should be aware that the normalization and equalization are carried out on the multi-annual data set, instead of repeating this exercise for each year separately.

Step 5: Integrated assessment of the land use functionality

The final step is the integrated assessment in order to derive a final functionality score. The integrated weighing of all the indicators contributing to a LUF, provides a comprehensive description of changes observed in the indicators, which in turn shows the overall consequences (stimulating, hindering or none) for the LUFs performance. It is mainly based in the integrated weighing of all the indicator values and is described below in the aggregation scheme, as published in Paracchini et al. (2011).

(i) The aggregation scheme

Aggregation can be performed in compensatory or non-compensatory frames. In the first case the weights have the meaning of trade-offs (Jeffrey, 2004), therefore a decrease in a LUF value is considered comparable to an increase in one or more other LUF values. Due to the complexity and multiple dimensions of the impacts to

be assessed in EU LUPA, it was decided to leave the analysis of trade-offs to the end user, since it would be impossible to assess *ex-ante* if conflicts between all possible targets exist. Therefore, a solution that holds some characters of non-compensation was sought. The basic aggregation framework is presented in Figure 2.

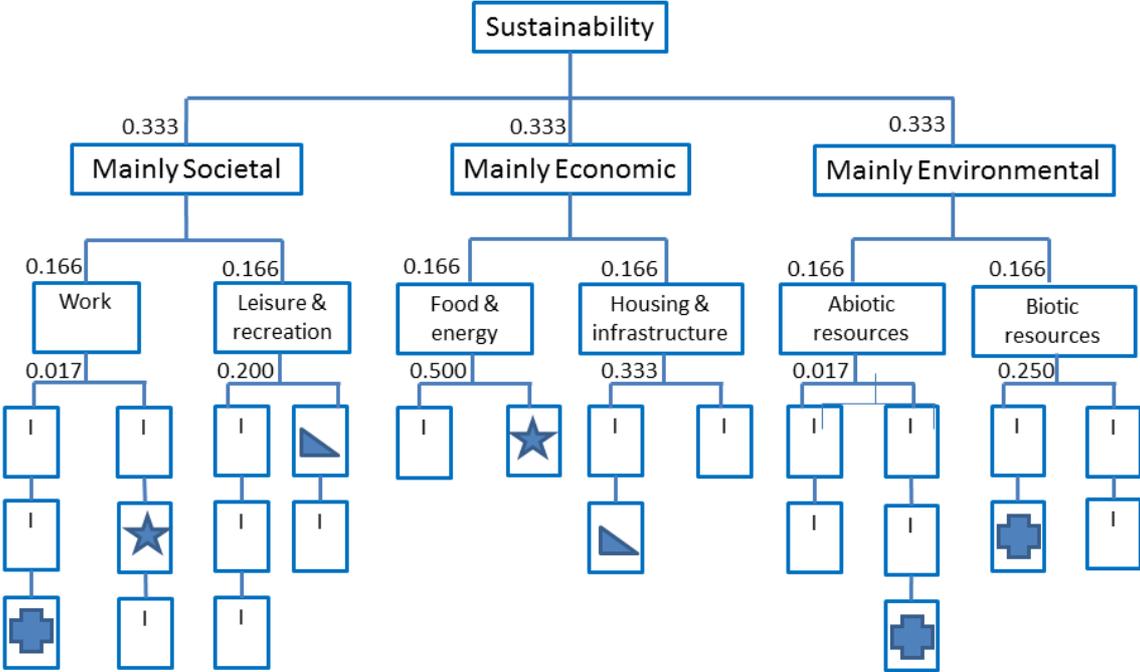


Figure 2 Basic aggregation scheme, after Paracchini et al. (2011). The symbols represent individual indicators contributing to more than one LUF.

In such a hierarchical scheme the six LUFs are grouped in pairs according to the three dimensions of sustainability, and indicators are individually assigned to one or several LUFs. In order to deal with the compensability problem in linear aggregation, and with the problem of assigning weights in a context of social choice, as suggested by Munda (2004) the value of the weights attached to each LUF is decided *a-priori* and LUFs are considered to be equally weighted. The indicator weights are then derived by dividing the LUF weight by the number of indicators concurring to it. The method therefore remains compensatory within a LUF, but not among the LUFs. It is the end-user of the system, i.e. the policy maker at the EU level, who makes the decisions on the possibility of accepting trade-offs between LUFs.

In practice, the requirements of the system are complex. The LUFs do not refer uniquely to a dimension of sustainability, but have a 'prevalent' social, economic or environmental character, acknowledging that the pillars of sustainability are not isolated, but involve numerous cross-linkages (mostly social, mostly economic and mostly environmental), as shown in Figure 2.

In this aggregation framework, three additional characteristics apply, as described in Paracchini et al (2011):

- a. Each indicator can concur to more than one LUF (as shown in Figure 2);
- b. The indicator link to a LUF can be positive or negative;
- c. Each indicator may perform differently according to the geographical/economic, environmental, social context in which it is measured.

All these elements must be taken into account when building the aggregation frame, and concur in solving the questions:

- how is spatial variability of the European environmental/socio/economic context taken into account;
- how is multifunctionality and sustainability (represented by the economic, environmental and social dimensions) included in the aggregation framework.

(ii) The weighting

The system uses three weighting components to achieve this multi-dimensional, regional assessment, and is organised in a way that the aggregated values of indicators produce a final LUF score on the same 0 – 10 scale.

In case data are missing, the corresponding weights are excluded from the scheme. If this will not be done, then the sum of the weights will be smaller than 1, resulting in a lower score. The calculation method has been automatised for the EU LUPA project by PP3 and corrects the weighting whenever data are missing based on the principles that the sum of the weights must always be 1.

The three weights are used as follows:

w1 – Number and type of indicators contributing to each LUF

Figure 2 shows that aggregation of indicators to LUFs is performed on a compensatory basis, in which the contribution of each indicator is weighted according to the number of indicators concurring to a LUF, the indicator inherent importance (addressing issues of redundancy between indicators) and the balance of indicators across the three sustainability pillars. This is the first of two weighting factors: **w1**, and is calculated as follows:

$$\mathbf{w1 = intrinsic\ indicator\ weight\ x\ pillar\ balance\ weight\ x\ 1/ n_{LUF}} \quad (1)$$

where n_{LUF} is the number of indicators concurring to the LUF.

Intrinsic weights should be shown as in the example shown in Tables XX in section 5. The importance of some individual indicators may be down-weighted to account for issues of redundancy. For example, N and P surplus where both represent impact of the agricultural sector on water quality. However, the spatial pattern varies across Europe, so rather than selecting just one indicator and fail to adequately capture this impact, it can be decided to retain both, but to down-weight them equivalent to one indicator. The second component to weight 1 takes into account the differences in

number of economic, social and environmental indicators to achieve balanced representation between the three pillars of sustainability. These two components are combined to a total weight of one. In the LUF framework, weight 1 is adjusted separately for each LUF to take into account the number of indicators contributing to that LUF (n_{LUF}), ensuring LUF calculations are evenly balanced through the framework.

w2 – Strength and sign of indicator impact on LUF performance

Expert panels of internal and external experts can assign values to the link between each indicator and the LUFs. Such weights are attributed in close relation to the indicators' ranges. Weight 2 describes the impact on sustainability, i.e. whether it has a positive or a negative impact on that LUF. Since these indicator weights can show positive or negative relations, great attention must be paid to the meaning attached to minima and maxima per each indicator in the normalisation frame. As explained above the same indicator can have a positive relation to one LUF and a negative one to a different LUF, and this must be reflected in the direction the scale min-max is assigned to indicators in each LUF during the normalisation process (i.e. high GDP may be good for LUF provision of work and bad for LUF provision of biotic resources, therefore the maxima are attached to high GDP values in the first case, to low GDP values in the second).

This is the second of two weighting factors: **w2**, taking discrete values from -1 to +1.

w3 – Regional importance of the indicator

Weight 3 reflects the importance of each indicator at a regional level. Once more a panel of experts need to define a set of indicator-specific rules to determine the importance of an indicator in separate regions. For example, *area harvested* is deemed of low importance in a region with a small agricultural area. Some indicators, particularly the economic ones, are considered of equal importance in all regions. Care needs to be taken to minimise co-correlation of factors determining the rule base and those from which the indicator values themselves were derived. This is the third of three weighting factors: **w3**, taking discrete values from 0 (not relevant) to +3 (strong importance).

As previously mentioned, this w3 was only calculated for the Netherlands (example of LUF implementation at national level), and it is described in section 4.

Together, the information in these weighting scores is used in the aggregation framework to address the issues a) to c) listed above, since they represent how much a LUF is sensitive to a change in a specific indicator and how much the relevance of a LUF changes across the European regions considered.

4. Application of the LUFs methodology considering the specificities of the region

In order to test the LUF methodology when considering regional specificities (i.e. including weight 3), the Netherlands was chosen as case study area considering the expertise of LP3. Since this analysis was done before the Interim Report, NUTS 2 was used as the spatial unit for the assessment. Nevertheless, a relevant set of indicators (not available at pan European level) was selected to describe the specific characteristics of the 12 Dutch provinces, e.g. demographic indicators (see figures

below in section 4.1). In the later European assessment, NUTS-X regions were used to comply with the request from the CU in their Response on the Interim Report. The twelve NUTS 2 regions of the Netherlands are listed in Table 4.

Table 4 Region codes and names of the NUTS 2 regions considered in the test case for the Netherlands.

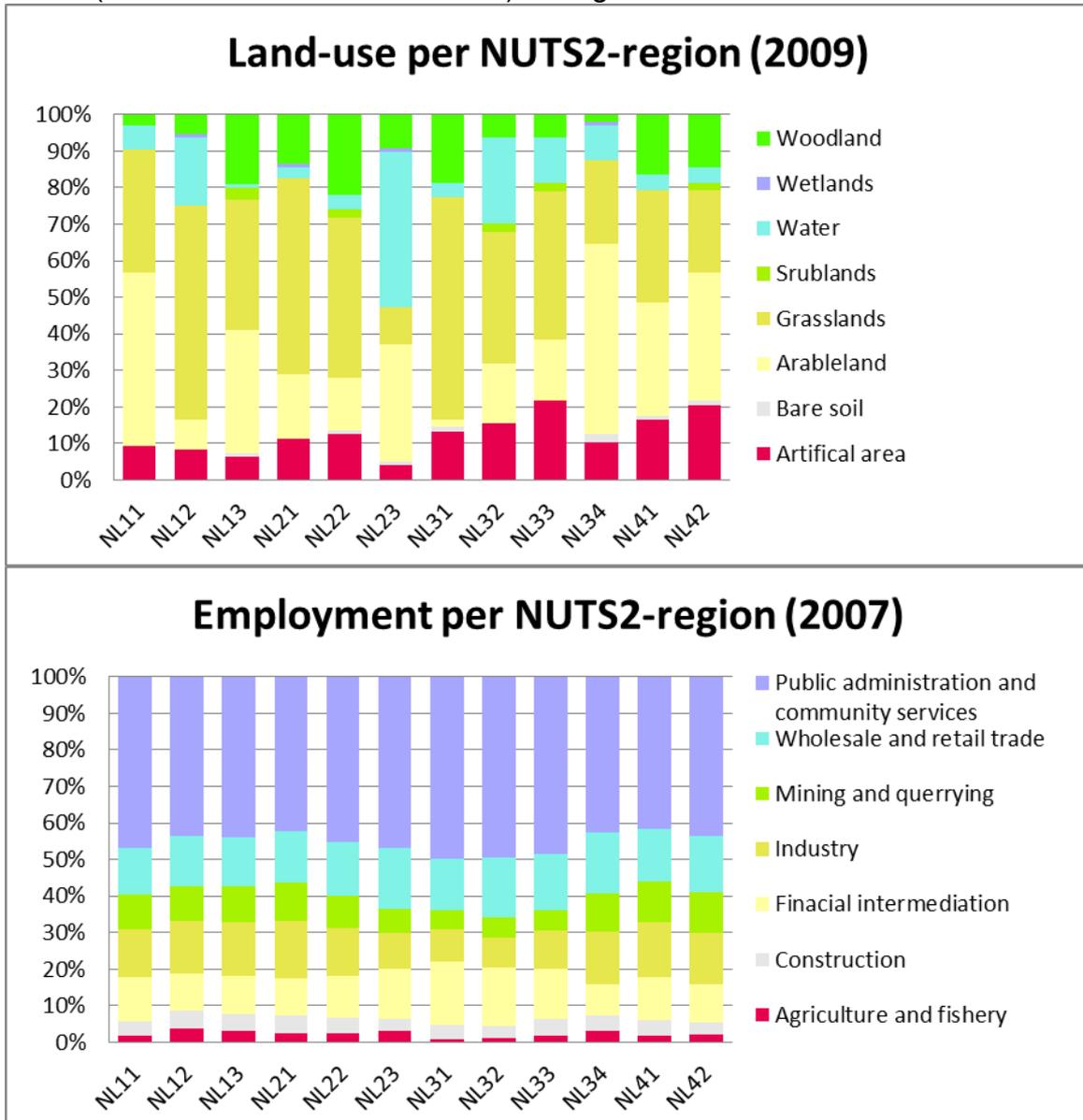
Region code NUTS 2	Region name
NL11	Groningen
NL12	Friesland (NL)
NL13	Drenthe
NL21	Overijssel
NL22	Gelderland
NL23	Flevoland
NL31	Utrecht
NL32	Noord-Holland
NL33	Zuid-Holland
NL34	Zeeland
NL41	Noord-Brabant
NL42	Limburg (NL)

The objective of this exercise was:

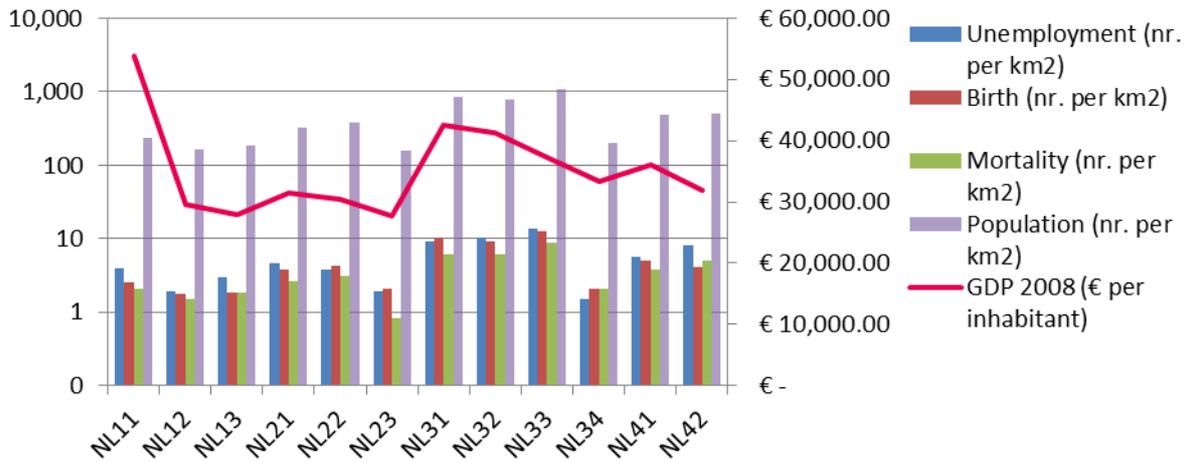
- To estimate the impact of land use changes between 2000 and 2006 on sustainability, measured as integration of the economic, social and environmental dimension, and not based on the partial views provided by individual indicators;
- To assess the suitability of the LUFs methodology in EU-LUPA for assessing the changes in main land functions considering regional specificities (i.e. including weight 3);
- To identify the number and quality of the land use functions present in the twelve Dutch provinces and therefore the degree of existing multifunctionality;

4.1 Detailed description of the 12 Dutch provinces (NUTS 2 regions)

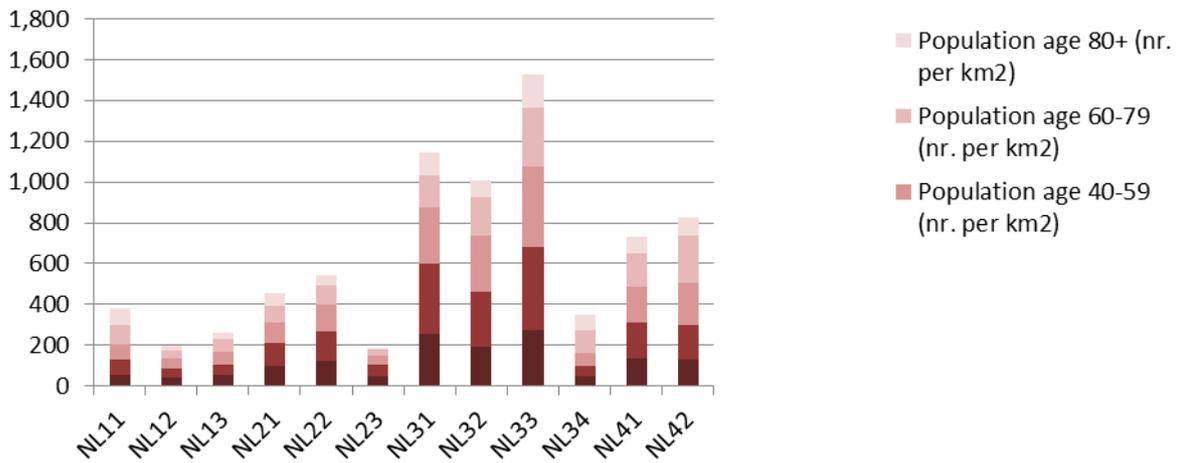
The objective was to describe in an easy to use and attractive way the key bio-physical and socio-economic variables describing the 12 Dutch provinces. The graphs provided below were used by the LP3 experts when filling in the regional tables (as those described in Table 3) linking indicators to Land Use Functions.



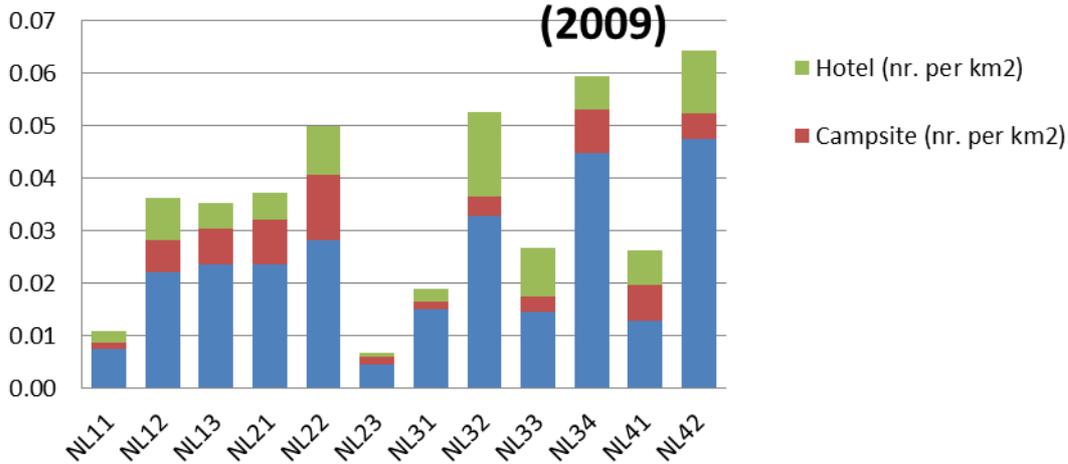
Demography per NUTS2-region (2009)



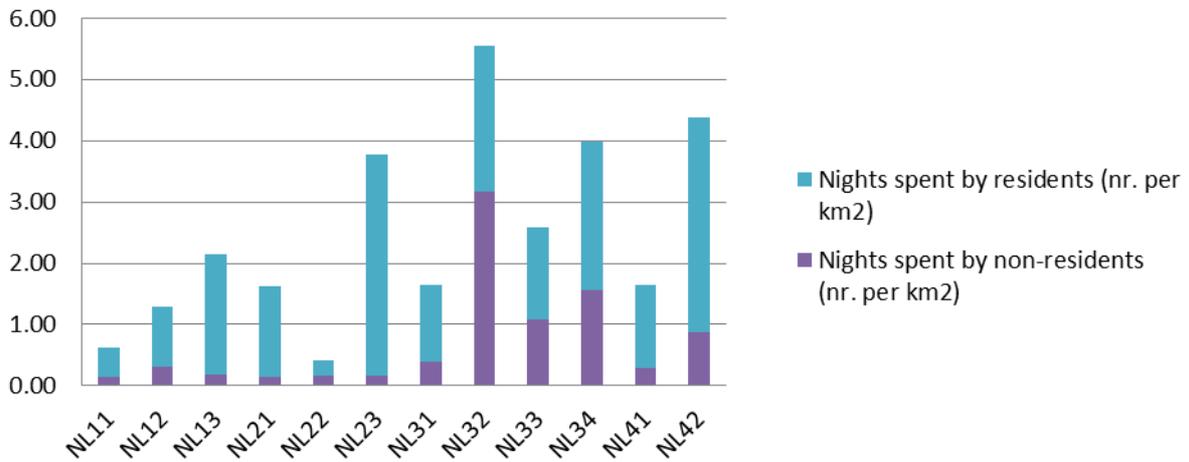
Demography per NUTS2-region (2009)



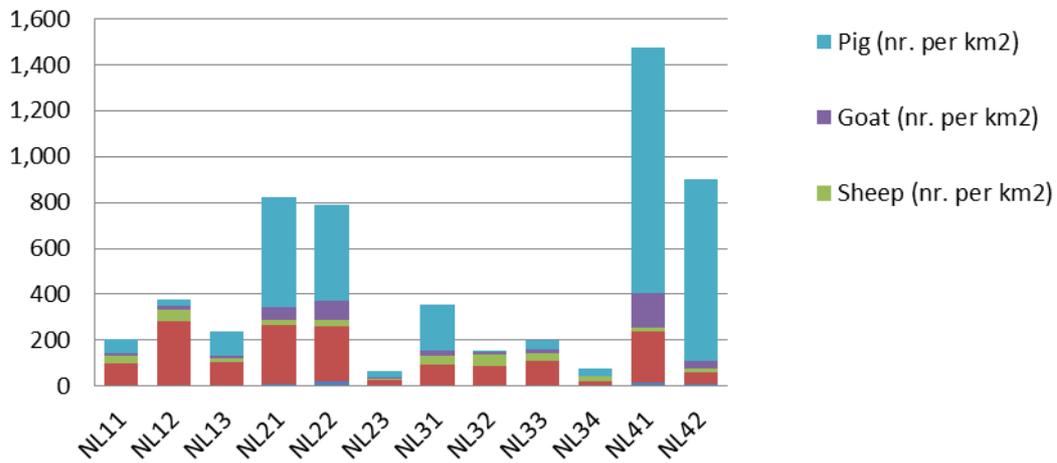
Tourist Accommodations per NUTS2-region (2009)



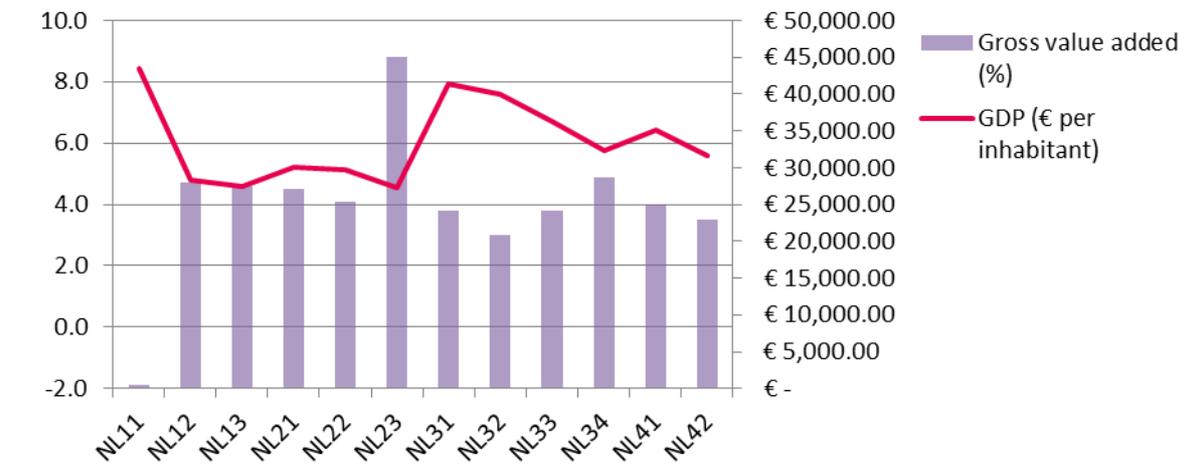
Tourist Accupancy per NUTS2-region (2009)



Livestock per NUTS2-region (2009)



Economy per NUTS2-region (2007)



4.2 Implementation of LUF methodology

Step 1: Selection of indicators

The following sources were reviewed for the indicator selection: EUROSTAT database, EU-LUPA database (produced in Task 2.1) and FP6 FARO-EU project database.

Justification for the selection of the indicators

The indicators were selected following the criteria described in step 1. In principle preference was given to indicators available at NUTS 3. However, only enough indicators were found at NUTS 2 level.

The final list of indicators considered in the test case is presented in Table 5. It consists of 17 indicators, namely 7 economic indicators, 5 environmental indicators and 5 social indicators. The slight imbalance between the number of indicators between the three dimensions is compensated using the 'weight 1' which incorporates an intrinsic indicator weight (see step 6 in section 3).

Table 5 List of 17 indicators that were finally selected for the LUFs framework in the Netherlands. The spatial resolution is NUTS 2. The indicators are grouped according to the sustainability dimension to which they are most largely linked.

Indicator code	Indicator name
ECO_01	Value added per sector (total)
ECO_01a	Value added per agriculture
ECO_2	GDP PPP
ECO_3	Nights spent in tourist accommodations
ECO_4	Transport networks
ECO_5	Agricultural accounts
ECO_06	Area harvested
ENV_01	Soil sealing
ENV_02a	Agricultural area in protected area
ENV_02b	Green areas
ENV_02c	Green areas close to residential areas (Based on percentage of artificial area)
ENV_05	Livestock density (current livestock density and area of pastures)
SOC_1	Unemployment rate
SOC_2	Net migration
SOC_3	Services of general interest
SOC_05	Household with broadband
SOC_6	Population density

Step 2: Definition of the links of the indicators with the LUFs

The summary of contributions of indicators to the six LUFs is presented in Table 6. It shows a reasonable spread of indicators across the LUFs with most indicators contributing to more than one dimension of sustainability. Detailed tables (Annex 3) describe the conceptual contribution of each selected indicator to each of the six

LUFs where clear links were identified. The generic tables present the scores associated to the contribution as well as the scientific justification and the confidence on the scoring.

Table 6 Summary of cross-linkages between the 15 selected indicators and the six LUFs. The full analysis is provided in Appendix 1 of the document.

Indicator main dimension	Indicator name	LUF 1	LUF 2	LUF 3	LUF 4	LUF 5	LUF 6
ECO	Value added per sector (total)	1	1		1		
ECO	Value added per agriculture			1			
ECO	GDP ppp	1	1		1	1	1
ECO	Nights spent (tourism)	1	1				
ECO	Transport networks (lot of artificial areas, minimum is 2)	1	1			-1	-1
ECO	Agricultural accounts			1			
ECO	Area harvested			1		-1	
ENV	Soil sealing	1		-1	1	-1	-1
ENV	Agricultural area in protected area	1					
ENV	Green areas		1				
ENV	Green areas close to residential areas (Based on percentage of artificial area)				1		
ENV	Livestock density (current livestock density and area of pastures)		-1	1			
SOC	Unemployment rate	-1		-1	-1		
SOC	Net migration	1			1		
SOC	Services of general interest	1			1		
SOC	Household with broadband				1		
SOC	Population density	1			1	-1	-1

Step 3: Assessment of the importance of each indicator for the sustainability of the region

The description of the decision rules used by the experts should be done in individual fact-sheets. The rule determines the relevance of an indicator for a particular region, and was based by the supporting descriptions of the 12 provinces presented at the start of this section 4. The 'regional importance' scores take values between 1 and 3 as explained in section 3, and are summarised in Table 7. A full description of the rule bases and the scientific justification should be given separately (example shown in Annex 4).

Table 7 The regional importance scores (1 to 3) are indicated for each selected indicator in the regions of analysis.

Indicator code	Indicator name	Twelve Dutch provinces (NUTS 2 regions)											
		NL11	NL12	NL13	NL21	NL22	NL23	NL31	NL32	NL33	NL34	NL41	NL42
		Groning n	Friesland	Drenthe	Overijssel	Gelderlan d	Flevoland	Utrecht	Noord- Holland	Zuid- Holland	Zeeland	Noord- Brabant	Limburg
ECO_01	Value added per sector (total)	2	2	2	2	2	2	2	2	2	2	2	2
ECO_01a	Value added per agriculture	3	3	2	2	2	3	2	3	2	3	3	2
ECO_2	GDP ppp	2	2	2	2	2	2	2	2	2	2	2	2
ECO_3	Nights spent (tourism)	1	2	2	2	3	1	2	3	2	3	2	3
ECO_4	Transport networks (there are many artificial areas, therefore the minimum score is 2)	2	2	2	2	2	2	3	3	3	2	2	3
ECO_5	Agricultural accounts	3	3	2	2	2	3	2	3	2	3	3	2
ECO_06	Area harvested	3	2	2	2	2	3	1	3	1	3	3	2
SOC_1	Unemployment rate	2	2	2	2	2	2	2	2	2	2	2	2
SOC_2	Net migration	3	2	2	2	2	2	2	2	2	3	2	3
SOC_3	Services of general interest	2	2	2	2	2	2	2	2	2	2	2	2
SOC_05	Household with broadband	2	2	2	2	2	2	2	2	2	2	2	2
SOC_6	Population density	1	1	1	2	2	1	3	3	3	1	2	2
ENV_01	Soil sealing	1	2	1	1	2	2	3	3	3	1	3	2
ENV_02a	Agricultural area in protected area	2	2	2	2	2	2	2	2	2	2	2	2
ENV_02b	Green areas	2	2	2	2	2	2	2	2	2	2	2	2
ENV_02c	Green areas close to residential areas (Based on percentage of artificial areaa)	1	1	1	2	2	1	2	2	3	1	2	3
ENV_05	Livestock density (current livestock density and area of pastures)	2	3	2	3	3	1	2	2	2	1	3	3

Step 4: Normalisation of the indicators

The equation used for normalisation of indicators is the following:

$$I_{NORM} = \frac{x - \min}{\max - \min} * 10$$

where x is the value of the indicator, and min and max are the minimum and maximum values of the whole range for the year 2000. These calculations are available in Excel sheets.

Step 5: Integrated assessment of changes in land use functionality: Land Use performance

The LUFs methodology has been successfully implemented, as it is shown in the following series of figures showing the variation in the impacts that the land use change that took place between 2000 and 2006 had on the six Land Use Functions in the 12 Dutch provinces.

The change in land use functionality was calculated using as reference the average values in 2000. This change is interpreted as change in the land use performance of the regions.

Figures 3a, 3b and 3c show the values of the six LUFs for each province, respectively, in 2000, 2006 and the difference between both years. Overall the economic functions (LUF1 and LUF2) are performing well, whereas the societal (LUF 3 and LUF4) and especially the environmental (LUF5 and LUF6) have mainly negative values, which is in accordance to the predictions made by the experts based on their expert knowledge and characteristics of the region analysed in the section before.

Figure 3c shows as well how small are the differences between 2000 and 2006 , which is in accordance to the small changes observed in CORINE Land Cover classes between the two years for the Netherlands. Still there are important differences between the regions, e.g. the three richest regions of the NL (NL 31, NL32 and NL33) have higher values in the economic LUFs.

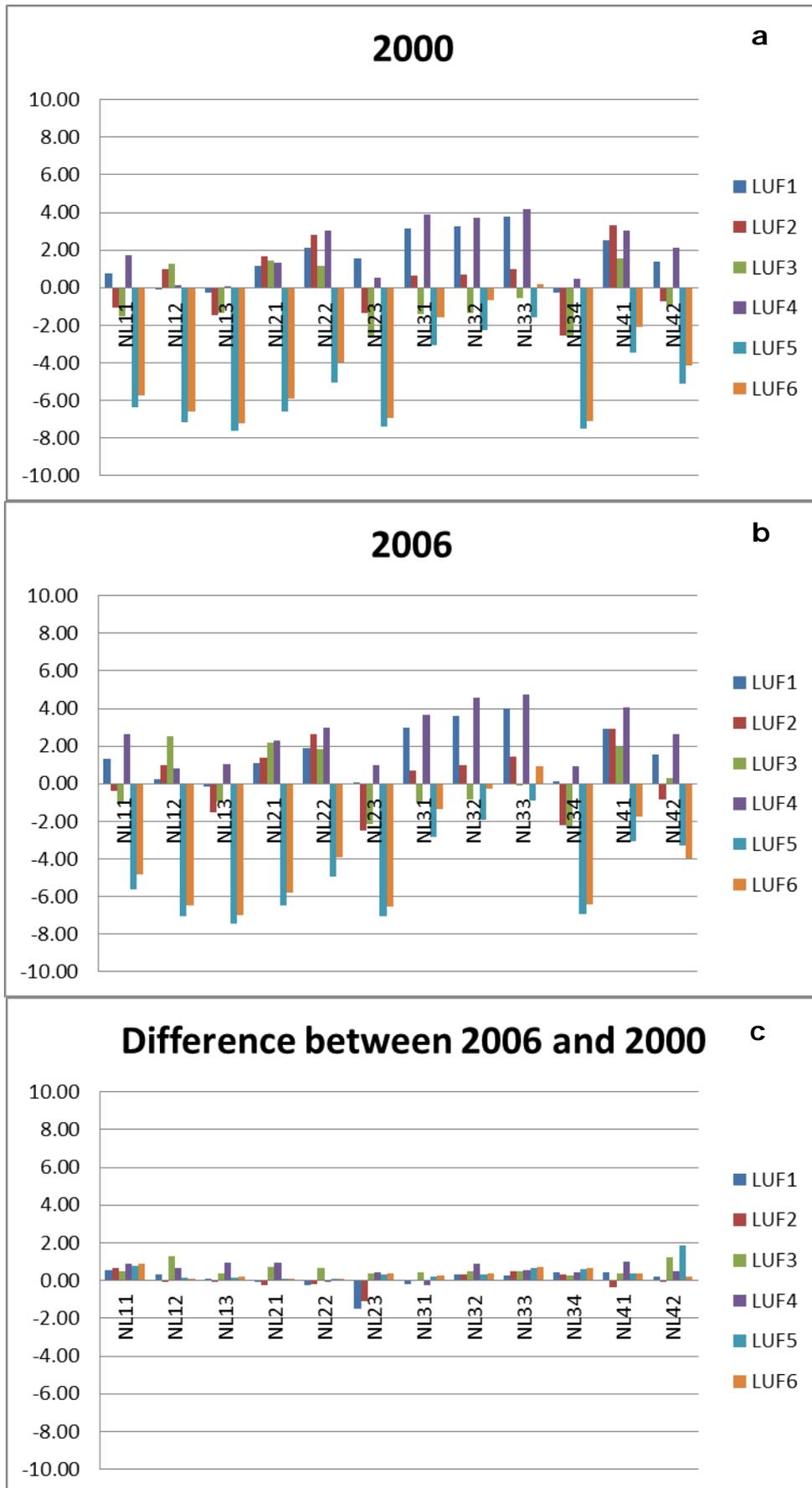
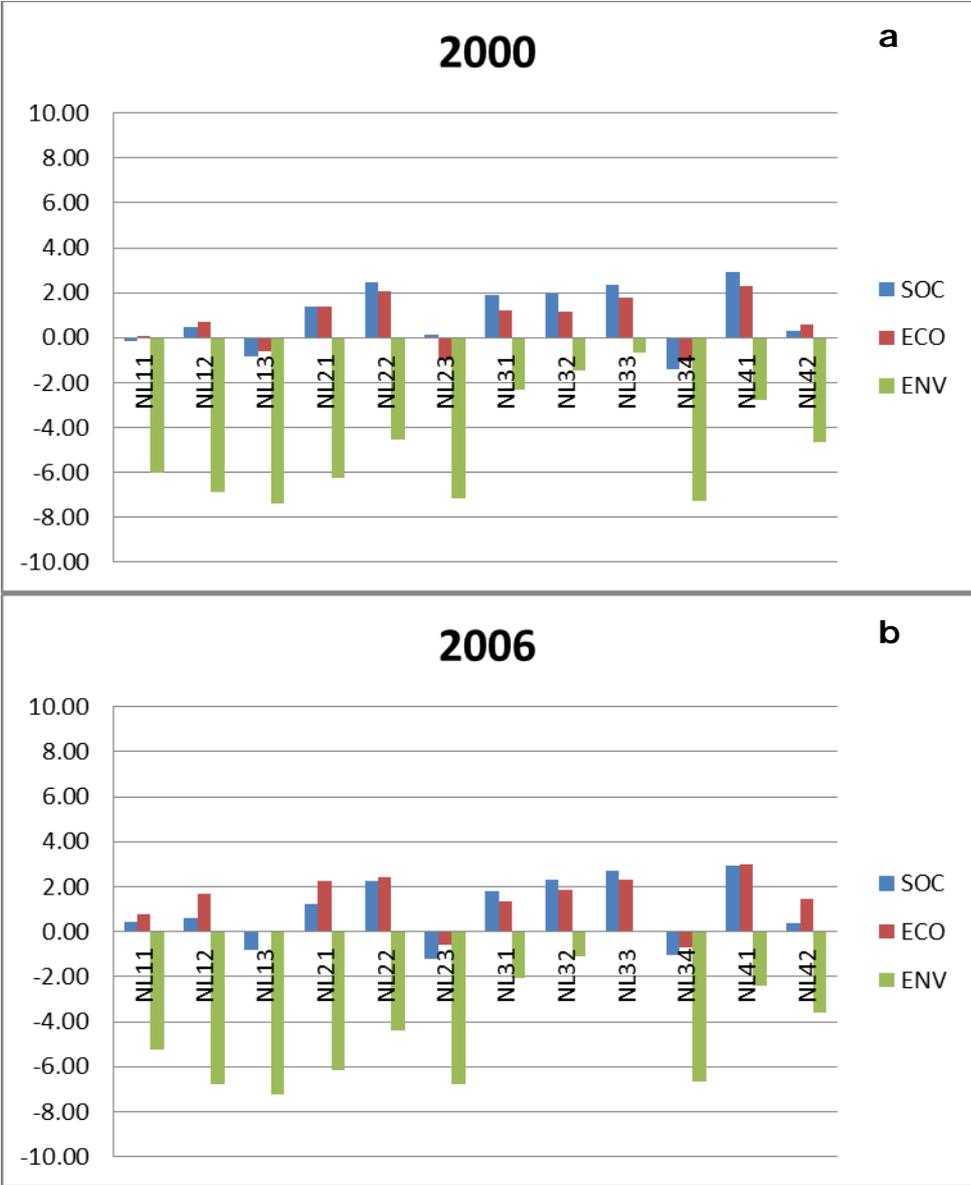


Figure 3 The values of the six LUFs for each Dutch province in (a) 2000, (b) in 2006, and (c) the difference between both years.

The second set of three figures (Figures 4a, b and c) show the aggregation of the six LUFs into the economic, environmental and social dimensions for each province in 2000 and 2006, and the difference between both years. In general terms, it shows how the economic and social functions are performing well, whereas the environmental dimension has negative values in all the provinces.



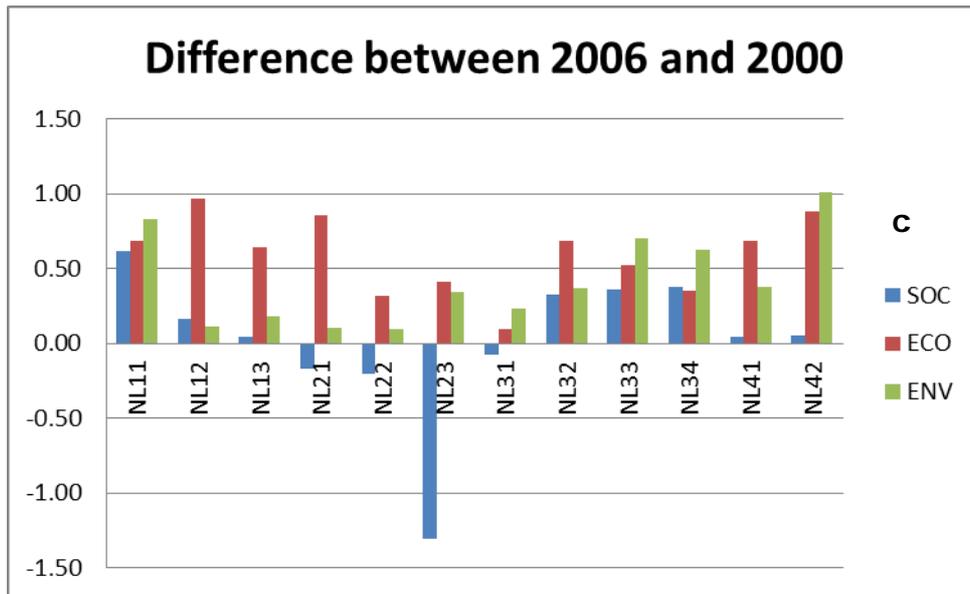


Figure 4 The values of the aggregated LUFs into social, economic and environmental dimensions for each Dutch province in (a) 2000, (b) in 2006, and (c) the difference between both years.

Figure 5 shows the total performance of each Dutch province in 2000 and 2006, by aggregating the three sustainability dimensions. It shows how all the provinces have increased their performance in 2006 compared to 2000, and the regions of Utrecht, Noord-Holland, Zuid-Holland, and Noord-Brabant are performing in general above the average, whereas the other eight provinces have a total performance below the average.

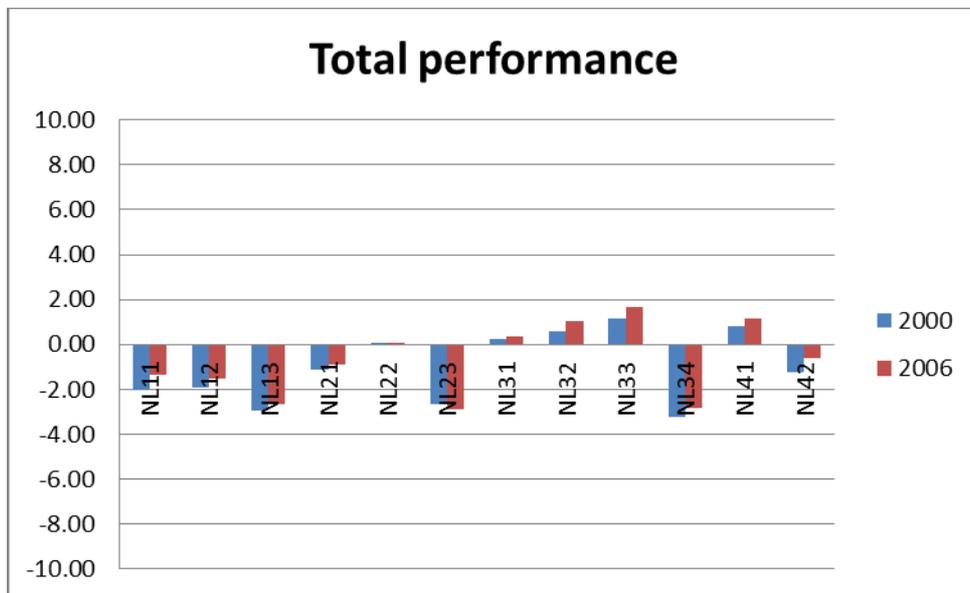


Figure 5 Total performance of each Dutch province in 2000 and 2006, by aggregating the three sustainability dimensions. The Land Use performance of each region is calculated using as reference the average of the 12 provinces for each year.

5. Application of the LUFs methodology at pan European level

The LUF methodology as described in section 3 was also applied at pan European level using NUTS X regions as spatial units. The specific regional weight 3 was not applied in this case due to the impossibility to determine regional weights for each NUTS X region within the framework of this project. The results are analysed at the end of this section.

Step 1: Selection of indicators

Preliminary indicator selection

The indicators were selected following the criteria specified in section 3. In agreement with Task 2.1 it was agreed to use the NUTS X level (a mixture of NUTS 2 and NUTS 3 to achieve a balanced size in the administrative regions; Renetzeder et al, 2008), as optimal spatial resolution considering the data availability. It should be always possible to upscale the data to a lower resolution. The selected indicators are presented in Table 8.

Table 8: List of 25 selected indicators, indicating their links to the three main dimensions of sustainability, e.g. economic, environmental and societal

Indicator Number	Dimension	Indicator
01	ECO	Multimodal potential accessibility normalised
07	ECO	Gross Domestic Product (Purchasing Power Standard per person)
08	ECO	Gross value added at basic prices - Agriculture and fishing (EURO per person)
09	ECO	Gross value added at basic prices - Total (EURO per person)
11	ECO	Industrial and commercial areas (Land cover)
16	ECO	Nights spent in tourist accommodations (nr/ha)
24	ECO	Urban fabric (Land cover)
02	ENV	Area harvested
03	ENV	Artificial non-agricultural vegetated areas (Land cover)
04	ENV	Status of bathing water (qualitative)
06	ENV	Forest and semi-natural areas (Land cover)
10	ENV	Green Urban Areas (Land cover)
12	ENV	Natural leisure (Land cover)
13	ENV	NH3 emission (kg N/ha)
14	ENV	Navigable rivers and canals (m/km ²)
17	ENV	N-surplus (kg N/ha)
19	ENV	Natural protected areas - CDDA and Natura2000
20	ENV	P-surplus (kg P/ha)
21	ENV	Sport and leisure facilities (Land cover)
25	ENV	NO ₃ concentration of leaching water from agriculture (mg NO ₃ /litre)
05	SOC	Pre-primary education – Total
15	SOC	Net migration - arrivals-departures (nr/km ²)
18	SOC	Population density (nr/km)
22	SOC	Monuments and other tourist sights (index)
23	SOC	Unemployment (nr/km ²)

The indicators and their sources are shortly described in Annex 1.

Final selection of indicators based on statistical correlation analysis and data quality

Once indicators have been selected, the next step is to analyse the statistical correlation between indicators at the NUTS X-level. The correlations per LUFs are analysed using a "pairwise.complete.obs" method¹, which is based on multi-annual data. Those indicators that show a correlation above 0.8 were considered highly correlated and therefore only one was selected (see correlation matrixes per LUF in Appendix 2). For example, N surplus and P surplus were highly correlated and only the P surplus was considered. As a rule, indicators with the highest quality of the dataset had priority in the selection. In addition, a data quality check was done for all the indicators, which resulted in the dismissal of the indicator 'Natural protected areas - CDDA and Natura2000' because the database of 2000 was incomplete. As a result of the correlation analysis and data quality check, some indicators were rejected per LUF as shown in Table 9.

Table 9: Indicators rejected per LUF as result of the correlation analysis and quality data check

LUF	Indicators rejected
LUF1	Pre-primary education – Total Population density (nr/km) Natural protected areas - CDDA and Natura2000
LUF2	Forest and semi-natural areas Natural protected areas - CDDA and Natura2000
LUF3	Land cover - Artificial non-agricultural vegetated areas Green Urban Areas Land cover - Industrial and commercial areas N-surplus (kg N/ha) Natural protected areas - CDDA and Natura2000
LUF4	Land cover - Industrial and commercial areas Nights spent in tourist accommodations (nr/ha) Population density (nr/km) Natural protected areas - CDDA and Natura2000
LUF5	NH3 emission (kg N/ha) N-surplus (kg N/ha) Natural protected areas - CDDA and Natura2000
LUF6	Green Urban Areas N-surplus (kg N/ha) Natural protected areas - CDDA and Natura2000

Step 2: Definition of the links between indicators and the LUFs

The specific links between the finally selected indicators and the LUFs were defined by a group of experts in LP3 and reviewed by LP2. They are presented in Table 10.

Table 10 Summary of cross-linkages between the finally selected indicators and the six LUFs (for definition of LUFs, see section 2).

¹ r-manual (<http://stat.ethz.ch/R-manual/R-patched/library/stats/html/cor.html>)

Indicator nr	Dimension	Indicator	LUF1	LUF2	LUF3	LUF4	LUF5	LUF6
0	ECO	Multimodal potential accessibility normalised	1	1		1		-1
1	ENV	Area harvested			1		-1	-1
3	ENV	Status of quality of bathing water		1			1	
4	SOC	Pre-primary education				1		
5	ENV	Forest and semi-natural areas (Land cover)			1		1	1
6	ECO	Gross Domestic Product (Purchasing Power Standard per person)				1		
7	ECO	Gross value added at basic prices - Agriculture and fishing (EURO per person)			1			
8	ECO	Gross value added at basic prices - Total (EURO per person)	1	1				
9	ENV	Green Urban Areas (km ²) (Land cover)		1				
10	ECO	Industrial and commercial areas (km ²) (Land cover)	1					
11	ENV	Natural leisure (km ²) (Land cover)		1				1
13	ENV	Navigable rivers and canals (m/km ²)		1			1	1
14	SOC	Net migration - arrivals-departures (nr/km ²)	1			1		
15	ECO	Nights spent in tourist accommodations (nr/ha)	1	1				
17	SOC	Population density (nr/km)					-1	
19	ENV	P-surplus (kg P/ha)			1		-1	-1
20	ENV	Sport and leisure facilities (km ²) (Land cover)		1				
21	SOC	Monuments and other tourist sights (index)	1	1				
22	SOC	Unemployment (nr/km ²)	-1					
23	ECO	Urban fabric (km ²) (Land cover)				1		-1

Step 3: Assessment of the importance of each indicator for the sustainability of the region

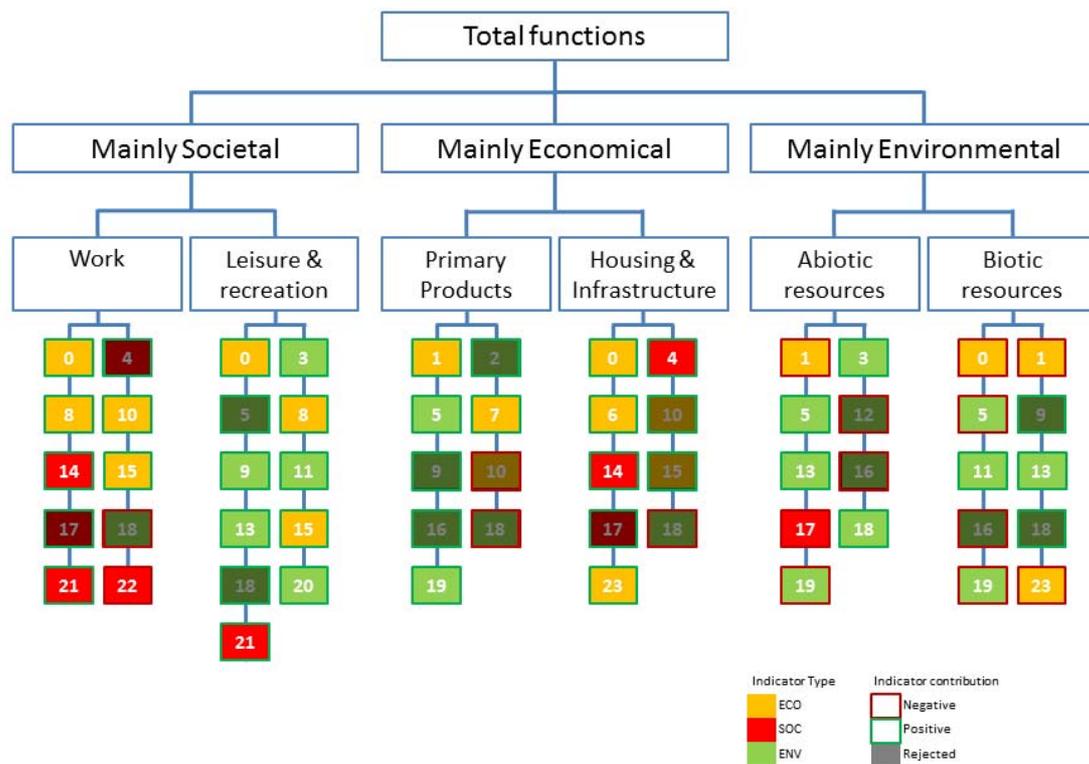
Due to the large number of NUTS-X regions and the limitations of this study, the assessment of the regional importance was not done at pan European level. However it was done for one country (the Netherlands) to test the methodology. This regional analysis used other list of indicators than the ones used at pan European level and results were shown previously in section 4.

Step 4: Normalization and equalizing of indicators values

The normalization was done following the method described in section 3. The calculations were automatized and excel sheets are available.

Step 5: Integrated assessment of the land use functionality

The resulting aggregation scheme showing the links between the selected indicators and the LUFs is shown in Figure 6.



Basic aggregation scheme, after Paracchini *et al.* (2011).

Figure 6 Basic aggregation scheme, after Paracchini *et al.* (2011). The colours indicate the economic, social and environmental dimensions. The number indicate the code of the indicators. The outlines define the type of link between the indicator and the functions (weight 2), i.e. red is a negative link and green is a positive link. The grey shadow shows the indicators that were finally rejected due to statistical correlation or data quality problems.

Weight 1 was calculated as described in Section 3 and the results are shown in Table 11.

Table 11: Example showing how components combine to form Weight 1. The first component is the intrinsic indicator weight (to account for issues of redundancy), The second component considers differences in number of economic, social and environmental indicators to achieve balanced representation between the three dimensions. These two components are combined to a total weight of one.

Indicator code	Indicator	Intrinsic indicator weight (A)	LUF balanced weight (B)	Product (A) x (B)	Balanced Weight 1
0	Multimodal potential accessibility normalised	1	0.14	0.14	0.14
6	Gross Domestic Product (Purchasing Power Standard per person)	1	0.14	0.14	0.14
7	Gross value added at basic prices - Agriculture and fishing (EURO per person)	1	0.14	0.14	0.14
8	Gross value added at basic prices - Total (EURO per person)	1	0.14	0.14	0.14
10	Industrial and commercial areas (km ²) (Land cover)	1	0.14	0.14	0.14
15	Nights spent in tourist accommodations (nr/ha)	1	0.14	0.14	0.14
23	Urban fabric (km ²) (Land cover)	1	0.14	0.14	0.14
	No. ECO indicators	7			1
1	Area harvested	1	0.14	0.14	0.14
3	Status of quality of bathing water	1	0.14	0.14	0.14
5	Forest and semi-natural areas (Land cover)	1	0.14	0.14	0.14
9	Green Urban Areas (km ²) (Land cover)	1	0.14	0.14	0.14
11	Natural leisure (km ²) (Land cover)	1	0.14	0.14	0.14
13	Navigable rivers and canals (m/km ²)	1	0.14	0.14	0.14
19	P-surplus (kg P/ha)	1	0.14	0.14	0.14
	No. ENV indicators	7			1
4	Pre-primary education	1	0.17	0.17	0.17
14	Net migration - arrivals-departures (nr/km ²)	1	0.17	0.17	0.17
17	Population density (nr/km)	1	0.17	0.17	0.17
20	Sport and leisure facilities (km ²) (Land cover)	1	0.17	0.17	0.17
21	Monuments and other tourist sights (index)	1	0.17	0.17	0.17
22	Unemployment (nr/km ²)	1	0.17	0.17	0.17
	No. SOC indicators	6			1

Results

When mapping the results of the analysis, it was considered that:

- The sum of all normalized indicators (with a nominal scale from 0 to 10) weights must add to one. The final LUF result will also be a nominal scale ranging from 0 to 10. However, as a nominal scale to describe performance of the functions can be unclear, the end result was converted into the following three classes; 1 = little functional performance (score 0 to 3); 2 moderate functional performance (score 3 to 6); 3 high functional performance (score 6 to 10).

- The results of the two different time steps are combined in a two digit number, in which the first digit expresses the functional performance in the year 2000, and the second digit the functional performance in the year 2006. Combining these two digits results in nine different classes, with three classes showing a functional performance increase, three classes show a decrease and three classes indicate that changes did not occur (Figure 7).

Figure 7: Description of legend used in the mapping of LUF performance changes between 2000 and 2006. Blue indicates no change, red indicates decrease and green indicates increase. The intensity of the colours shows the level of the LUF performance, from light colour (low performance) to deep colour (high performance).

2006	High	13	23	33
	Medium	12	22	32
	Low	11	21	31
		Low	Medium	High
		2000		

As a result of the implementation maps were developed for:

- the economic, environmental and social dimensions (aggregated results of the contributing LUFs) presented in Figure 8.
- the six LUFs (aggregation of the selected indicators following the LUF methodology) ; shown in Figure 9;
- each indicator contributing to the LUFs (see Annex 5).

The spatial assessment of the changes in land use functionality between 2000 and 2006 starts with a general overview of the performance of economic, environmental and social dimensions. As it can be seen in Figure 8 the performance of the three dimensions remained quite stable (i.e. dominance of the blue colours). Few changes are observed, mainly in the economic and environmental aspects, and these changes are moderated – never from high to low or low to high. They do not follow apparently any geographical specific pattern. The social performance is high in the *Blue Banana* corridor. Interestingly, the regions where changes in economic performance are found do not coincide with those regions showing changes in environmental or social performance. This indicates that the three dimensions are not following the same development patterns. The economic aspects show a decrease in performance in Southern Finland, Northern Denmark, North France, Cataluña (North-eastern Spain) and central Italy, and increases in southern Norway and Levante (eastern Spain).

The assessment of the changes in the six LUFs provides a more detailed insight at functional level (Figure 9). The analysis of the LUFs maps show that:

- Extreme changes do not occur and the overall pattern shows relative stability during the six years studied. Overall Scandinavia shows the highest stability, being central and southern Europe more unstable with mixed patterns.
- The two mainly economic LUFs (*LUF1 Provision of work, and LUF2 Leisure*) show a high and stable performance in the *Blue Banana* corridor, as it could be expected, although some negative changes in LUF 1 are observed in the fringes, e.g. in the Netherlands and East Germany, Eastern France and Barcelona. Positive changes are scattered except in Scandinavia and the Baltic countries. Other countries showing positive development are eastern Turkey, western Spain and central Europe.
- *LUF2 Leisure* shows a more general trend to increase the performance than to decrease. In general, coastal areas and the Canarias islands improve. Romania and Bulgaria increase from low to medium, showing developments in the tourist sector in the previous years to their entrance in the EU (2007).
- In contrast with the economic LUFs, *LUF3 Provision of food, timber and biofuels* shows negative developments in several regions, especially in the Mediterranean countries, which could be associated to land abandonment and decrease in area harvested (mainly due to conversion of rural areas into urban). In contrast, there are positive changes in Scotland and central Europe. It is interesting to see the different geographical patterns in Sweden, with a high and stable performance in the North (associated to forestry production), and a negative performance in the south (linked to agricultural production).
- *LUF4 Housing and infrastructure* shows a high stable performance in the Blue Banana, similarly to the economic LUFs, indicating significant urban and infrastructure developments in the European Megalopolis. Coastal areas in the Mediterranean show as well a high and stable performance and even an increase in some regions. Increases are also observed in southern Spain, southern Italy and eastern Germany, as well in main cities in central Europe (Budapest, Bratislava and surroundings). Decrease is found in few rural areas of Romania, Poland, South Sweden and Lleida (Spain).
- *LUF5 abiotic resources* shows scattered changes as it describes broad environmental issues linked to air, water and soil quality. Therefore variations are difficult to explain without assessing the changes in the specific indicators affecting the LUF.
- *LUF6 biotic resources* shows significant improvement in central Spain and north-western France. There are more negative developments than in the other environmental LUF. For example, in some regions of the Dutch 'randstad' (industrial and metropolitan conurbation occupying west-central Netherlands) where significant infrastructure and urban development has taken place. This trend appears as well in the southern Alps including the densely populated Po valley.

Figure 8 Changes in the economic, environmental and social dimensions in the period 2000-2006, based on aggregated changes observed in Land Use Functions.

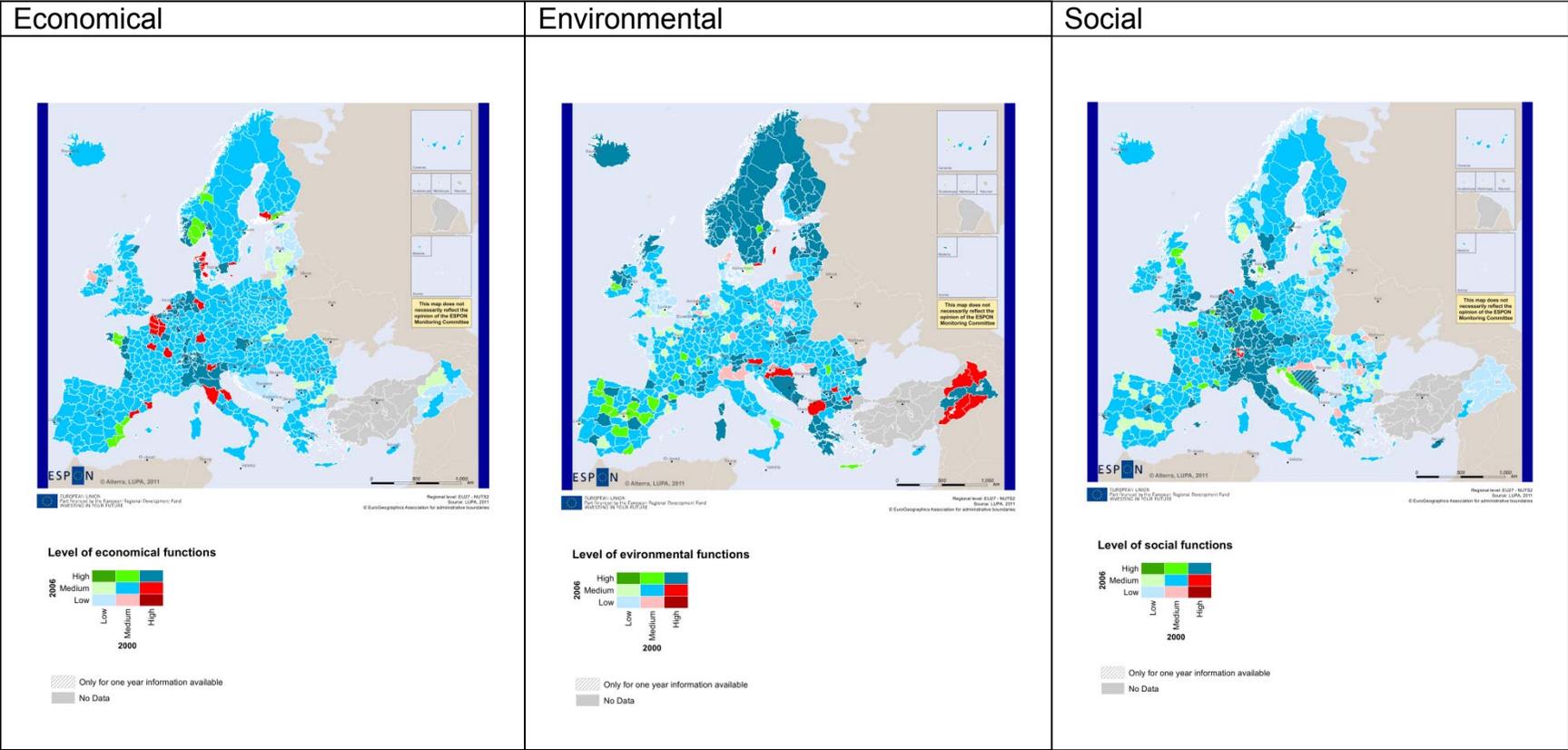
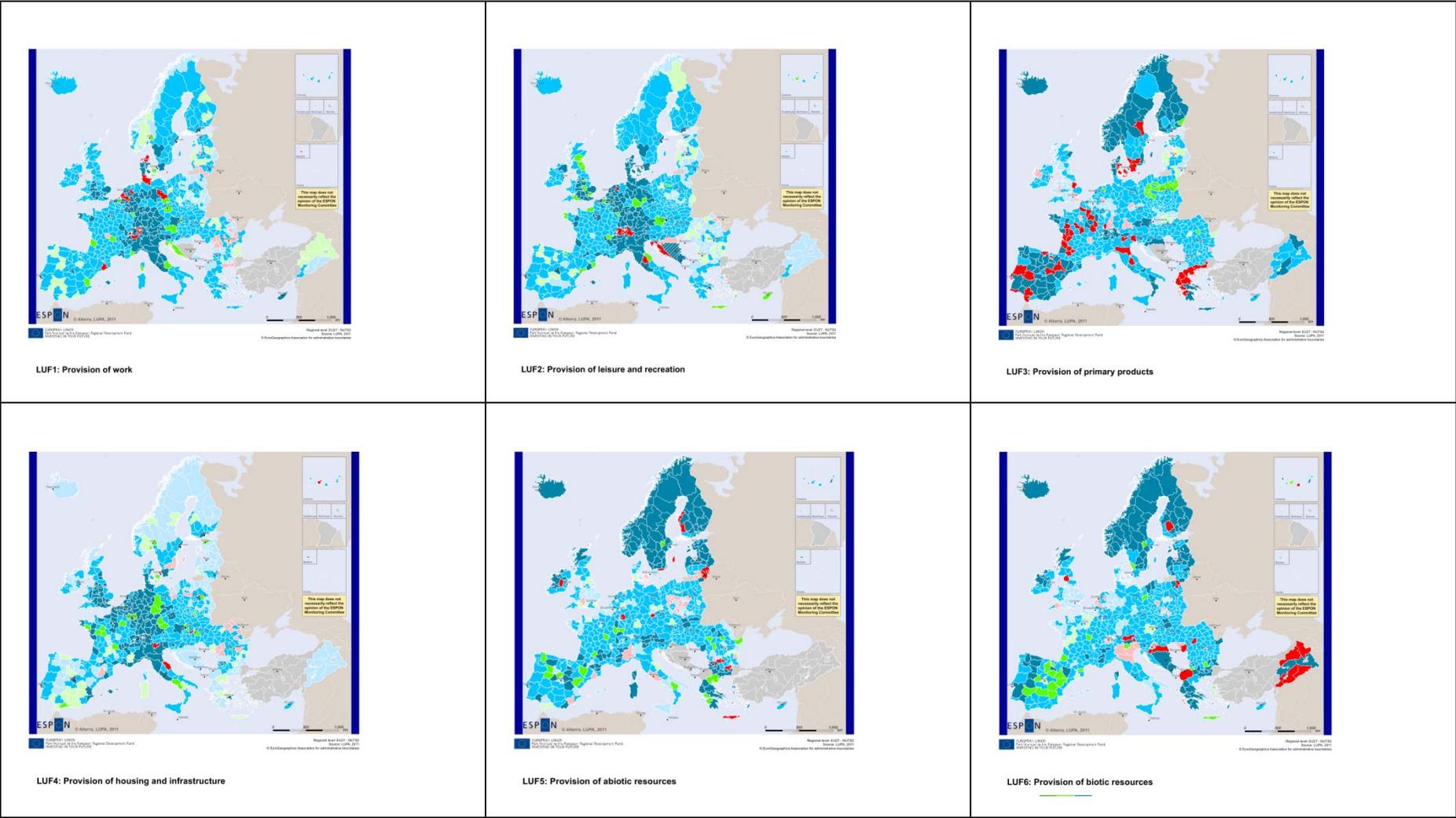


Figure 9: Changes in the performance of the six LUFs: LUF1 Provision of Work, LUF2 Provision of leisure, LUF3 Provision of food and bioenergy, LUF 4 Provision of housing and infrastructure, LUF5 Provision of abiotic resources and LUF6 Provision of biotic resources, for the period 2000-2006.



6. Land Use Performance and Land Use Efficiency

In this chapter the concept of Land Use Functions is further applied to define Land Use Performance and Land Use Efficiency. By assessing the individual performance and efficiency of the six LUFs, a deeper insight is reached in the depiction of the multifunctionality of a region.

6.1 Land Use Performance

Land Use performance is defined in EU-LUPA as the degree in which the use of the land to deliver a specific function complies with a function-related (e.g. agricultural production, accessibility, habitat provision, etc.) policy target. The policy targets could be a single value (e.g. job provision, air quality, soil quality) or a ratio (e.g. job-to-housing ratio). In order to apply this definition in EU LUPA, the policy targets should follow the next criteria:

- be defined quantitatively;
- be directly related to the list of indicators selected to define the Land Use Functions. This will allow the linkage between the policy targets and the function performance;
- be available at national or regional level.

In EU LUPA the policy targets will be defined in Task 2.5 based on the policy analysis. In case these policy targets do not follow the criteria mentioned above, then the EU or national averages or other statistical measures could be used as reference.

Following the analysis of the policy targets identified in Task 2.5 (see Annex 6), it was concluded that it was not feasible to calculate the LU performance using as reference policy targets because only few targets were found that were quantifiable and could be therefore linked to the values of the LUFs indicators.

Example of Land Use Performance calculation when a policy target is available: Nitrate Directive

In order to show how the calculations could be done if quantifiable policy targets and corresponding indicators were available at NUTS 2/3 level, the LU performance was calculated as regards the Nitrate Directive. The Nitrate Directive requires MS to monitor surface waters and groundwater for nitrate pollution against a maximum limit of **50 mg nitrate/l** (Directive 91/676/EEC on pollution caused by nitrates from agricultural sources). '*...The Directive seeks to reduce or prevent the pollution of water caused by the application and storage of inorganic fertiliser and manure on farmland. It is designed both to safeguard drinking water supplies and to prevent wider ecological damage in the form of the eutrophication of freshwater and marine waters generally...*'. This policy target clearly refers to the two environmental LUFs (LUF5 Provision of abiotic resources and LUF6 Provision of biotic resources). One of the indicators considered underpinning these functions is the Nitrogen surplus, for which values are available at NUTS 3 level. The Nitrogen surplus values were

calculated as nitrate concentration of leaching water from agriculture for the years 2000 and 2006, as calculated by the model MITERRA Europe (Velthof et al. , 2009).

Two options were considered:

Option 1: Showing the level of compliance above and below the policy target.

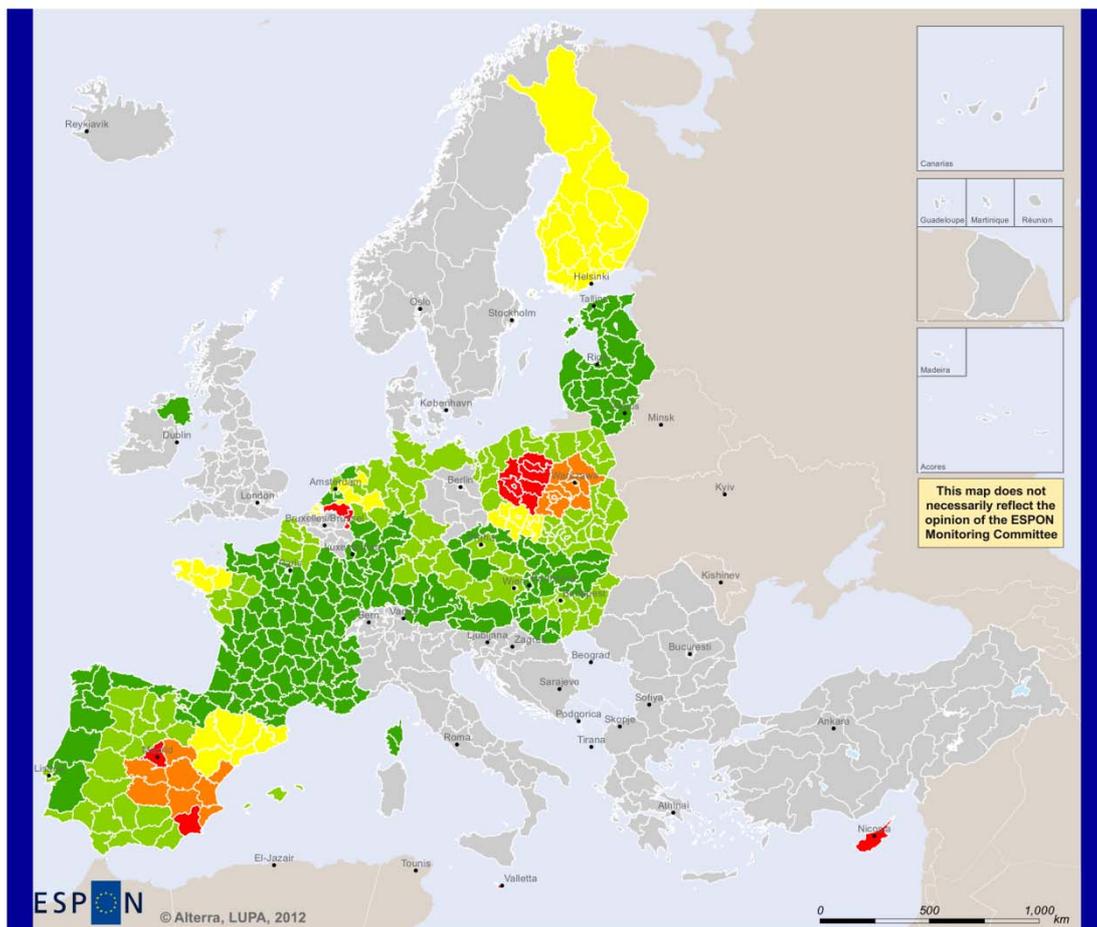
- If nitrate concentration in the NUTS 3 region is > 50 mg Nitrate / litre (policy target) (which is considered as 100%), then the LUF5 and LUF6 performances are negative and it is expressed as a proportion below the 100%
- If nitrate concentration is < 50 mg Nitrate/l , then the LUF5 and LUF6 performances are positive as it is expressed as a proportion above the 100% .

Option 2: Showing only the level of compliance when the values are above the policy target and considering all values below the threshold as 100% compliance.

The results are shown in Figures 10 and 11, respectively for Options 1 and 2.

The results in Figures 10 and 11 show that regions in eastern and central Spain, Bretagne in France, south of the Netherlands, Belgium, some regions in the western part of Germany, Finland and some regions in Poland do not comply with the nitrate directive and therefore their LUF5 and LUF 6 environmental land use performance regarding the agricultural land use is negative.

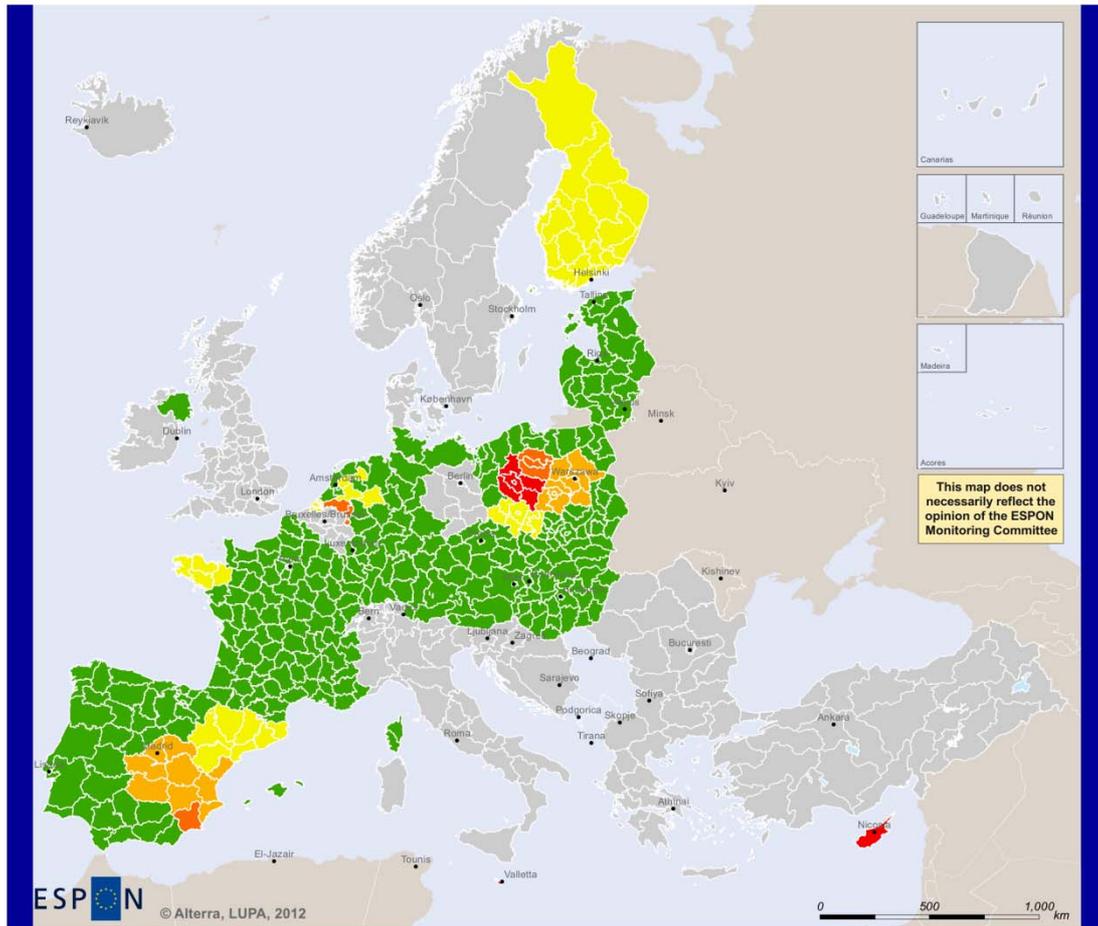
Figure 10 Land Use Performance of the agricultural land use regarding Nitrate Directive showing the level of compliance above and below the policy target



**Option 1. Land use performance regarding the Nitrate directive
Policy target is below 50 mg Nitrate / litre - year 2000**

- 67 - 140 % above threshold
- 34 - 66 % above threshold
- 1 - 33 % above threshold
- 1 - 50 % below threshold
- 50 - 99 % below threshold
- Only for one year information available
- No Data

Figure 11 Land Use Performance of the agricultural land use regarding Nitrate Directive showing the level of compliance only above the policy target



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**Option 2. Land use performance regarding the Nitrate directive
 Policy target is below 50 mg Nitrate / litre - year 2000**

- 121 - 140 % above threshold
- 81 - 120 % above threshold
- 41 - 80 % above threshold
- 1 - 40 % above threshold
- Complying policy target
- Only for one year information available
- No Data

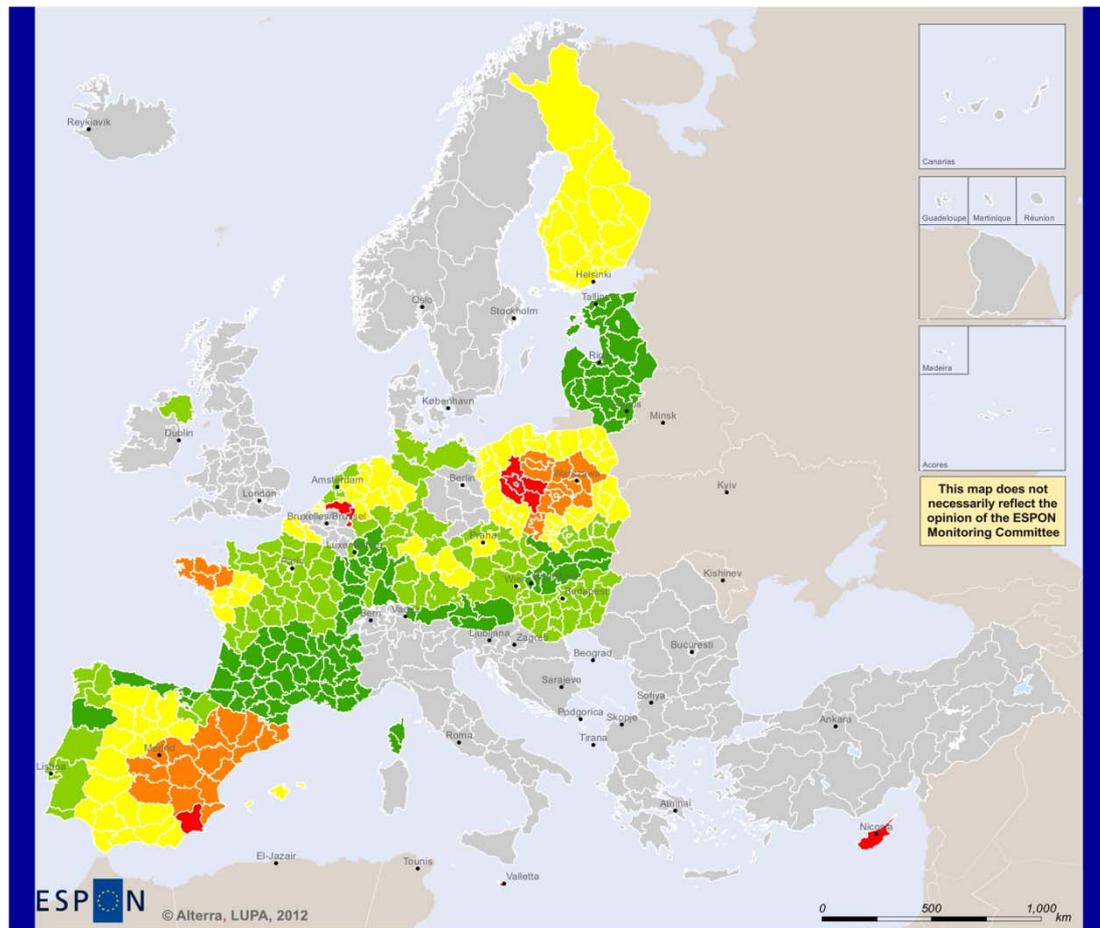
Example of Land Use Performance calculation when policy targets are not available or suitable for the

The limited number of policy targets related to land use made necessary to develop other approach for the calculation of the LU performance. It was calculated considering the performance of each indicator regarding the European average, as it is often used, and the performance of the indicators was aggregated per LUF to calculate the LUFs performance in the same way as described in Section 3.

As example of the calculation of the LU performance using as reference the EU average, we used again as indicator the Nitrogen surplus. The same assessment was made but considering the distance of the regional nitrate values to the European average, in the case that no policy target would be available. In the same way as before, Figure 12 shows the distances above and below the European average, and Figure 13 only the distances above the European average.

The results in Figures 12 and 13 show that in case no policy target would be available for the nitrogen surplus and then the distance to the European average will be considered as estimation of the Land use performance, the results would be quite different since the European average is below the threshold of 50 mg nitrate/ l. Consequently, more regions would show a low environmental land use performance concerning agricultural land use, with values above the European nitrate concentration average.

Figure 12 Land Use Performance of the agricultural land use regarding the European average showing the distances above and below the average



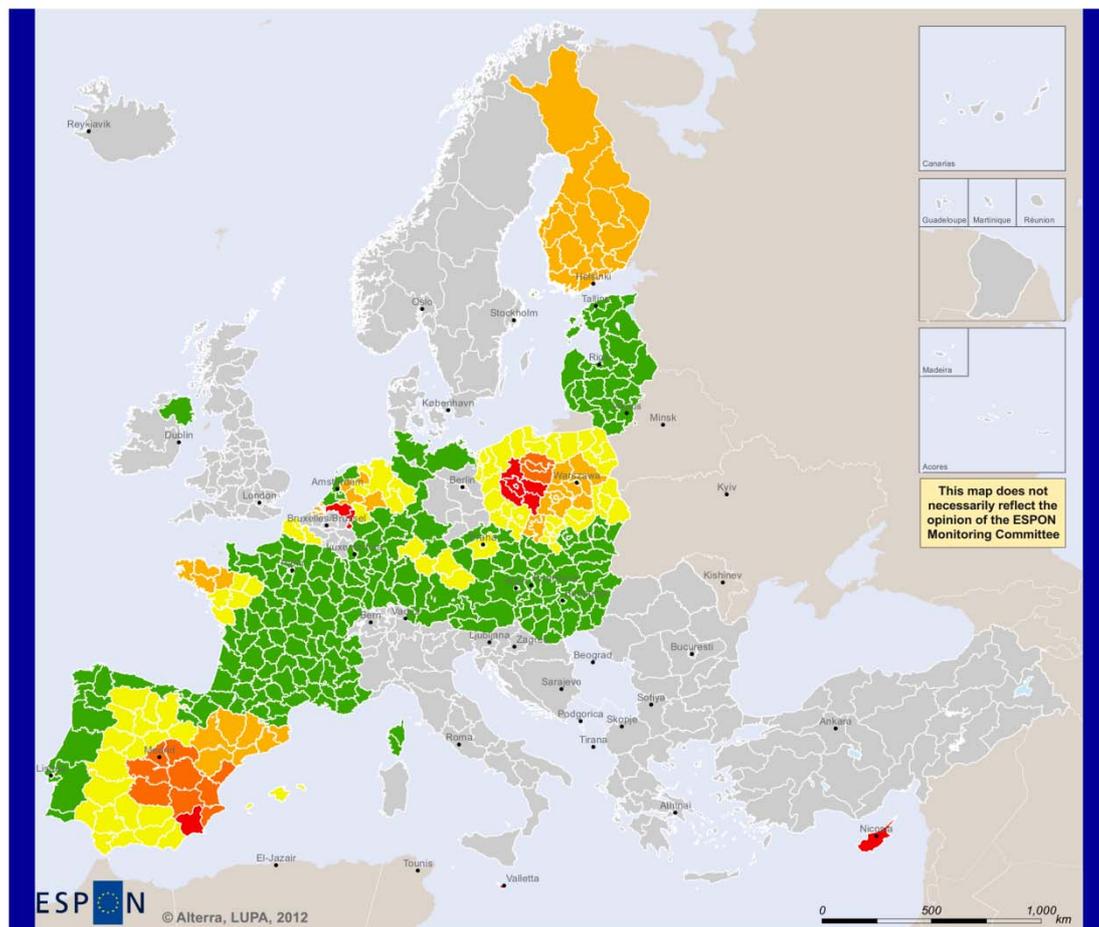
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Regional level: EU27 - NUTS2
Source: LUPA, 2011
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**Option 1. Land use performance regarding the Nitrate directive
Based on EU-average - year 2000**

- 200 - 287 % above average
- 100 - 199 % above average
- 1 - 99 % above average
- 1 - 50 % below average
- 51 - 100 % below average
- Only for one year information available
- No Data

Figure 13 Land Use Performance of the agricultural land use regarding the European average showing the distances above the average



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Regional level: EU27 - NUTS2
 Source: LUPA, 2011
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**Option 2. Land use performance regarding the Nitrate directive
 Based on EU-average - year 2000**

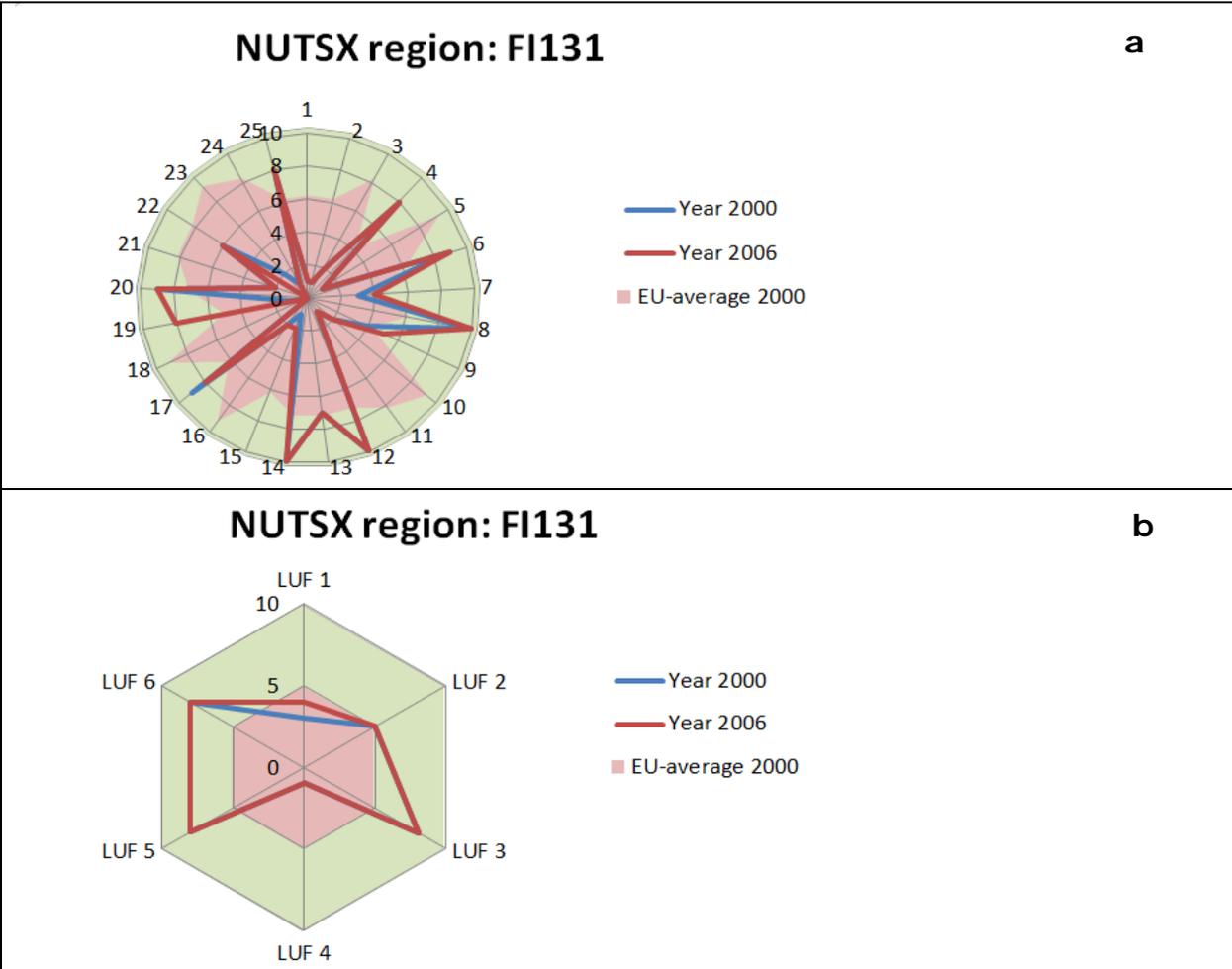
- 210 - 287 % above EU-average
- 140 - 209 % above EU-average
- 70 - 139 % above EU-average
- 1 - 69 % above EU-average
- Equal or lower than EU-average
- Only for one year information available
- No Data

In addition to the maps, the Land Use Performance results were visualised as well using spider diagrams, which show the normalised scores for the indicators or the Land Use Functions, compared to the normalised value of the European average. The normalisation by range is given a nominal scale of 0 to 10.

Spider diagrams were produced for all NUTS X regions. As example we produced spider diagrams for regions in Finland, the Netherlands and Spain (showed below) and for Poland (shown in the next chapter as part of the testing of the LUF methodology for a case study region).

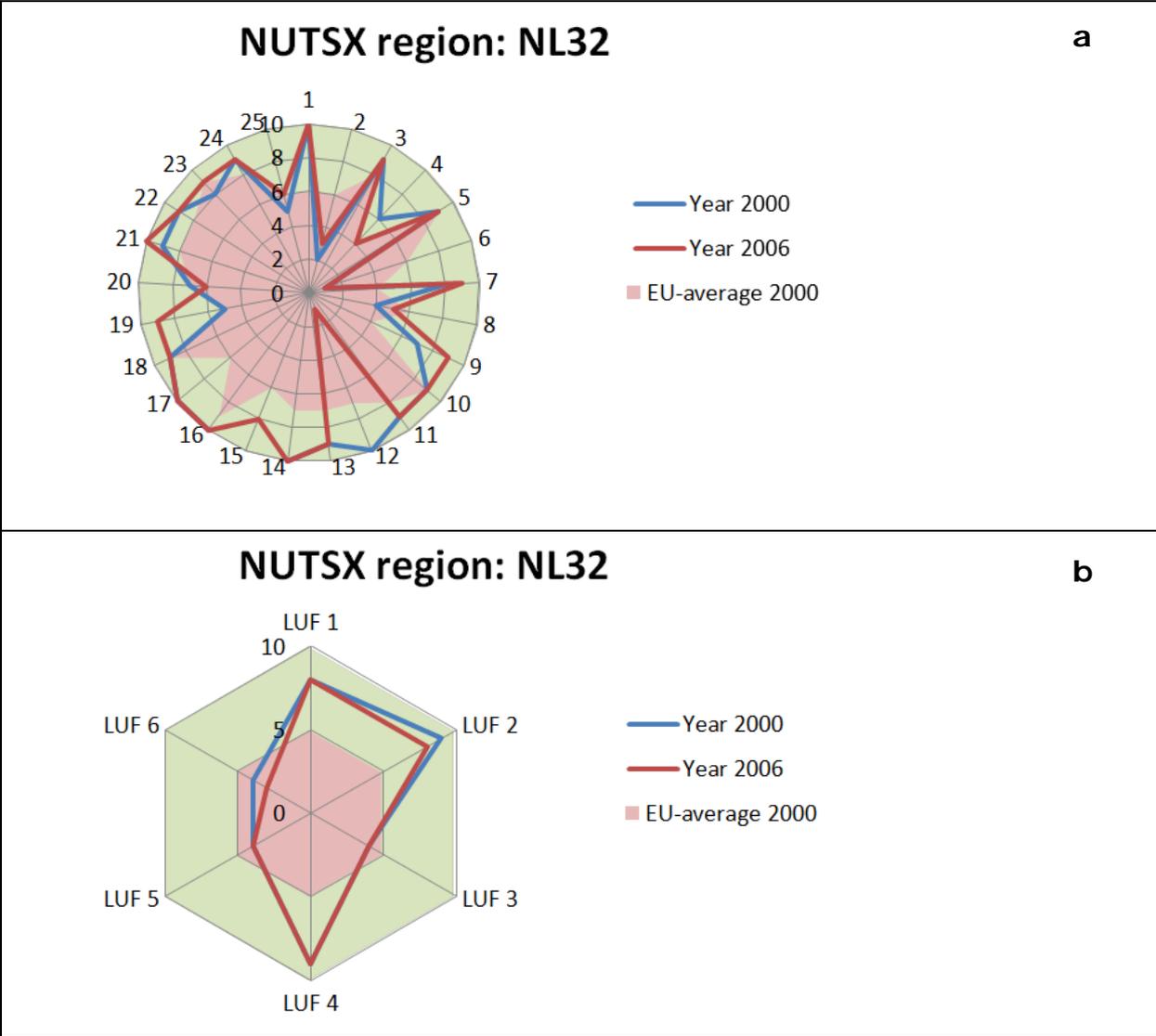
As the figures below show, the spider diagrams seem to be an useful tool to visualise at once all the indicators or the LUFs for a single region, displaying their distance to the EU average. Being able to analyse simultaneously the spider diagrams of the indicators and the LUFs, also helps to understand the role that the indicators play in underpinning the values of the LUFs. The spider diagrams show as well the large differences between the NUTSx regions and highlight their main functional specificities, as shown in Figures 14-18.

Figure 14: Spider diagrams showing the results of (a) the 25 individual indicators and (b) LUFs for NUTS 3 region FI131 - Etelä-Savo. The names of the 25 indicators are provided in Table 8.



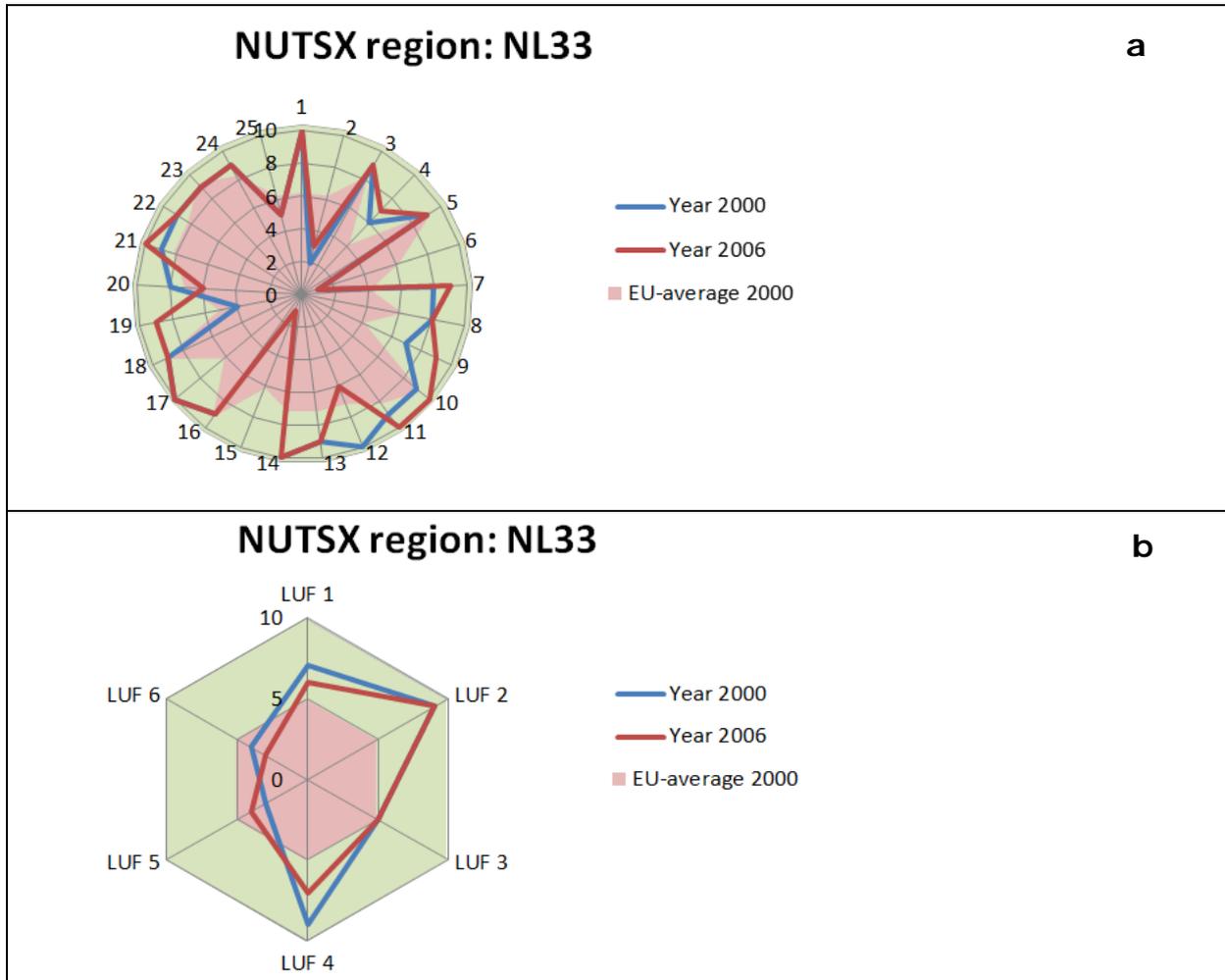
Etela-Savo (Southern Savonia) is a region in the south-east of Finland. It is located in the heart of the Finnish lake district. It has only two major towns in the region, the rest being mainly rural or remote areas (shown by the low values of LUF 4 and high values of LUF 5 and LUF 6). Its key economic sectors are services (67%) and manufacturing (24%), with a minor role of the primary sector (9,2%). Because of the climate, agricultural development is limited to maintaining self-sufficiency in basic products. Forestry, an important export earner, provides a secondary occupation for the rural population (shown by high values above EU average of LUF3). It has a high unemployment rate (12%) (shown by low values of LUF1).

Figure 15: Spider diagrams showing the results of (a) the 25 individual indicators and (b) LUFs for NUTS 2 region NI32 Noord-Holland. The names of the 25 indicators are provided in Table 8.



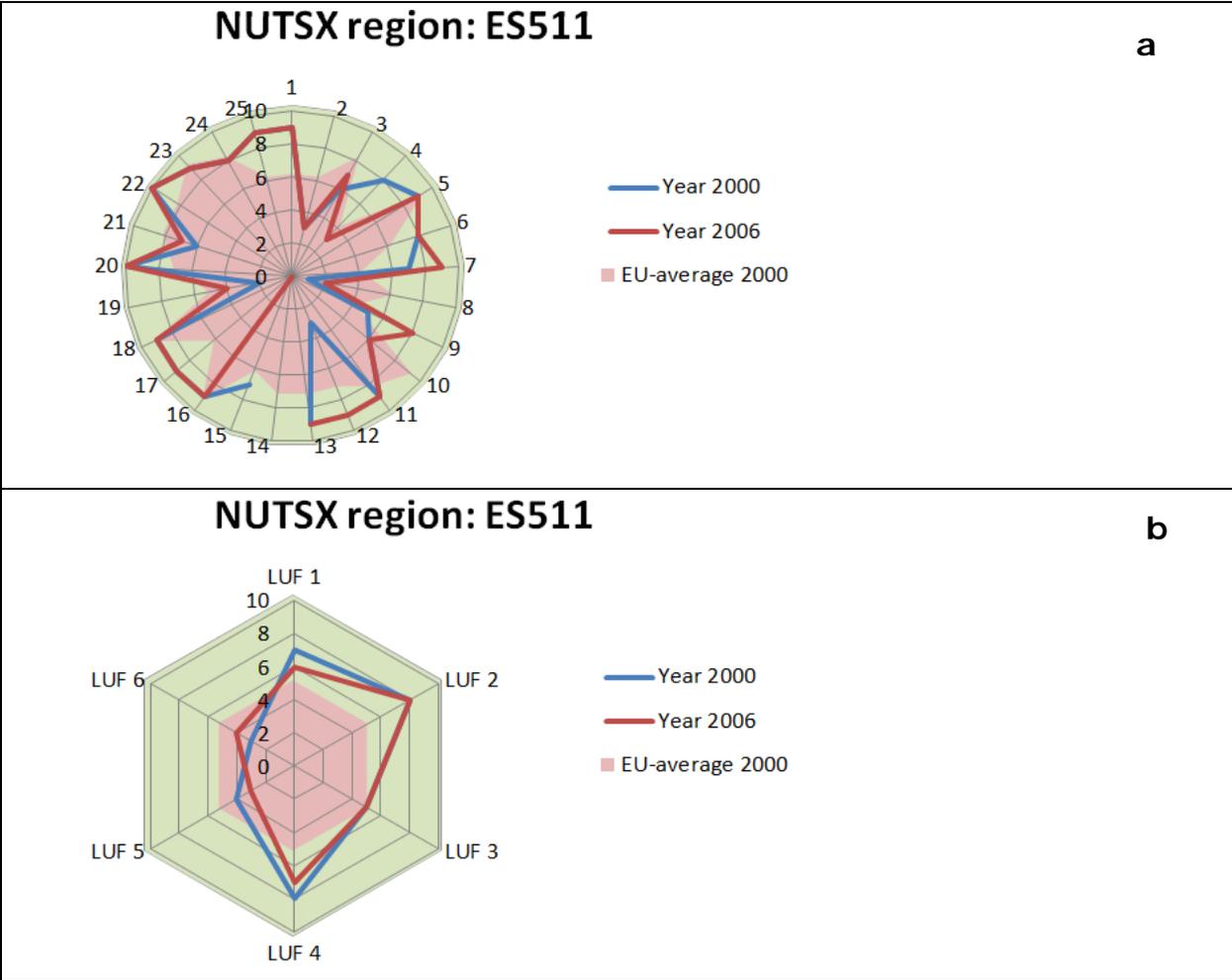
North Holland is a province situated on the North Sea in the northwest part of the Netherlands. North-Holland is the country’s second most densely populated province, with high level of urbanisation (as shown by the very high values of LUF 4 compared to the EU average). It is as well one of the most attractive touristic areas as it is shown by the also very high values of LUF 2.

Figure 16: Spider diagrams showing the results of (a) the 25 individual indicators and (b) LUFs for NUTS 2 region NI33 Zuid-Holland. The names of the 25 indicators are provided in Table 8.



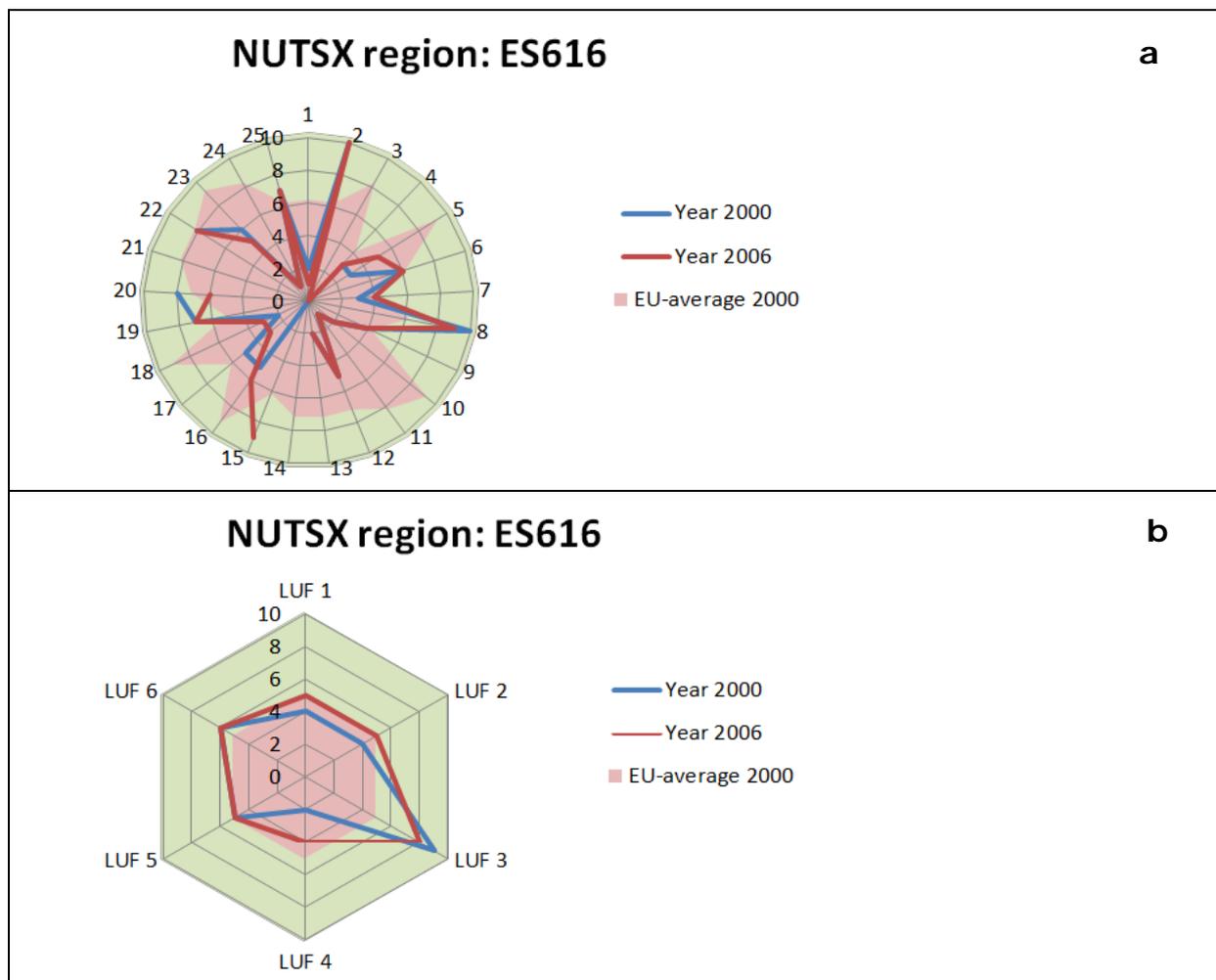
South Holland (Dutch: Zuid-Holland) is a province situated on the North Sea in the western part of the Netherlands. South Holland is one of the most densely populated and industrialised areas in the world (as it is shown by LUF4), and is the province with the highest population density in the Netherlands. South Holland is the country's most important province in terms of economy, agriculture and the provision of services (as it is indicated by the very high scores of LUF1 and LUF4). It is a hive of activity, criss-crossed by a busy network of roads, railways and waterways. Rotterdam with its mainport is South-Holland's largest city. The provincial capital is The Hague, which is the seat of national government and the Queen's official place of residence. Outside its urban heart, South-Holland offers spacious tranquillity, sprawling countryside, rivers, polders, lakes, dunes and endless sandy beaches (high level of LUF2). Despite being neighbour provinces in the same country, it is interesting to see the differences between the two Dutch provinces regarding agricultural production (LUF3) –higher in South Holland, and the two environmental LUFs.

Figure 17: Spider diagrams showing the results of (a) the 25 individual indicators and (b) LUFs for NUTS 3 ES511 Barcelona. The names of the 25 indicators are provided in Table 8.



The province Barcelona is located in eastern Spain on the Mediterranean coast. It is one of the most touristic provinces in Spain with its capital Barcelona one of the most visited cities in the world (high LUF 2). The whole province is highly populated and very urbanised (high values of LUF 4) which has significant impacts on the environmental resources (low values of LUF 5 and LUF 6).

Figure 18: Spider diagrams showing the results of (a) the 25 individual indicators and (b) LUFs for NUTS 3 ES616 Jaén. The names of the 25 indicators are provided in Table 8.



Jaén is a province of southern Spain, in the eastern part of the autonomous community of Andalusia. Jaén consists of mainly rural and remote areas with few cities. It is one of the larger producer of olive oil in the world. The results show indeed the main relevance of the LUF3 for land-based production, which is far above the EU average, and the slight increase in this LUF between 2000 and 2006, which could be explained by the influence of the CAP. At present, olive oil production is heavily subsidised by the CAP. This policy has led to intensification and increased output. On the other hand, it has helped to reduce the land abandonments in marginal regions.

6.2 Land Use Efficiency

The definition of Land Use efficiency in EU-LUPA is a complex issue. This complexity not only relies on the need to relate to key concepts used and developed in the project (i.e. multifunctionality through the LUFs approach and LU performance), but also on the viability to measure it in a quantitative way based on the current data availability at pan European level.

Efficiency has a wide variation in meaning for different disciplines. In general terms, efficiency describes the extent to which time or effort is well used for the intended task or purpose. In the case of land use science, this definition could be translated as the extent to which land is well used for the intended function considered.

The term "efficient" is very much confused and misused with the term "effective". In general, efficiency is a measurable concept, quantitatively determined by the ratio of output to input. "Effectiveness", is a non-quantitative concept, mainly concerned with achieving objectives. IN EU-LUPA effectiveness is clearly related with the Land use performance definition, i.e. achieving policy objectives.

How to measure land use efficiency quantitatively? Efficiency can be expressed as a result by way of a percentage of what ideally could be expected, hence with 100% as ideal case. This does not always apply, not even in all cases where efficiency can be assigned a numerical value, as it is the case in EU-LUPA. In this case, it is suggested to use a slightly broader model of efficiency, i.e. efficiency corresponds to the ratio

Land Use efficiency=Output/Input

of the amount *Output* of some valuable resource/revenue produced by the use of the land, per amount *Input* of land used.

In the context of the EU LUPA project, LU efficiency is defined considering the central concept of multifunctionality, i.e. Land Use Functions. Therefore the LU efficiency ratio is calculated for each of the six Land Use Functions. For example, in LUF1 Provision of Work, the main *output* is the nr of jobs, and the LU efficiency will be defined as the nr of jobs per sector related to the use of the land for that specific sector. The definition of efficiency is therefore linked to the specific functionality of the land used and does not always correspond to a percentage when the resource/revenue produced and the areal (amount of land) used are not compatible units, or if they are transformed into products. For example, in the analysis of the efficiency for the LUF 3 Provision of food, the *Output* may be the revenues obtained by the production of food, timber and bioenergy, while the *Input* is the amount of land used as input.

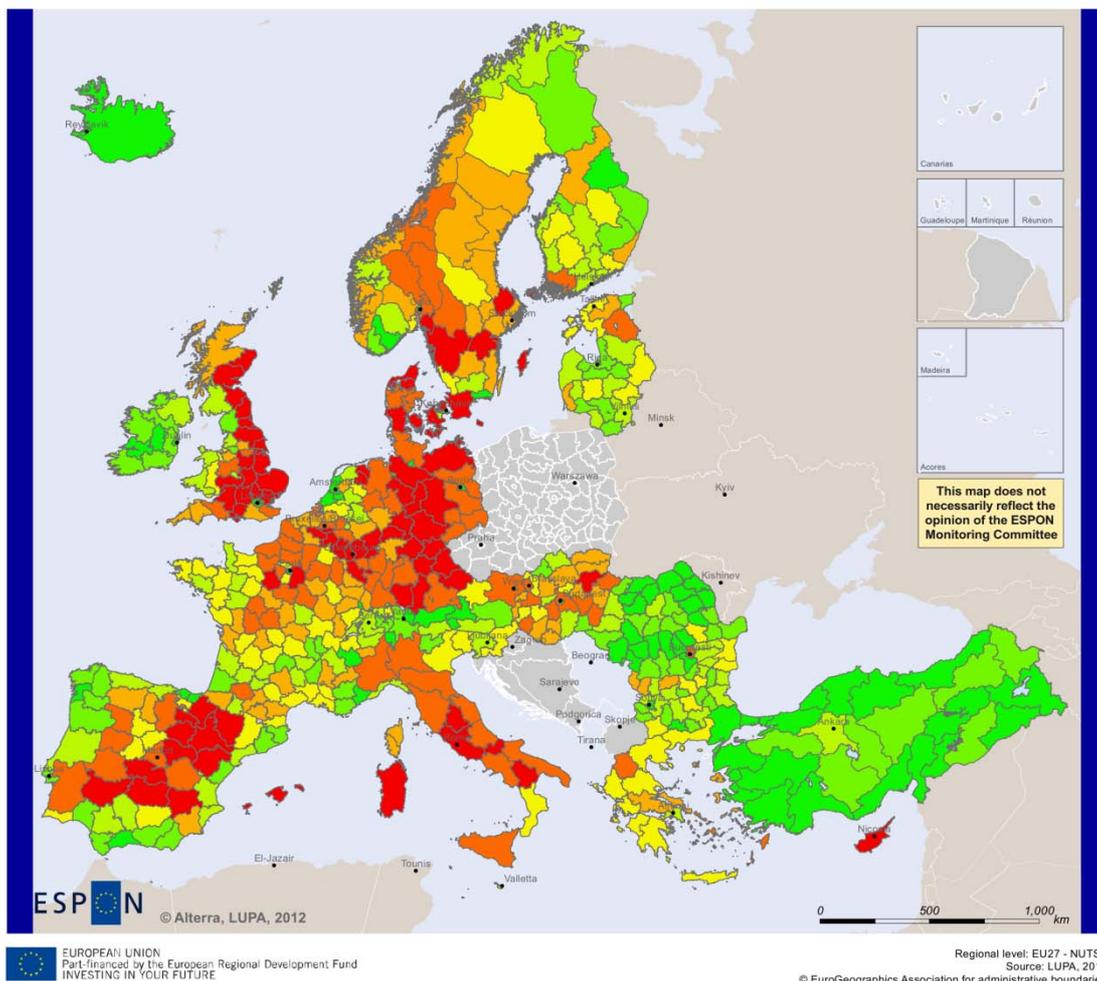
The definition of the Output and Input to calculate Land use Efficiency ratio for each Land Use Function are described in Table 12.

Table 12 Definition of the Land Use Efficiency Output and Input for each Land Use Function. CLC nr refers to the second level of CORINE Land Cover classes. CLC 11 = urban fabric; CLC 14 = Artificial non-agricultural vegetated areas; CLC 21 = Arable land; CLC 22 = Permanent crops and CLC 24 = Heterogeneous agricultural areas.

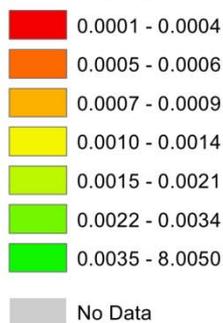
LUF	Output	Input	Definition
Provision of work	Nr of jobs per sector	Area used by each sector	Based on NACE data on jobs per sector; considering two categories: (i) the agricultural sector and (ii) all the other sectors: (i) Nr of agri-jobs / km ² agriculture (CLC 21 + 22 + 24) (ii) Nr of jobs outside agriculture / km ² built-up area (CLC 11)
Provision of leisure	Nr of tourists (proxi: Nights spent in tourist accommodations)	Urban areas	Nr of nights spend in tourist accommodations / km ² urban areas (CLC 11 + 14)
Provision of food and bioenergy (only for agricultural production)	Area harvested	Agricultural area	Area harvested (km ²) / agricultural area (CLC 21 + 22 + 24)
Provision of housing and transport and transport infrastructure	Population nr	Built-up area or roads longitude	(i) For housing: Population nr / km ² built-up area CLC 11) (ii) For transport infrastructure: Population nr / km roads
Provision of abiotic resources	All the soil that is not sealed is consider as potential source of abiotic resources	Area of the region	Un-sealed area (km ²) / Total area region (km ²)
Provision of biotic resources	Area covered by N2000 and CDDA in 2006	Area of the region	Protected area (km ²) / Total area (km ²)

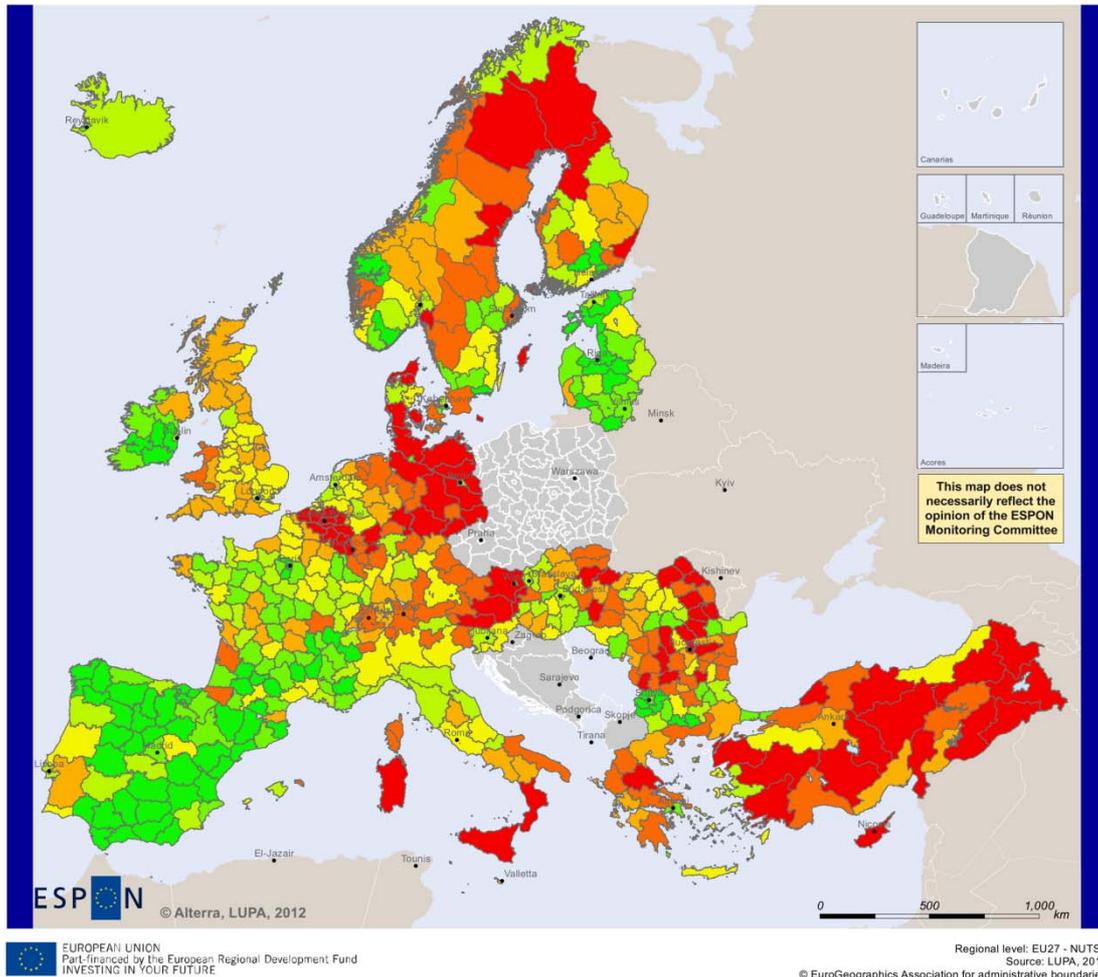
The maps in the eight following figures visualise the LU efficiency for the six LUFs, as defined above.

Figure 19 : Land Use Efficiency regarding to (1) Provision of work based on agricultural land use; (2) Provision of work based on other activities than agriculture; (3) Provision of leisure; (4) Provision of food and bioenergy; (5) Provision of housing; (6) Provision of transport infrastructure; (7) Potential Provision of abiotic resources; and (8) Provision of biotic resources.

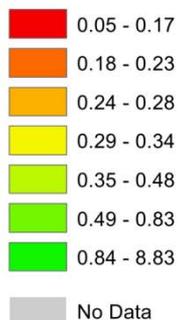


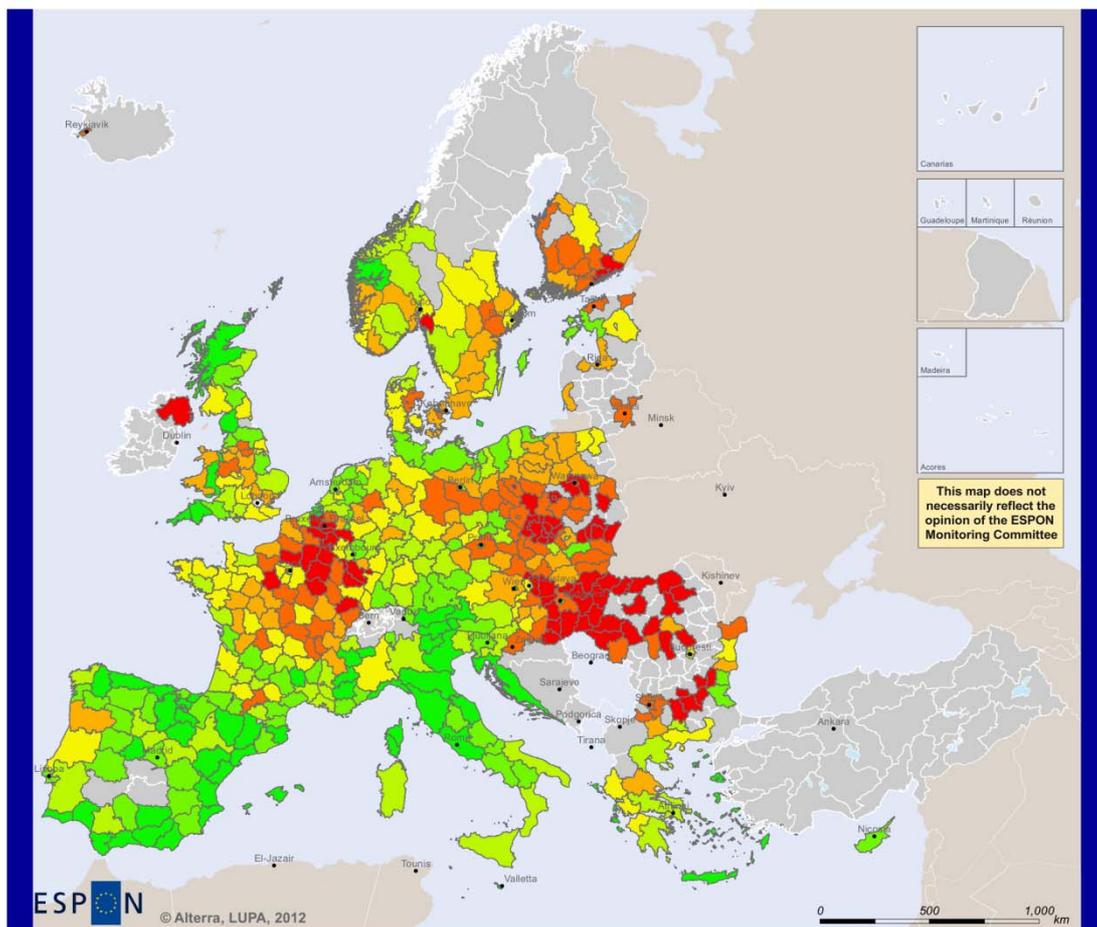
1. Land-use efficiency regarding Provision of Work (Nr of agri-jobs / km2 agriculture CLC 21 + 22 + 24)





2. Land-use efficiency regarding Provision of Work (Nr of jobs outside agriculture / km² buildup area CLC 11)



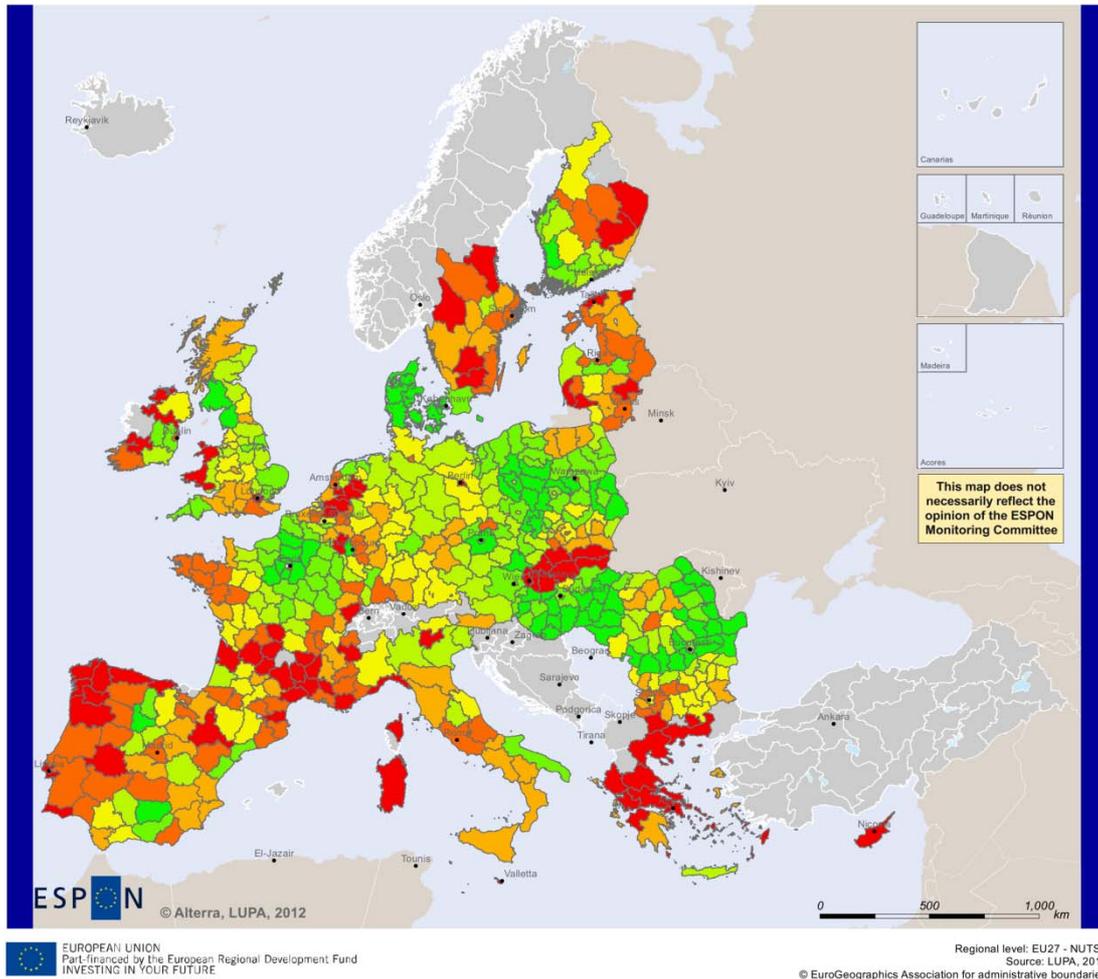



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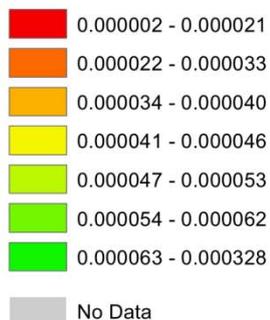
Regional level: EU27 - NUTS2
 Source: LUPA, 2011
 © EuroGeographics Association for administrative boundaries

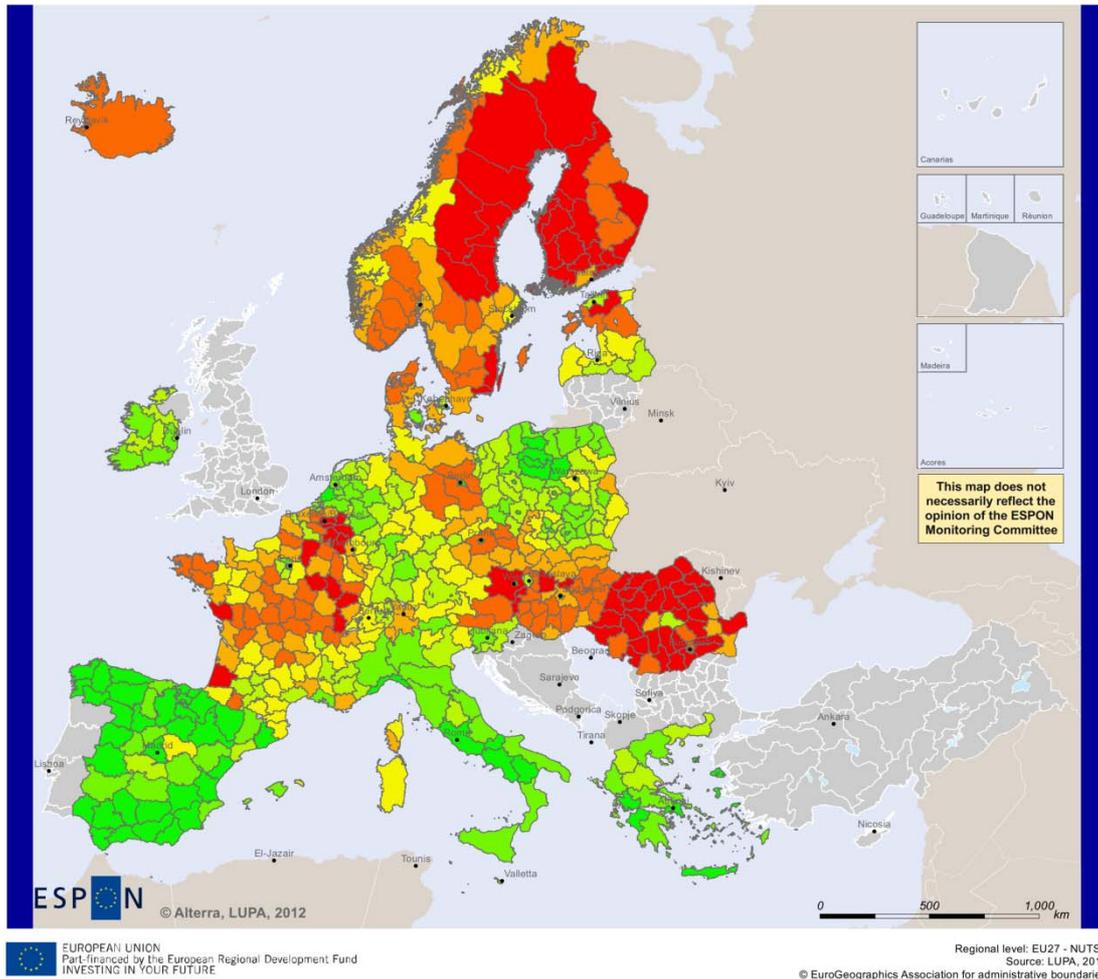
3. Land-use efficiency regarding Leisure and Recreation (Nr of nights spend in tourist accommodations / km² urban areas CLC 11 + 14)



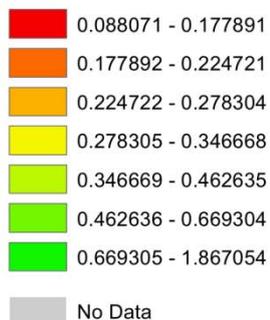


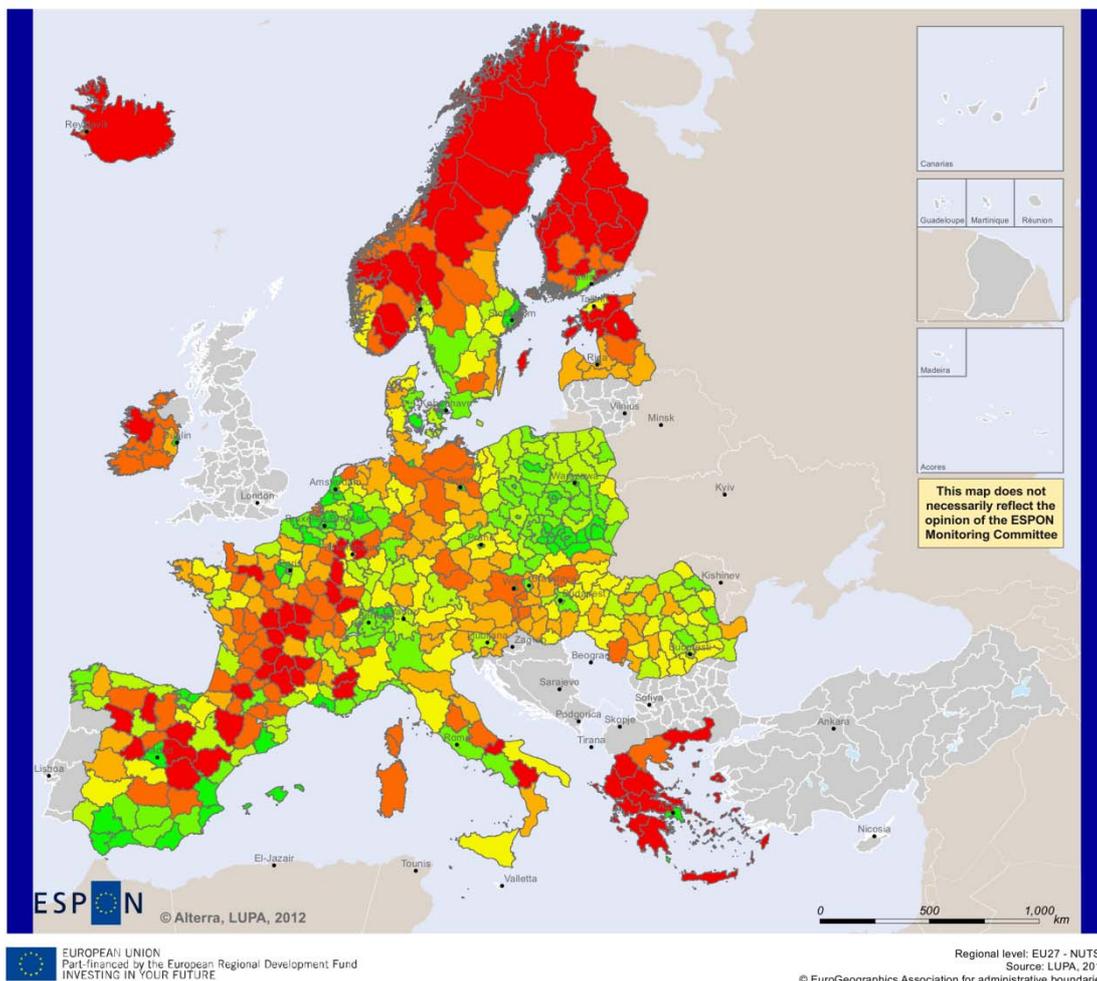
4. Land-use efficiency regarding Food and Energy (km² harvested / km² agriculture CLC 21 + 22 + 24)





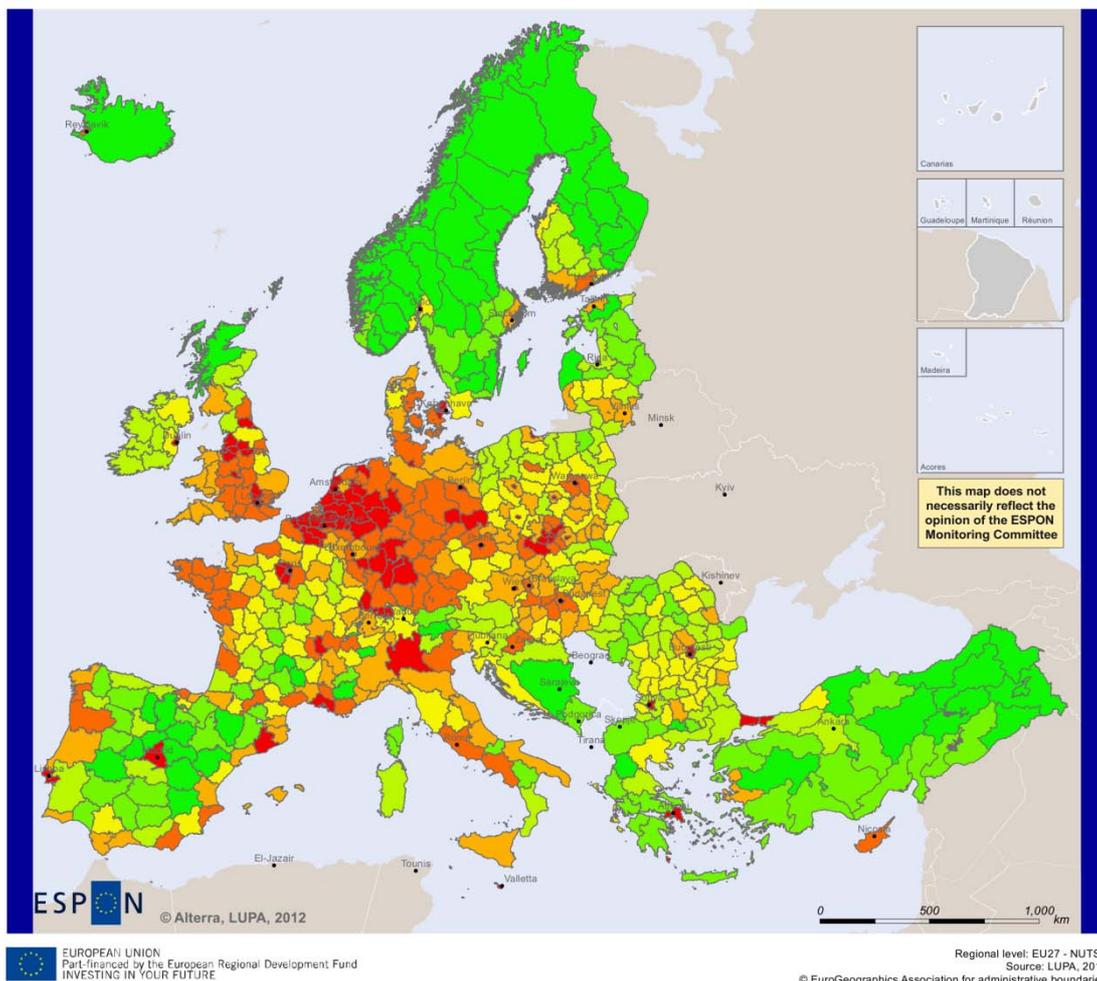
5. Land-use efficiency regarding Housing and Transport (Population nr / km² buildup area CLC 11)



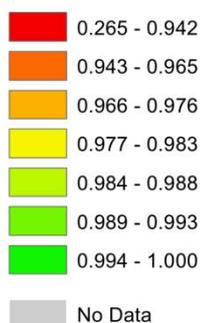


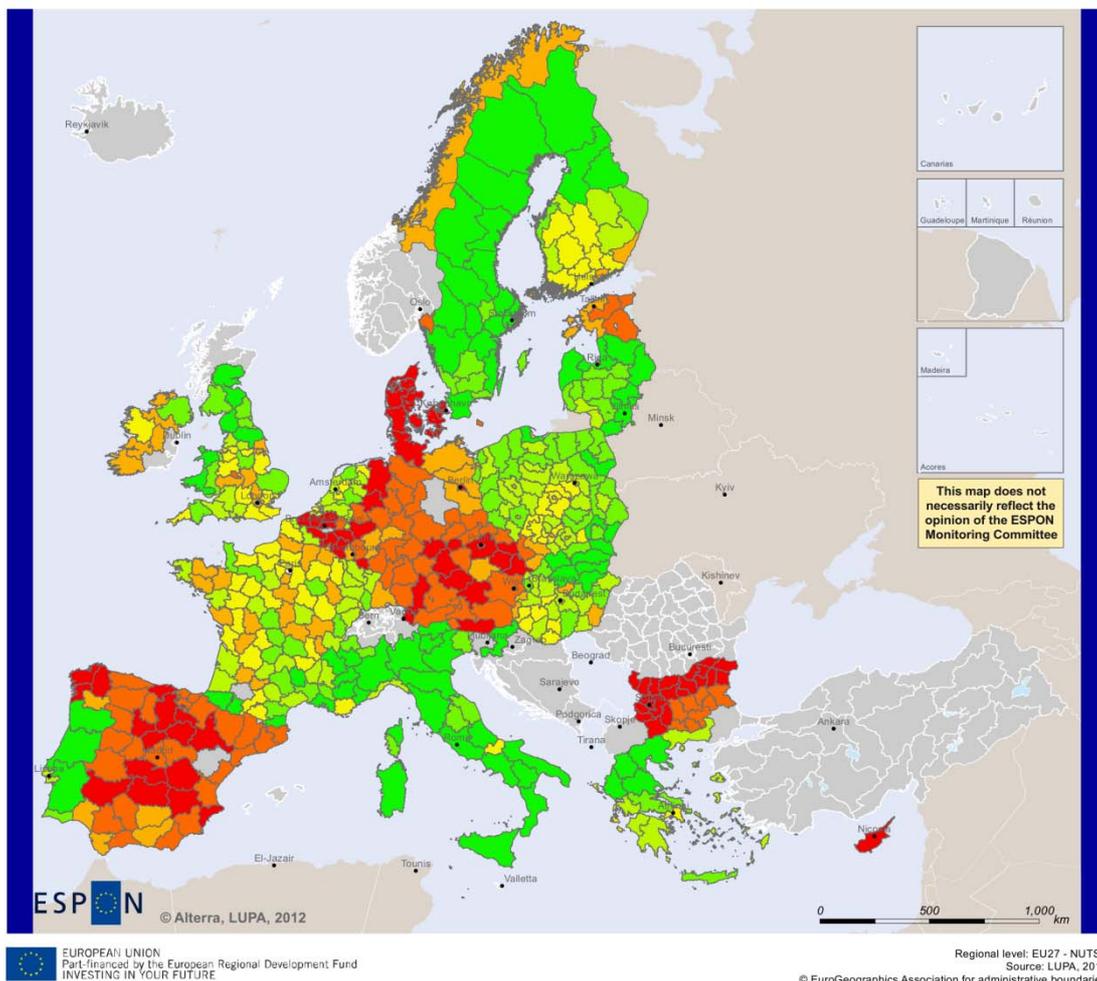
6. Land-use efficiency regarding Housing and Transport (Population nr / km roads)



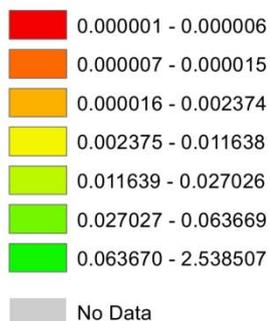


7. Land-use efficiency regarding Provision of Abiotic Resources (Unsealed area km² / Total area km²)





8. Land-use efficiency regarding Provision of Biotic Resources (Protected area km² / Total area km²)



The approach to assess LU efficiency is in principle quite coarse. However it helps to show how relatively efficient works out multifunctionality in every region. For example, the land of a region can be used very efficiently to provide food, while at the same time being inefficient in providing housing and abiotic resources (e.g. some North provinces of the Netherlands). The LU efficiency approach also helps to find out the degree of current use regarding the maximum (e.g. provision of food and bioenergy) or the potential use (e.g. in provision of abiotic resources).

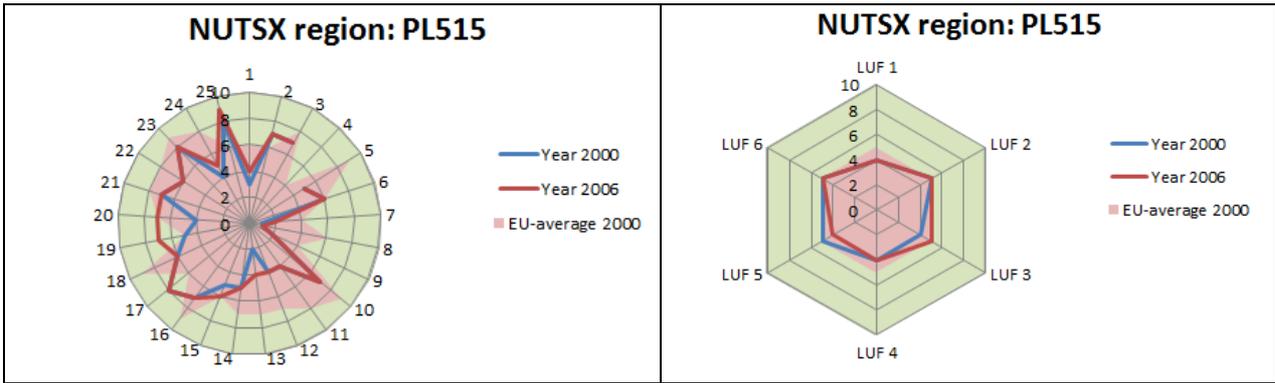
7. Testing the pan European LUF results for a case study in Poland

In order to test the results obtained when applying the LUF methodology at pan European level, it was decided to compare the results with those obtained for one of the case studies in Poland. The case study NUTS 3 region PL515 Jeleniogorski was selected for the test.

7.1. Results based on LUF analysis

Firstly we analysed the indicators and LUFs spider diagrams of the NUTS 3 region to get an impression of the performance of this region compared to the European average (Figure 20).

Figure 20: Results of the LUF assessment and the individual indicators for PL515 Jeleniogorski



The results are summarised in Table 13.

Table 13 Summary of changes in LUFs values between 2000 and 2006 for the NUTS 3 region PL515 Jeleniogorski

LUF	2000	2006	Change
LUF1 work	4	4	=
LUF2 Leisure	5	5	=
LUF3 Food & Bioenergy	4	5	+
LUF4 Housing & Infrastructure	4	4	=
LuF5 Abiotic conditions	5	4	-
LUF6 Biotic conditions	5	5	=

According to them, the changes in the Jeleniogorski region between 2000 and 2006 are similar to the European average. However there are some differences. For example, there is an increase in the performance of *LUF3 Provision of food and bioenergy* (score increases from 4 to 5 between 2000 and 2006). Concerning *LUF5 Abiotic conditions*, the situation has slightly deteriorated (score from 5 to 4).

A more detailed analysis based on the individual indicators ((Table 14) shows that the situation has improved for Multimodal potential accessibility (Multimod00) and Gross domestic product (PPS) (Gross_Do06), but has deteriorated the indicators: ammonia emissions (NH3_emis12), net migration (Net_migr14), phosphorus surplus (P_surplu19), urban fabric (Urban_fa23) and nitrate concentration(NO3_conc24). These indicator trends suggest a significant urban growth and in rural areas a larger use of fertilizers in agriculture.

Table 14 Changes in indicator values between 2000 and 2006 for the NUTS 3 region PL515 Jeleniogorski

Indicators	2000	2006	Change	Interpretation
Multimod00	3	4	+1	Improvement
Gross_Do06	1	2	+1	Improvement
NH3_emis12	2	4	+2	Deterioration
Net_migr14	5	6	+1	Deterioration
Natural_18	5	7	+2	Improvement
P_surplu19	4	7	+3	Strong Deterioration
Urban_fa23	4	5	+1	Deterioration
NO3_conc24	8	9	+1	Deterioration

7.2. Comparison of LUF results with case study analysis

The comparison of the LUFs results with the outcomes of the case study area based on in depth analysis of national data, provides a first validation of the LUF methodology. The summary of the comparison are presented in Table 15.

Table 15 Comparison of case study results with the LUFs results for the NUTS 3 region PL515 Jeleniogorski

Nr	Case Study PL515 Jeleniogorski	LUFs/indicator assessment	Matching
1	Overall socio-economic situation in this subregion is very much below the average level that is noted in the Dolnośląskie Region.	According to spider diagram situation PL515Jeleniogorsk is more or less on European average	
2	Outmigration from the subregion, with only few exceptions such as the suburban areas (especially around Jelenia Góra). However these zones are very narrow. Also, on the areas of great touristic and cultural value, people are migrating from bigger towns (mostly from outside of the subregion). New settlements are much more scattered. It leads to the chaotic development of spatial structures.	According to spider diagram Net migration goes from 5 to 6, i.e. is high and became even higher.	
3	There is a dichotomous process in settlement development. There are some villages, which are almost inhabited, in contrast with other villages well located and with attractive landscape surroundings that have noted a considerable share of newcomers in last two decades.	Indicator 23 Urban fabric shows an overall increase in acreage.	

4	There is one principal and basic reason for outmigration – collapse of industrial functions which were dominating on these areas in the past.	According to spider diagram Net migration goes from 5 to 6. In addition, indicator industrial areas is decreasing.	
5	High level of unemployment – collapse of many industrial activities; reduction in the previous employment in industrial factories cannot be compensated by employment offered by tourism institutions.	According to indicator 22 unemployment stays very high (score 8 in 2000 and 8 in 2006).	
6	In the lowland part of the subregion, the big agricultural enterprises have appeared – process of consolidation of land can be observed. In the upland and mountainous part, the agriculture plays less and less important function in spatial organization and economical structures.	LUF3 food an bioenergy increases and linked to this the abiotic conditions decrease	
7	The biggest tourist investments are now located in the touristic areas.	Indicator 15 nights spend is high (score 7 in 2000 and 2006)	
8	There still persists a stereotype that that region is very polluted and ecologically destroyed – the so-called “Black Triangle”. In the past, a number of large industrial factories did really produce a lot of pollutions – right now this situation has changed for the better. Now the quality of environment is much better.	According to LUF5 the environmental conditions are deteriorated, which is supported by the indicators on emissions and fertilizers that have strongly increased (due to intensification agriculture)	

In summary: only two conclusions from the case study are not in line with the LUF/ indicator analysis.

8. Conclusions

This report describes the methodology of the LUFs as adapted for the EU-LUPA project, and its implementation to The Netherlands (considering specific regional differences) and to Europe. The results at pan European level have been validated for one of the Polish case study areas, comparing the LUFs results to the detailed information gathered at national level. The results indicate that the application of the LUFs methodology is feasible and the results are plausible. Finally, the application of the LUFs concept to assess the Land Use Performance and Land Use Efficiency seems an useful approach to get deeper insight in the complexity of the multifunctionality of the land in the European regions.

Regarding the implementation of the LUFs methodology and its further use as tool to support regional policy assessments (ex-ante and ex-post), it can be concluded:

- The Land Use Functions (LUFs) provide a useful approach by focusing on a fixed set of cross-cutting issues linked to the main sectors involved in the use of the land, including the economic, environmental and societal dimensions. Therefore LUFs may be relevant for the design of policies addressing the interface between socio-economic development and the environment, i.e. sustainable development.
- These issues are in line with several EU policies that affect directly or indirectly the use of the land, e.g. employment, agriculture, resource efficiency, transport, urban areas, biodiversity, etc. The LUF methodology could turn into a workable tool for policymakers at different spatial scales ranging from European, national to sub-national level.
- LUFs provide an integrated assessment of the economic, environmental and social aspects of the land used, providing a good basis for trade-off analysis between the different main land functions.
- The two environmental LUFs and their respective indicators are linked to non-marketed environmental services (e.g. “Status of quality of bathing water”, “natural leisure”) and help showing how areas contribute to the overall well-being of Europe. The potential link to policy targets, as shown in the project, can help to indicate how may such ecosystem services be at risk, and how can policies take these aspects into account considering the interaction with marketed goods and services.
- LUFs and the indicators used to build them can be used to estimate land use performance using different references. Firstly, LU performance when compared to specific policy targets. And secondly, LU performance of a specific region when compared to others (EU, national and sub-national level).
- The six LUFs identified in EU LUPA offer a consistent and broad basis to approach the complex concept of LU efficiency. For example, it allows identifying regions that may be very efficient in terms of agricultural production whereas inefficient in maintaining natural resources.
- The LUFs approach may help to approach a multi-level governance by identifying diverse patterns and trends, not only within each LUF category but among the full set of categories as well, on the basis of NUTS X data (and case studies?). The LUFs help to identify common issues (both concerning performance and efficiency) that support the finding of similar solutions. Therefore the LUFs approach is also useful as

a basis for pan-European dialogue, insofar as territories with the same LUFs profile are relatively more prone to develop cooperation.

- The LUFs approach demonstrates that the designation of territorial policies needs to be integrated, considering the heterogeneity and dynamics of, and trade-offs between, the economic, environmental and social profiles within each type of areas. At the same time, the LUFs categories can be a useful tool to deal with the individuality of territories, insofar as they make it possible to categorise states and processes in a consistent way across the European regions.
- The LUFs methodology has been consistently applied at NUTS 2/3 level, based on a shared set of indicators available at pan European level. Unfortunately some key indicators were not available for all regions or their quality did not suffice to be used. This lack of relevant indicators represents a major constrain in the implementation of the methodology, as it has been explained in the report and pleas for further work on gathering new data at higher spatial resolution by the appropriate European institutions (e.g. Eurostat, EEA, JRC). The methodology is flexible and can be applied at all spatial levels (European, national and sub-national).
- Relevant maps to be included: maps showing one or two LUFs, their performance and efficiency. It will be very advisable to produce LUFs maps for one of the case study areas, if data will be provided to Alterra. Spider diagrams for a couple of regions (hot-spots in terms of performance) showing the trade-offs among the six LUFs.

Regarding the implementation of the LUFs concept to the Land Use performance and LU efficiency can be concluded:

- Visualisation of the LU performance results with maps and spider diagrams brings complementary information. The maps show the spatial distribution of the calculated values and help to identify hot spots, however it is difficult to get the full picture (i.e. addition of all the LUFs and indicator maps) for one region. The spider diagrams provide this by visualising at once all the indicators or the LUFs for a single region, displaying their distance to the EU average. Being able to analyse simultaneously the spider diagrams of the indicators and the LUFs, also helps to understand the role that the indicators play in underpinning the values of the LUFs. The spider diagrams show as well the large differences between the NUTSx regions and highlight their main functional specificities.
- The approach to assess LU efficiency is in principle quite coarse. However it helps to show how relatively efficient works out multifunctionality in each region. For example, the land of a region can be used very efficiently to provide food, while at the same time being inefficient in providing housing and abiotic resources (e.g. some North provinces of the Netherlands). The LU efficiency approach also helps to find out the degree of current use regarding the maximum (e.g. provision of food and bioenergy) or the potential use (e.g. in provision of abiotic resources).

Annex 1: Description of selected indicators for the European assessment

Indicator	Definition	Source
Areas harvested - Total crop area	Harvested area includign ALL crops. Areas refer to the area under cultivation. Area under cultivation means the area that corresponds to the total sown area, but after the harvest it excludes ruined areas (e.g. due to natural disasters). If the same land parcel is used twice in the same year, the area of this parcel can be counted twice.	Eurostat (agr_r_crops) and national statistics
Landcover - Artificial non-agricultural vegetated areas	Class 14 of CLC	CLC v 15
Landcover - Forests and semi-natural areas	Class 3 of CLC	CLC v 15
Landcover - Green urban areas	Class 141 of CLC	CLC v 15
Gross domestic product (Purchasing Power Standard)	Gross Domestic Product at current market prices (Purchasing Power Standard)	Eurostat (nama_r_e3gdp)
Gross value added at basic prices - Agriculture and Fishing	Gross Value Added at Basic Prices: Agriculture and fishing	Eurostat (nama_r_e3vabp95)
Gross value added at basic prices - Total	Gross Value Added at Basic Prices: all NACE activities	Eurostat (nama_r_e3vabp95)
Landcover - Industry and Commercial areas	Class 121 of CLC	CLC v 15
Monuments and other tourist sights (index)	Monuments and other tourist sights valued 2 stars in TCI "green guides series". The final value is a weighted average of "stars" in TCI guidebook series in each NUTS area (assigning weight 3 to "conjuncts" and 1 to individual monuments and objects)	ESPON ATTREG
Multimodal potential accessibility	Potential accessibility describes how easy people in one region can reach people located in other regions. Within the accessibility model used by ESPON potential accessibility is based on two elements: (1) population in NUTS 3 regions and (2) the effort in time to reach them. The accessibility model measures the minimum travel time between all NUTS 3 regions for rail, road and air separately. For multimodal accessibility the accessibility by road, rail and air are integrated into one indicator expressing the combined effects of these modes for each NUTS 3 region. The potential accessibility of a NUTS 3 region is calculated by summing up the population in all other European regions, weighted by the travel time to go there. In order to avoid "edge" effects, European regions just outside the territory covered by ESPON are also included in this calculation, in particular Eastern European regions and the Western Balkan.	ESPON db (Air and Multimodal Accessibility)
Landcover - Natural leisure	Classes 331 +335 + 511 + 512 of CLC	CLC v 15
Navigable rivers and canals	Navigable rivers and canals	Eurostat
Net migration	Derived from LAU2 population development as collected for the ESPON GEOSPECS project database: "Change in LAU2-population from 2001 and 2006"	Eurostat, National statistical agencies, ESPON GEOSPECS project
NH3 emission	The NH3 emission in groundwater is calculated with the MITERRA-Europe model, a deterministic and static model, which calculates N, P and C budgets. Within CCAT, the model is expanded by including metal budgets as well. In case of N, the model also calculates N emissions and N leaching on an annual basis using N emission factors and N leaching fractions. MITERRA-Europe is based on the existing models GAINS and CAPRI, supplemented with an N cycle and leaching module, P and metal inputs and P and metal uptake. GAINS estimates current and future gaseous N and C emissions from agriculture (and other sectors) in Europe. CAPRI is an agricultural sector model at NUTS 2 level in the EU-27, with a global market model for agricultural products.	MITERRA model (ALTERRA)
Nights spent in tourist accomodations	Nights spent in tourist accomodations	Eurostat
N-surplus	The N-surplus in groundwater is calculated with the MITERRA-Europe model, a deterministic and static model, which calculates N, P and C budgets. Within CCAT, the model is expanded by including metal budgets as well. In case of N, the model also calculates N emissions and N leaching on an annual basis using N emission factors and N leaching fractions. MITERRA-Europe is based on the existing models GAINS and CAPRI, supplemented with an N cycle and leaching module, P and metal inputs and P and metal uptake. GAINS estimates current and future gaseous N and C emissions from agriculture (and other sectors) in Europe. CAPRI is an agricultural sector model at NUTS 2 level in the EU-27, with a global market model for agricultural products.	MITERRA model (ALTERRA)
Population density	Population density	
Pre-primary education	Pre-primary education is defined as the initial stage of organised instruction, designed primarily to introduce very young children to a school-type environment, that is, to provide a bridge between home and a school-based atmosphere.	Eurostat
Natural protected areas - CDDA and Natura2000	Protected areas includes nationally designated areas (CDDA) and Natura 2000 sites. When there is an overlap the area is only counted once.	CDDA, Natura2000
P-surplus	The P-surplus in groundwater is calculated with the MITERRA-Europe model, a deterministic and static model, which calculates N, P and C budgets. Within CCAT, the model is expanded by including metal budgets as well. In case of N, the model also calculates N emissions and N leaching on an annual basis using N emission factors and N leaching fractions. MITERRA-Europe is based on the existing models GAINS and CAPRI, supplemented with an N cycle and leaching module, P and metal inputs and P and metal uptake. GAINS estimates current and future gaseous N and C emissions from agriculture (and other sectors) in Europe. CAPRI is an agricultural sector model at NUTS 2 level in the EU-27, with a global market model for agricultural products.	MITERRA model (ALTERRA)
Status of coastal bathing water	Quality of coastal bathing waters is provided in four categories (from better to worst): <ul style="list-style-type: none"> CG - compliant with the mandatory and the guide values of the Water Framework Directive CI - compliant with the mandatory values of the Directive NC - not compliant with the mandatory values of the Directive B - banned or closed (temporarily or throughout the season) These categories were transformed in a numeric scale (5,4, 2,1 –to give more weight to good quality), and average computed for NUTS region.	WaterBase
Status of inland bathing water	Quality of inland bathing waters is provided in four categories (from better to worst): <ul style="list-style-type: none"> CG - compliant with the mandatory and the guide values of the Water Framework Directive CI - compliant with the mandatory values of the Directive NC - not compliant with the mandatory values of the Directive B - banned or closed (temporarily or throughout the season) These categories were transformed in a numeric scale (5,4, 2,1 –to give more weight to good quality), and average computed for NUTS region.	WaterBase
Unemployment rates (age >=15)	Unemployed persons are persons: aged 15-74 (in ES, SE (1995-2000), UK, IS and NO: 16-74), who were without work during the reference week, but currently available for work, who were either actively seeking work in the past four weeks or who had already found a job to start within the next three months.	Eurostat
Landcover - Urban fabric area	Class 11 of CLC	CLC v 15

Annex 2: Statistical correlations between indicators per LUF

 Correlation ≤ 0.8
 Rejected indicator

LUF 1	Indicator 0: Multimodal potential accessibility	Indicator 4: Pre-primary education	Indicator 8: Gross value added at basic prices - total	Indicator 10: Industry and commercial areas	Indicator 14: Net. Migration	Indicator 15: Nights spent in tourist accommodations	Indicator 17: Population density	Indicator 18: Natural protected areas - CDDA and Natura2000	Indicator 21: Number of tourist sights	Indicator 22: Unemployment rates > 14 years old
0	1	0.37	0.56	0.5	0.17	0.19	0.41	0.07	0.19	0.34
4	0	1	0.28	0.59	0.03	0.84	0.94	0.04	0.13	0.95
8	0	0	1	0.32	0.01	0.21	0.25	0.05	0.15	0.29
10	0	0	0	1	0.03	0.21	0.87	0.05	0.07	0.64
14	0	0	0	0	1	0.13	0.04	0.04	0.04	0.01
15	0	0	0	0	0	1	0.52	0.04	0.15	0.78
17	0	0	0	0	0	0	1	0.05	0.04	0.91
18	0	0	0	0	0	0	0	1	0.04	0.04
21	0	0	0	0	0	0	0	0	1	0.11
22	0	0	0	0	0	0	0	0	0	1

LUF 2	Indicator 0: Multimodal potential accessibility	Indicator 3: Status of bathing water	Indicator 5: Forests and semi-natural areas	Indicator 8: Gross value added at basic prices - total	Indicator 9: Green urban areas	Indicator 11: Natural leisure	Indicator 13: Navigable rivers and canals	Indicator 15: Nights spent in tourist accommodations	Indicator 18: Natural protected areas - CDDA and Natura2000	Indicator 20: Artificial leisure areas	Indicator 21: Number of tourist sights
0	1	0.07	0.36	0.56	0.43	0.09	0.32	0.19	0.07	0.46	0.19
3	0	1	0.18	0.1	0.09	0.09	0.01	0.02	0.07	0	0.06
5	0	0	1	0.07	0.28	0.23	0.23	0.08	0.15	0.38	0.01
8	0	0	0	1	0.34	0.13	0.2	0.21	0.05	0.41	0.15
9	0	0	0	0	1	0.03	0.13	0.52	0.03	0.63	0.08
11	0	0	0	0	0	1	0.37	0	0.07	0.02	0.05
13	0	0	0	0	0	0	1	0.03	0.04	0.23	0.03
15	0	0	0	0	0	0	0	1	0.04	0.22	0.15
18	0	0	0	0	0	0	0	0	1	0.05	0.04
20	0	0	0	0	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	1

LUF 3	Indicator 1: Harvested agricultural areas	Indicator 2: Landcover - Artificial non-agricultural vegetated areas (0/000)	Indicator 5: Forests and semi-natural areas	Indicator 7: Gross value added at basic prices - agriculture and fisheries	Indicator 9: Green urban areas	Indicator 10: Industry and commercial areas	Indicator 16: N-surplus	Indicator 18: Natural protected areas - CDDA and Natura2000	Indicator 19: P-surplus
1	1	0.13	0.53	0.01	0.17	0.13	0.06	0.13	0.06
2	0	1	0.36	0.29	0.92	0.81	0.1	0.05	0
5	0	0	1	0.14	0.28	0.35	0.37	0.15	0.14
7	0	0	0	1	0.25	0.33	0.03	0.06	0.15
9	0	0	0	0	1	0.79	0.01	0.03	0.06
10	0	0	0	0	0	1	0.09	0.05	0.01
16	0	0	0	0	0	0	1	0.03	0.84
18	0	0	0	0	0	0	0	1	0.02
19	0	0	0	0	0	0	0	0	1

LUF 4	Indicator 0: Multimodal potential accessibility	Indicator 4: Pre-primary education	Indicator 6: Gross domestic product (PPS)	Indicator 10: Industry and commercial areas	Indicator 14: Net. Migration	Indicator 15: Nights spent in tourist accommodations	Indicator 17: Population density	Indicator 18: Natural protected areas - CDDA and Natura2000	Indicator 23: Build up areas
0	1	0.37	0.4	0.5	0.17	0.19	0.41	0.07	0.57
4	0	1	0.24	0.59	0.03	0.84	0.94	0.04	0.71
6	0	0	1	0.33	0.01	0.17	0.24	0.02	0.32
10	0	0	0	1	0.03	0.21	0.87	0.05	0.86
14	0	0	0	0	1	0.13	0.04	0.04	0.04
15	0	0	0	0	0	1	0.52	0.04	0.38
17	0	0	0	0	0	0	1	0.05	0.91
18	0	0	0	0	0	0	0	1	0.07
23	0	0	0	0	0	0	0	0	1

LUF 5	Indicator 1: Harvested agricultural areas	Indicator 3: Status of bathing water	Indicator 5: Forests and semi-natural areas	Indicator 12: NH3 emission (kg N/ha)	Indicator 13: Navigable rivers and canals	Indicator 16: N-surplus	Indicator 17: Population density	Indicator 18: Natural protected areas - CDDA and Natura2000	Indicator 19: P-surplus
1	1	0.11	0.53	0.08	0.08	0.06	0.15	0.13	0.06
3	0	1	0.18	0.19	0.01	0.15	0.03	0.07	0.06
5	0	0	1	0.29	0.23	0.37	0.26	0.15	0.14
12	0	0	0	1	0.28	0.83	0.01	0.03	0.79
13	0	0	0	0	1	0.49	0.23	0.04	0.27
16	0	0	0	0	0	1	0.07	0.03	0.84
17	0	0	0	0	0	0	1	0.05	0
18	0	0	0	0	0	0	0	1	0.02
19	0	0	0	0	0	0	0	0	1

Annex 3: The indicators and their contributions to the six Land use Functions

Table a: Impact indicators contributing to LUF 1 *Provision of work*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
Value added per sector (80/ESTAT)	ECO8.1	1	Medium positive link: positive returns on investments;	High
GDP ppp (1/ESTAT)	ECO11.1	2	Strong positive link: high growth rate of real GDP purchasing power parties per inhabitant are beneficial to the economy and to the society and means better preconditions to strengthen potentials in all economic and social LUFs;	High
Unemployment rate (125 ESTAT)	SOC1.1	-2	Strong negative link: increase in unemployment rate means more tensions in labour markets and more problematic access to employment opportunities;	High
Net migration (137/ESTAT)	SOC9.1	2	Strong positive link: positive migration balance means attractiveness for workers;	High
Agricultural area within protected areas ¹	SOC11.1	+1	Medium positive link: increase in agricultural area within protected areas means more jobs in the agricultural sector;	High
Soil sealing (CLC or HRSS layers)	ENV3.2	1	Medium positive link: Soil sealing occurs as a result of construction, which means provision of work in the construction sector. BE AWARE IN REGIONS WITH HIGH AGRICULTURAL AREA BECAUSE RURAL MIGRATION TO CITIES TO WORK IN THE CONSTRUCTION? Decrease in employment in agriculture due to increase in SS?.	Medium
Nights spent (Total/ 103 ESTAT)		2	Strong positive link: high number of nights means more jobs in the area;	High
Transport networks (105/ESTAT or ESPON accessibility indicator)		2	Strong positive link: higher accessibility means more jobs in the area;	High
Services of general interest (hospitals, schools, universities)		1	Medium positive link: higher nr of SIG means more jobs in the area; it could be also for people living there but not working;	High

Gross expenditure on research and development (GERD)(88/ESTAT)		1	Medium positive link: higher investments resulting in more direct jobs and spin-off;	
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¹Perhaps ESTAT/55 'Agricultural areas in less favoured areas'

Table b: Impact indicators contributing to LUF 2 *Provision of leisure activities*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
Value added per sector (80/ESTAT)	ECO8.1	1	Medium positive link: positive returns on investments;	High
GDP ppp (1/ESTAT)	ECO11.1	1	Medium positive link: high growth rate of real GDP per capita means that more money is available for leisure; however, it also often means more congestion (bad for recreation);	High
Green areas	SOC11.1	+2	High positive link: increase in green areas means more areas for leisure;	High
Cultural heritage sites (UNESCO)		+2	High positive link: increase in green areas means more areas for leisure;	High
Cultural (cinemas, theaters, pubs, restaurants, SERGENI)		+2	High positive link: increase in green areas means more areas for leisure;	High
Nights spent (Total/ 103 ESTAT)		2	Strong positive link: high number of nights means more jobs in the area;	High
Livestock density (57)		-2	Strong negative link: high intensity of agriculture means less attractiveness for recreation;	High
Transport networks (105/ESTAT or ESPON accessibility indicator)		2	Strong positive link: higher accessibility has a positive impact on leisure;	High
Forest fire risks (ESPON)	ENV9.1	-1	Medium negative link: if the risk is high, it has a negative impact on landscape recreational amenities. Potential risk of death and respiratory problems.	High

Table c: M2 indicators contributing to LUF 3 *Food and energy production*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
Value added per sector (agriculture) (ESTAT/80)	ECO8.1	2	Strong positive link: increase in value added in agriculture means better valuation of agriculture potentials, in link with more efficiency and competitiveness of the sector;	high
Value added per sector (energy) (ESTAT/80)	ECO8.1	1	Medium positive link: increase means potentials in land based renewable energy sources are more valued;	Medium (since modelled at country level)
Renewable energy (ask Berien)				
Agriculture accounts (ESTAT 56)		2	High positive link: the higher the subsidies, the higher the stimulus for farmers to increase the use of land;	High
Unemployment rate	SOC 1.1	-1	Medium negative link as in countries with a high level of employment in the primary sector (say >= 10%) when unemployment increases the impact will fall mostly on agriculture and other sectors with land-based production;	high
Soil sealing	ENV3.2	-2	In case of good quality agricultural soils, the sealing (covering the soil with concrete, urbanisation) results to rapid decrease of soil availability and thus reduces its production potential;	high
Nitrogen and P input (ask Jan-Peter Lesschen)	ENV 6.6	2	Medium positive link. Increased use of N and P generally increases yields;	High
Area harvested (ESTAT/58)		2	High positive link: the higher the subsidies, the higher the area harvested, the higher the potential agricultural production;	High
Forest fire risk (ESPON natural hazards)	ENV 9.1	-2	Forest fires strongly affect economic functions of forests such as production of timber and non timber forest products.	high

Table d: M2 indicators contributing to LUF 4 *Housing and transport and energy infrastructure*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
Value added per sector	ECO8.1	1	Medium positive link: positive returns on investments;	High
GDP	ECO11.1	2	Strong positive link: high growth rate of real GDP per capita are beneficial to the economy and to the society and means better preconditions to strenghten potentials in all economic and social LUFs;	high
Unemployment rate	SOC1.1	-1	Strong negative link: increase in unemployment rate has a negative impact on households income and consumer demand;	high
Net migration	SOC9.1	1	Medium positive link;	Medium
Green areas within or close to residential zones	SOC11.1	1	Proximity to green areas has weak link to residential and no link to non-land based production function. In regions where the green areas are proxime, residential areas and services have higher value on the market;	Low
Soil sealing	ENV 3.2	2	One of the definitions of soil sealing is a covering (sealing) the soil trough building or construction work, it means the urban expansion and increase of space where residential, social and productive human activities could take place;	high
Household with broadband access (ESTAT 133)		2	Strong positive link;	
Services of general interest (hospitals, schools, universities)		1	Strong positive link: higher nr of SIG means more jobs in the area; it could be also for people living there but not working;	High
Gross expenditure on research and development (GERD)(88/ESTAT)		1	Medium positive link: higher investments resulting in more direct jobs and spin-off.	

Table g: M2 indicators contributing to LUF 5 *Provision of abiotic resources*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
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GDP	ECO11.1	1	Strong positive link: high growth rate of real GDP per capita is beneficial to the economy and to the society with positive externalities for the environment;	high
NH3	ENV1.1	-2	Ammonia emissions affect negatively the quality of air, water and soil. Ammonia is a secondary particulate precursor affecting air quality. It can cause plant damage. In addition, deposition of nitrogen compounds from NH3 emissions can lead to increased concentrations of nitrate in ground and drinking water due to nitrate leaching. Finally, ammonia emissions increase the N deposition and can lead to eutrophication and acidification of soils (EEA 2001; Velthof et al. 2007);	High
NOx	ENV1.2	-2	Contributes directly to eutrophication of semi-natural habitats, together with NH3 emissions, and therefore loss in biodiversity and quality of habitats. Indirect effects include subsequent impacts on acidity and eutrophication of freshwaters through leach;	High
N/P surplus	ENV 2.1	-1	Could have negative impact on quality of water resources;	
Soil sealing	ENV 3.2	-2	In case of good quality agricultural soils, the sealing (covering the soil with concrete, urbanisation) results to rapid decrease of soil availability. Same implies also to availability of some raw materials. In some cases, the change of surface and ground water cycle as well as pollution connected with the ongoing urbanisation may result to decrease of water quality and availability;	high
Transport networks (105/ESTAT or ESPON accessibility indicator)		-2	Strong negative link: higher accessibility means more air/water pollution;	High
Pesticide use	ENV 6.6	-1	Direct negative link: pesticides impact on quality of water resources;	High
Forest fire risk	ENV 9.1	-1	Forest fires could affect non production functions of forest (maintenance of water circulation, erosion prevention, desertification mitigation, microclimate maintenance, etc.) and decrease the availability of quality water, soil or air;	high
Area harvested (ESTAT/58)		-2	High negative link: the higher the subsidies, the higher the area harvested, the higher the potential agricultural production and risk for pollution.	High

Table h: M2 indicators contributing to LUF 6 *Provision of biotic resources*

Indicator	Impact issue	Score	Justification for score	Confidence of expertise
GDP	ECO11.1	2	Strong positive link: high growth rate of real GDP per capita is beneficial to the economy and to the society with positive externalities for the environment;	high
NH3	ENV1.1	-2	Ammonia emissions increase the N atmospheric deposition, which causes nitrogen enrichment (eutrophication) of soil and surface waters, which in turn can lead to excessive algal blooms in coastal waters and a decrease in faunal and floristic species diversity in natural areas (EEA 2001, Velthof et al. 2007);	High
NOx	ENV1.2	-2	Contributes directly to eutrophication of semi-natural habitats, together with NH3 emissions, and therefore loss in biodiversity and quality of habitats. Indirect effects include subsequent impacts on acidity and eutrophication of freshwaters through leach;	High
N/P surplus	ENV 2.1	-1	Negative impact on water quality with;	
Soil sealing	ENV 3.2	-2	The increment of built up areas and transport infrastructures causes fragmentation of habitats and disruption of migration corridors for wildlife species;	high
Transport networks (105/ESTAT or ESPON accessibility indicator)		-2	Strong negative link: higher accessibility means more disturbance in the area;	High
Pesticide use	ENV 6.6	-2	Strong negative impact on biodiversity;	High
Forest fire risk	ENV 9.1	-2	Fires can lead to the fragmentation of forest habitats important for species. (note. This is not the case of natural fires, which are one of the elements of ecosystem regeneration).	medium

1 fragmentation: Is there an indicator available?

Appendix 4: Examples of Rule bases and scientific justification for deriving Regional Importance Scores (weight 3)

2.1 Environmental indicators

ENV NOx emissions

Nitrogen dioxide (NOx) can have impacts on human health (e.g. respiratory problems) (Kampa & Castanas, 2006), can damage buildings via acid rain (Butlin, 1990), and is one source of atmospheric nitrogen (the other major source is ammonia) which when deposited can lead to eutrophication of natural habitats, and nitrate leaching into waterways (Achermann & Bobbink, 2003; Bobbink *et al.*, 1998). Thus its importance was calculated based on a combination of population density in a cluster (for human health and impacts on the built environment) and the proportion of habitats potentially sensitive to eutrophication and acidification – which was taken to include all land protected under NATURA2000 designation (or similar data from CORINE Biotopes for those countries for which NATURA2000 data were not available). Population density was obtained from the description of cluster regions (Annexe 1), taken as the upper limit of the range in which the median population density occurred (median of the distribution of values for all NUTSx regions in that cluster). The proportion of land under NATURA2000 or similar designation was also calculated per Cluster region (Table 3.x). The basic rules for attributing a score in relation to these two descriptors were as follows:

- Impact on urban areas, based on Population density (Pop Dens):
IF Pop Dens < 50 THEN score 1 (*predominantly rural*)
IF Pop Dens 50 < x < 100 THEN score 2
IF Pop Dens > 100, score 3 (*large centres of population, or highly urbanised areas*)
- Impact on natural habitats, based on Proportion of protected land area (Prot Area):
IF Prot Area < 0.35 THEN score 1 (*25%ile*)
IF Prot Area 0.35 < x < 1.75 THEN score 2
IF Prot Area > 1.75 THEN score 3 (*75%ile*)

Most clusters have reasonably high population density somewhere within the region where NOx effects may occur, and all clusters will have some measure of sensitive natural habitats that should be protected from eutrophication. Therefore, these two scores were combined with a simple rule base to achieve a final score which is intended to highlight the importance of NOx in all regions except those which have very few centres of population and have very little habitat in need of protection from eutrophication. All scores are shown in Table 10 below. The rule base for calculating the final importance for NOx in each cluster was as follows:

- If scores sum to 2, score 1
- If scores sum to 3, score 2
- If scores sum to 4 or more, score 3

Table 16 Descriptors of cluster regions used to assess the importance of NOx in the cluster regions

CR	Cluster Region name	Median population density	% of protected land area	Population density score	Protected area score	FINAL REGIONAL IMPORTANCE SCORE (NOx emissions)
1	Scandinavian mountains and valleys	10	0.07	1	1	1
2	Scandinavian Shield	10	0.39	1	2	2
3	Eastern Baltic Plains	39	1.98	1	3	3
4	Central Baltic Plains	19	1.30	1	2	2
5	South-East Baltic	79	2.28	2	3	3
6	Alpine Mountains and Valleys	149	0.11	3	1	3
7	North-West Atlantic	149	0.98	3	2	3
8	West Baltic/North Sea North-Eastern	299	0.30	3	1	3
9	Lowlands/Southern Baltic	149	0.22	3	1	3
10	North Sea Plains	299	1.95	3	3	3
11	Balkan Plains	79	3.46	2	3	3
12	Central Continental Lowlands	149	0.75	3	2	3
13	South Continental	79	1.74	2	2	3
14	Atlantic Plains	79	1.71	2	2	3
15	Central Atlantic Plains/Hills	299	0.26	3	1	3
16	Central Atlantic Hills	79	0.47	2	2	3
17	Central Atlantic Hills/Plains	79	0.28	2	1	2
18	Central Atlantic Lowlands Northern Mediterranean	599	0.60	3	2	3
19	Coastal/Hinterland	149	0.38	3	2	3
20	Central Pannonian Plains	79	3.45	2	3	3
21	East Pannonian Plains	79	1.67	2	2	3
22	North Pyrenean Margin	79	0.45	2	2	3
23	Atlantic Lusitanian Coast	149	0.33	3	1	3
24	West Mediterranean	149	0.52	3	2	3
25	Core Mediterranean	39	0.68	1	2	2
26	South-East Mediterranean	39	1.52	1	2	2

27	West Mediterranean Islands	Iberia and	79	2.01	2	3	3
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Impact issue: Water quality

2.2 Socio-economic indicators

Related to employment

Preliminary remarks

The methodology implemented in this document has been developed on the basis of the information written in the report *'The detailed description of cluster regions'* (Annexe 1). This information provided us with essential data to implement our process and finalise the framework. However, the range of socio-economic indicators and the spatial level at which these indicators were described forced us to make some simplifications both in terms of the decision rules applied and of the spatial level at which the assessment was carried out. This last point is particularly important because cluster regions are characterized by a high level of heterogeneity with regard to socio-economic indicators (Annexe 1). Our rationale is based on the recognition of two different kinds of indicators: general indicators and specific ones.

General indicators

ECO6.1; ECO11.1; SOC1.1; SOC 3.1 and SOC 3. 2

They cover socio-economic contextual characteristics of the cluster regions that can favour (or hinder) the performances of the LUFs. Thus, they help examining the overall potentials of the LUFs based on the assumption that good economic and social conditions mean high potentials in terms of LUFs. General indicators are considered relevant for all the clusters and a score 2 is automatically assigned to general indicators in all the clusters.

Specific indicators

ECO8.1a and ECO8.1b

They assess the performances of the LUFs with regard to particular aspects which importance for each cluster has to be assessed. In order to identify the importance of the indicators in the 27 cluster regions we made use of a two-step assessment that starts with general indicators and then evaluates specific indicators. Consistently with what we have assumed, general indicators are considered relevant for all the clusters. Thus, score 2 was assigned to general indicators in all the clusters. Then, in those clusters where the level of the general indicator does not pass the threshold, as defined in table 10 of the Deliverable 3.2.2b (socio-economic aspects), we moved to examine specific indicators which may reveal *'hidden'* problems. Otherwise, when the indicator passes the threshold we did not evaluate the importance of the specific indicators because a negative general assessment cannot be compensated by a positive assessment referred to particular aspects.

In order to assess the importance of specific indicators in cluster regions, it was assumed that they would be relevant when the sector they refer to is important for the economic structure of the cluster. This importance was evaluated with the following descriptors of cluster regions:

- The degree of relevance of the agricultural sector was assessed by using the proportion of arable cover in the cluster region;
- The degree of relevance of the energy sector was assessed by using GDP per capita, assuming the existence of a positive link between GDP and energy demand.

The Descriptor '*arable land*' was available in absolute terms. Thus, in order to identify decision rules, the statistical distribution of this descriptor was analysed and the criteria for the selection of the regions where agriculture is important sectors were defined with regard to the quartiles values. The importance of the sector was considered to be 0 when descriptor value was less than the first quartile, to be 1 when the descriptor value was comprised between the first and third quartile and to be 2 when the descriptor value was above the third quartile. The cut off values for each descriptor are presented below:

- Importance of the agriculture sector:

IF arable cover <13 THEN A = 0

IF 13 < arable cover < 38 THEN A = 1

IF arable cover > 38 THEN A = 2

As for the descriptor GDP per capita, rules for deciding on the importance of the indicator were as follows:

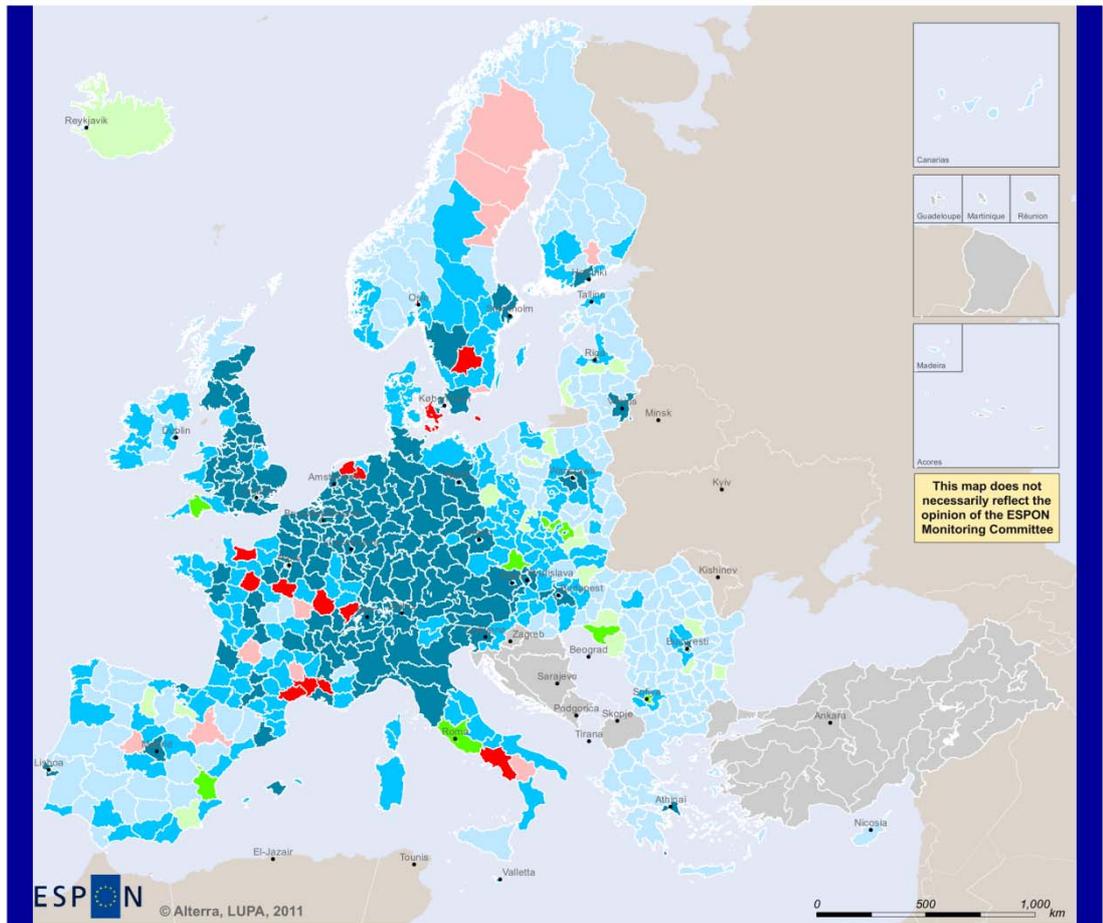
- Importance of energy sector:

IF % area of cluster is in class 'below 16000 \$PPP per capita' < 50 THEN A = 0

IF % area of cluster is in class 'over 20000 \$PPP per capita' > 50 THEN A = 0

ELSE A = 1

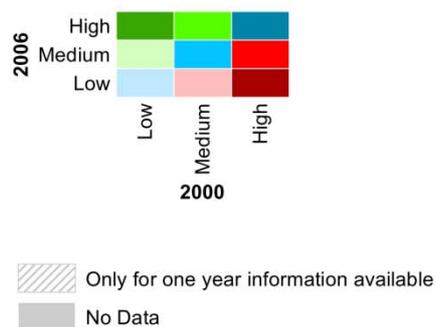
Annex 5: Indicator maps for the European assessment

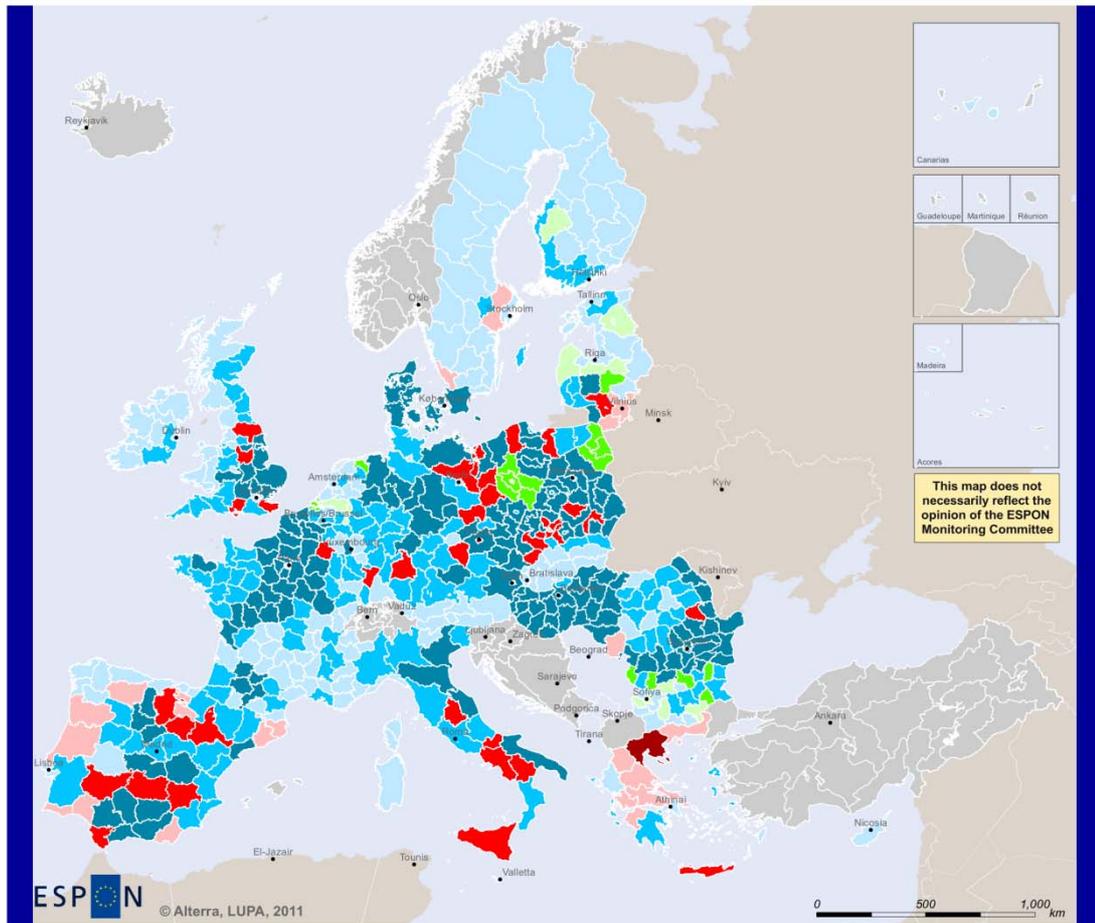


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Indicator 0: Multimodal potential accessibility (2006)

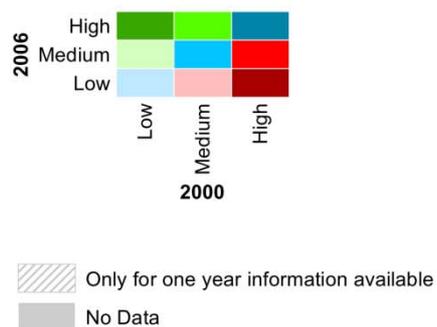


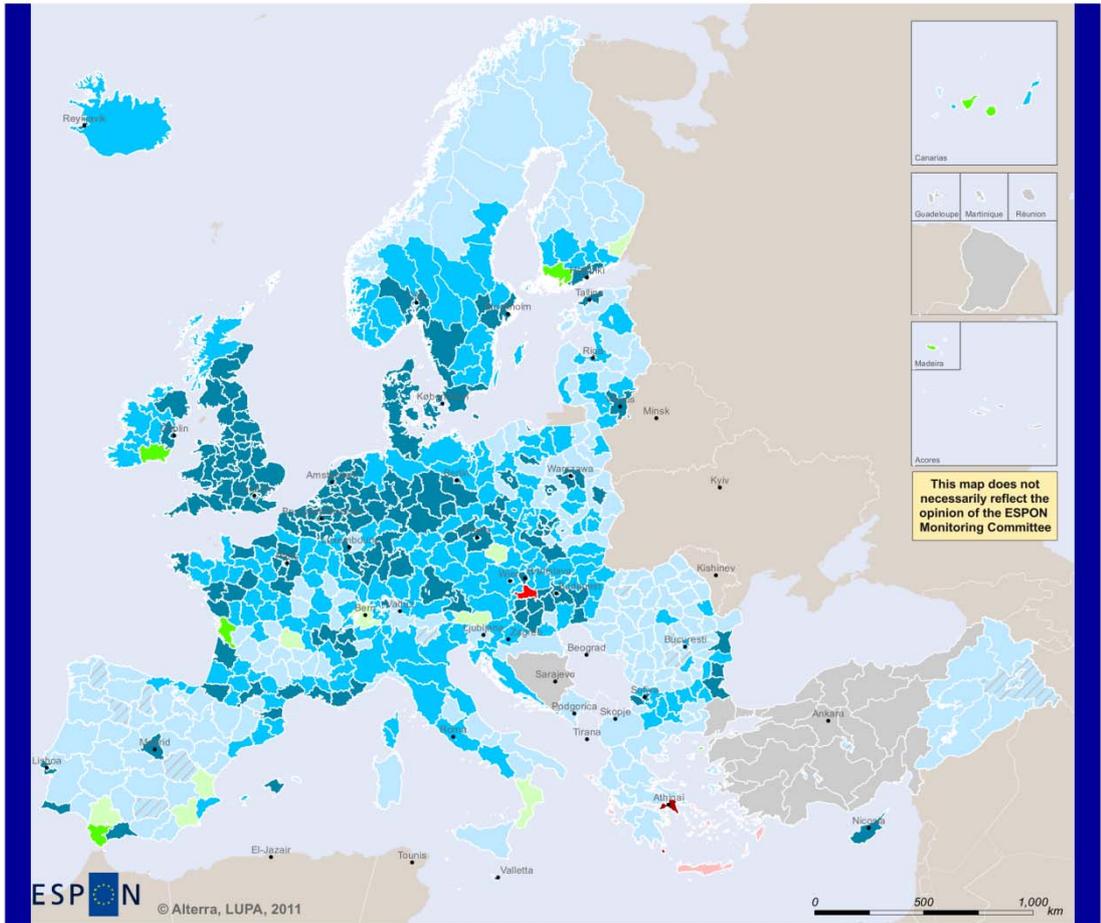


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Indicator 1: Harvested agricultural areas (2006)

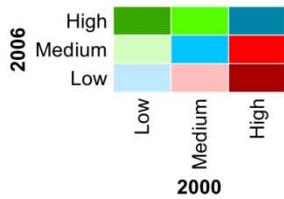




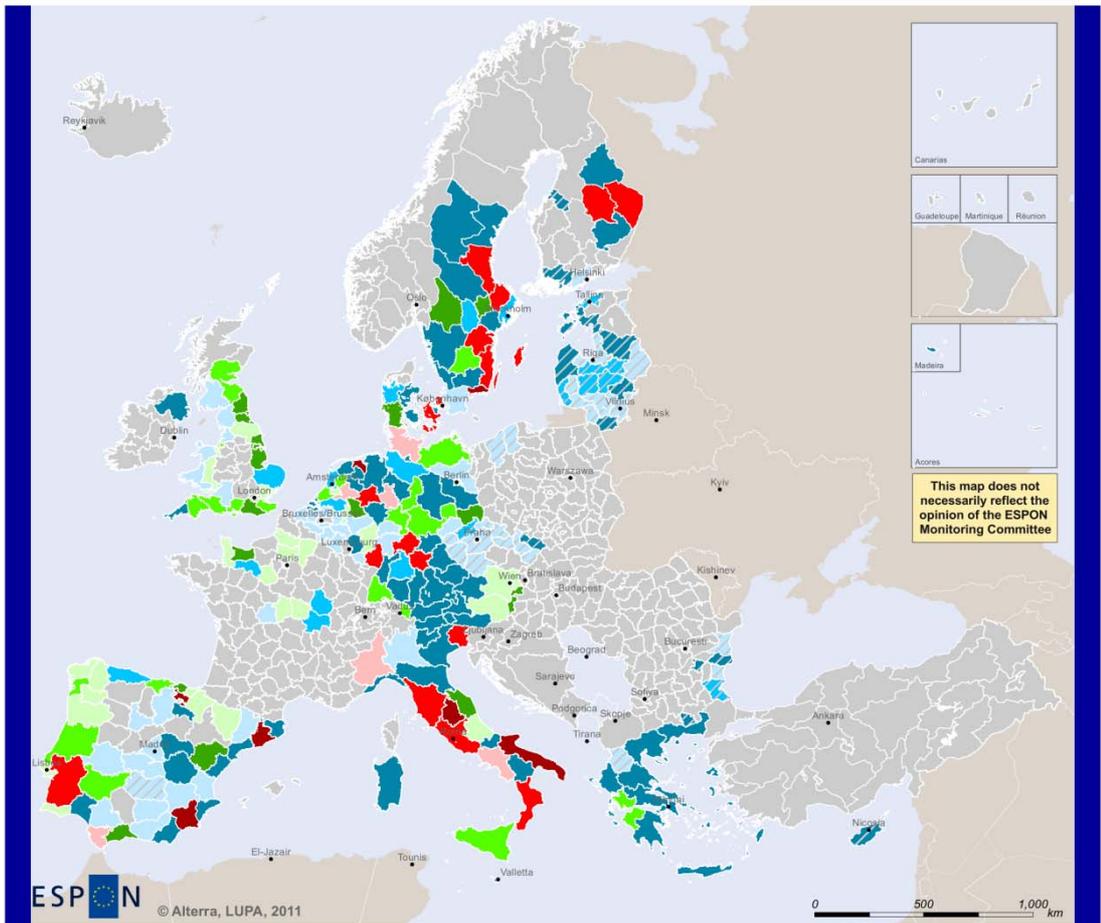
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Indicator 2: Landcover - Artificial non-agricultural vegetated areas (0/000) (2006)



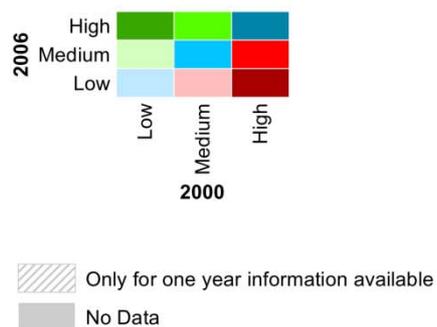
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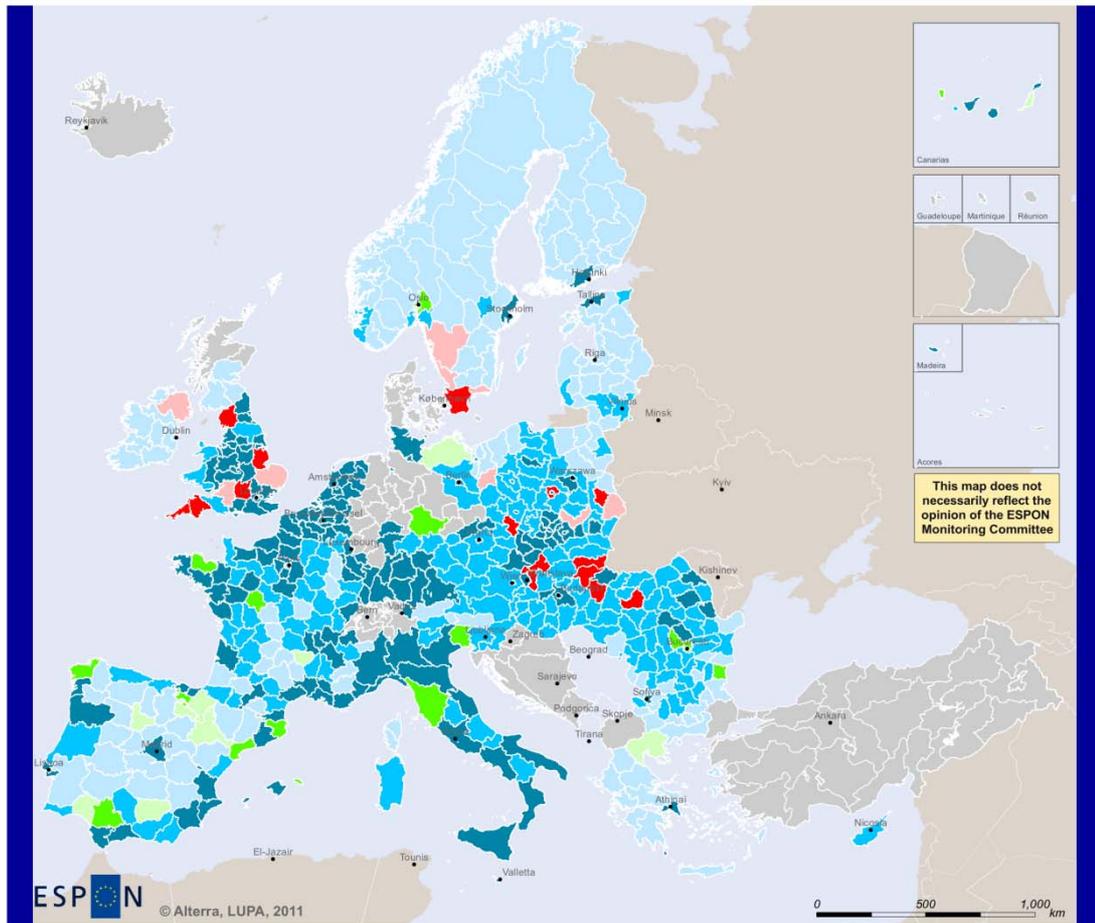


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Indicator 3: Status of bathing water (2006)

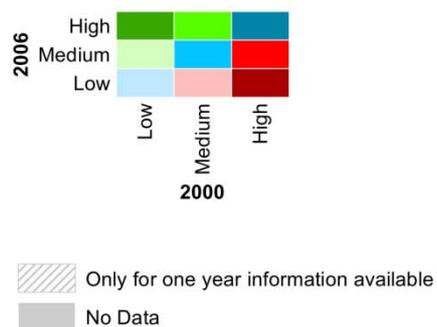


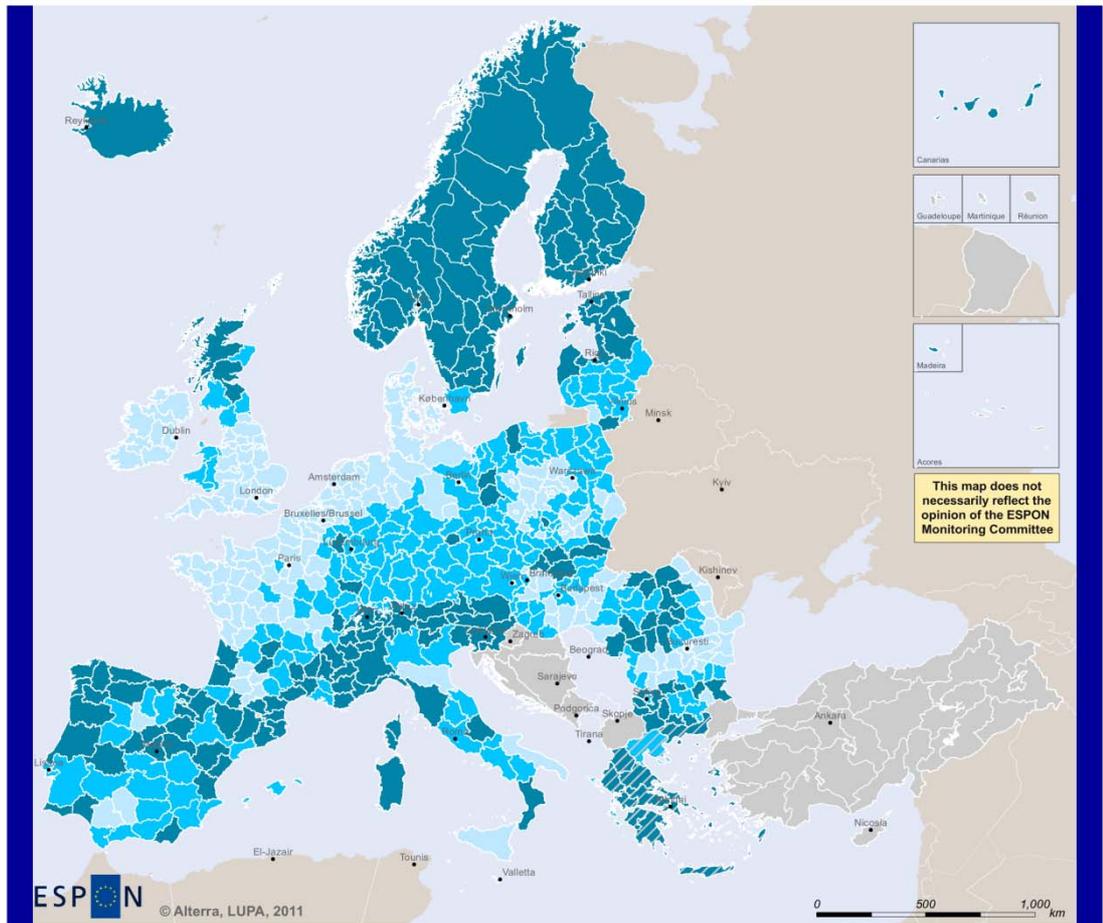


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Indicator 4: Pre-primary education (2006)

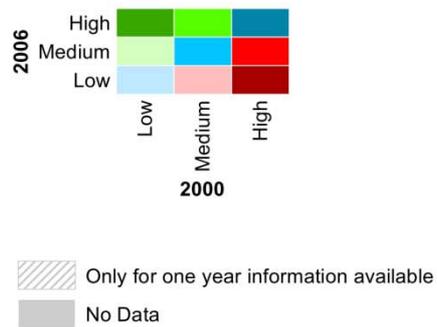


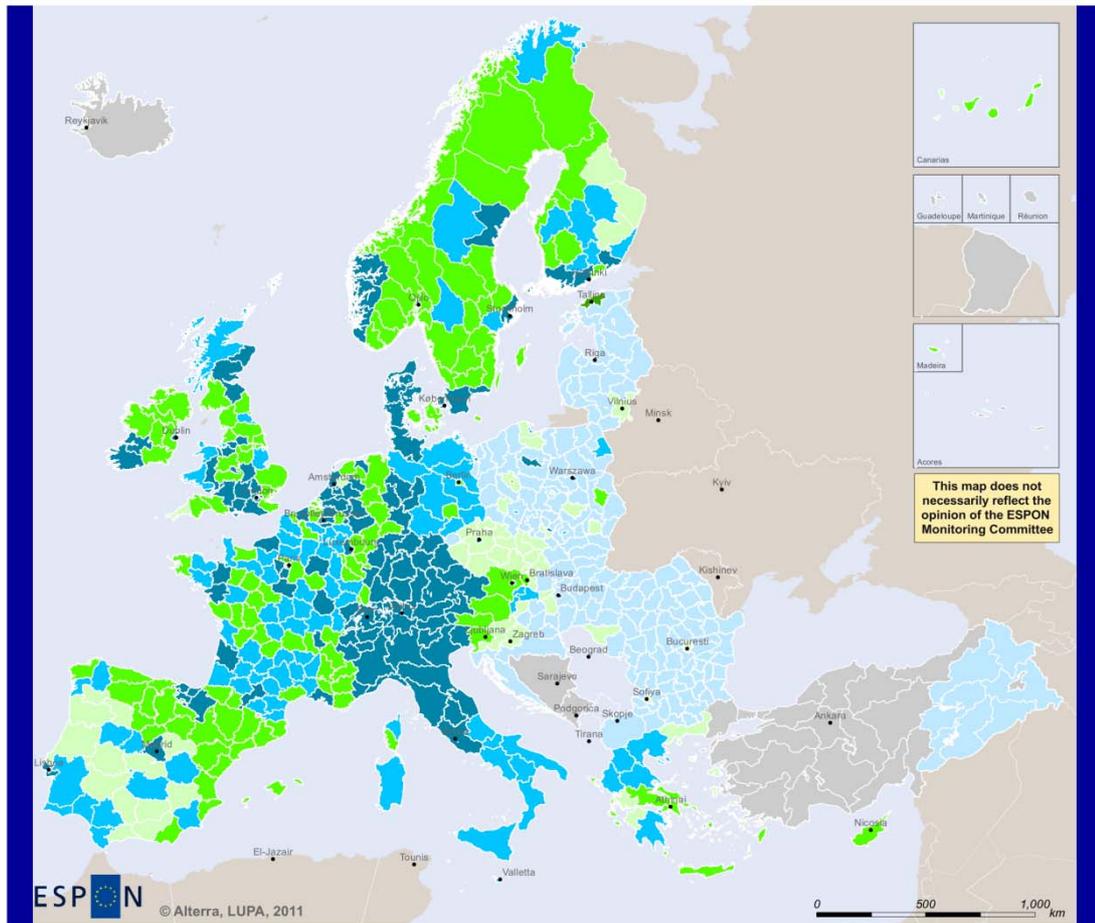


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Indicator 5: Forests and semi-natural areas (2006)

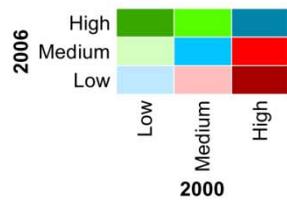




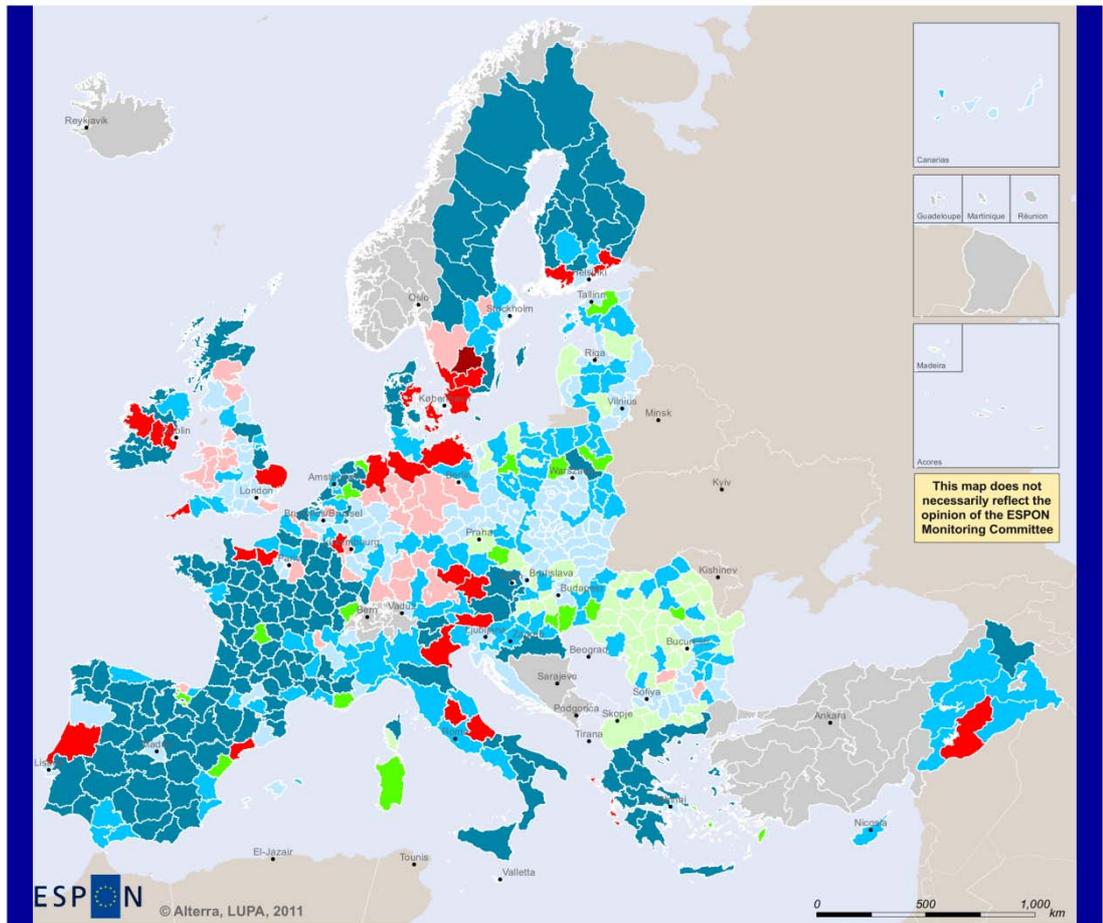
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Indicator 6: Gross domestic product (PPS) (2006)



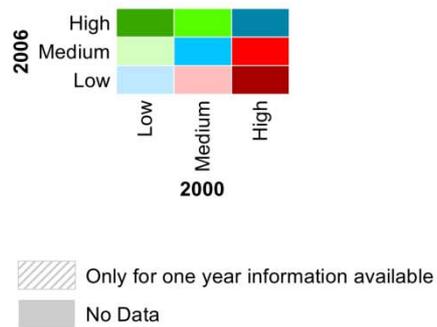
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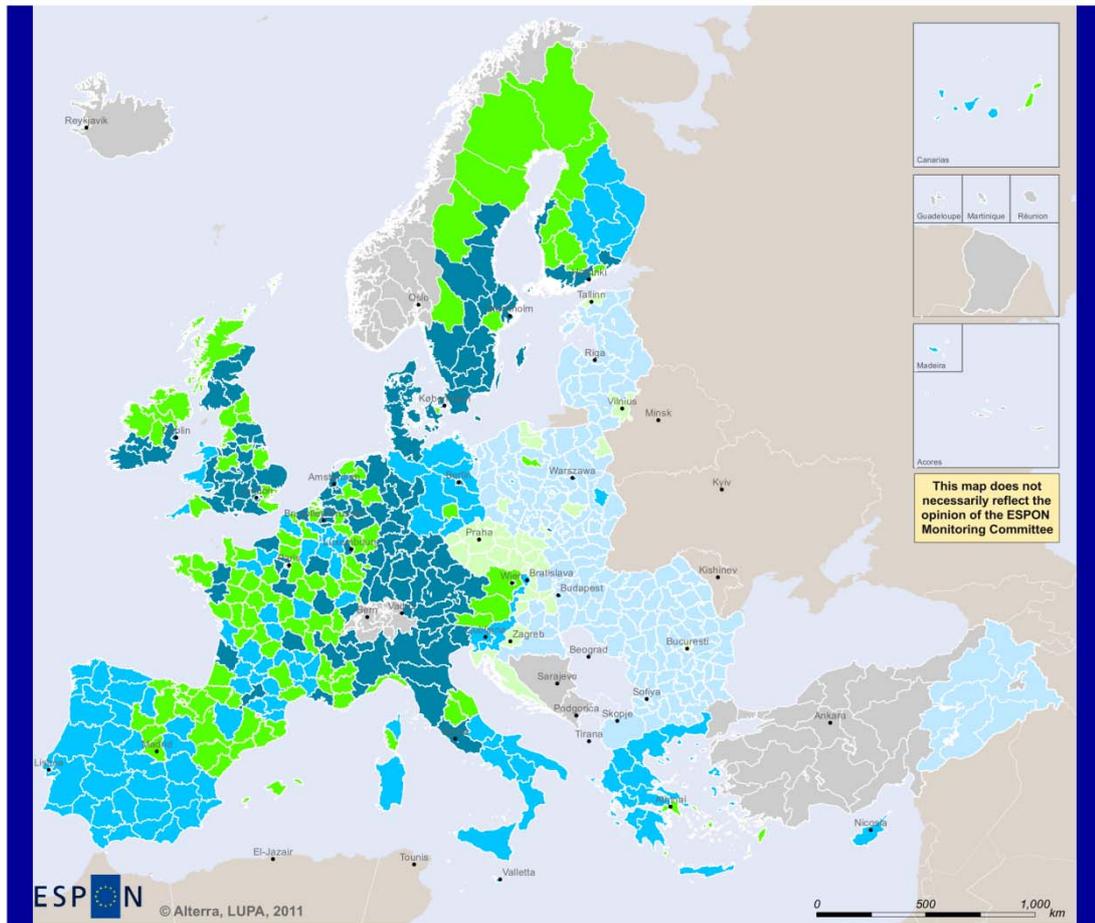


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Indicator 7: Gross value added at basic prices - agriculture and fisheries (2006)

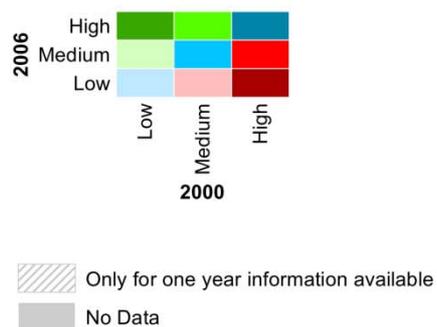


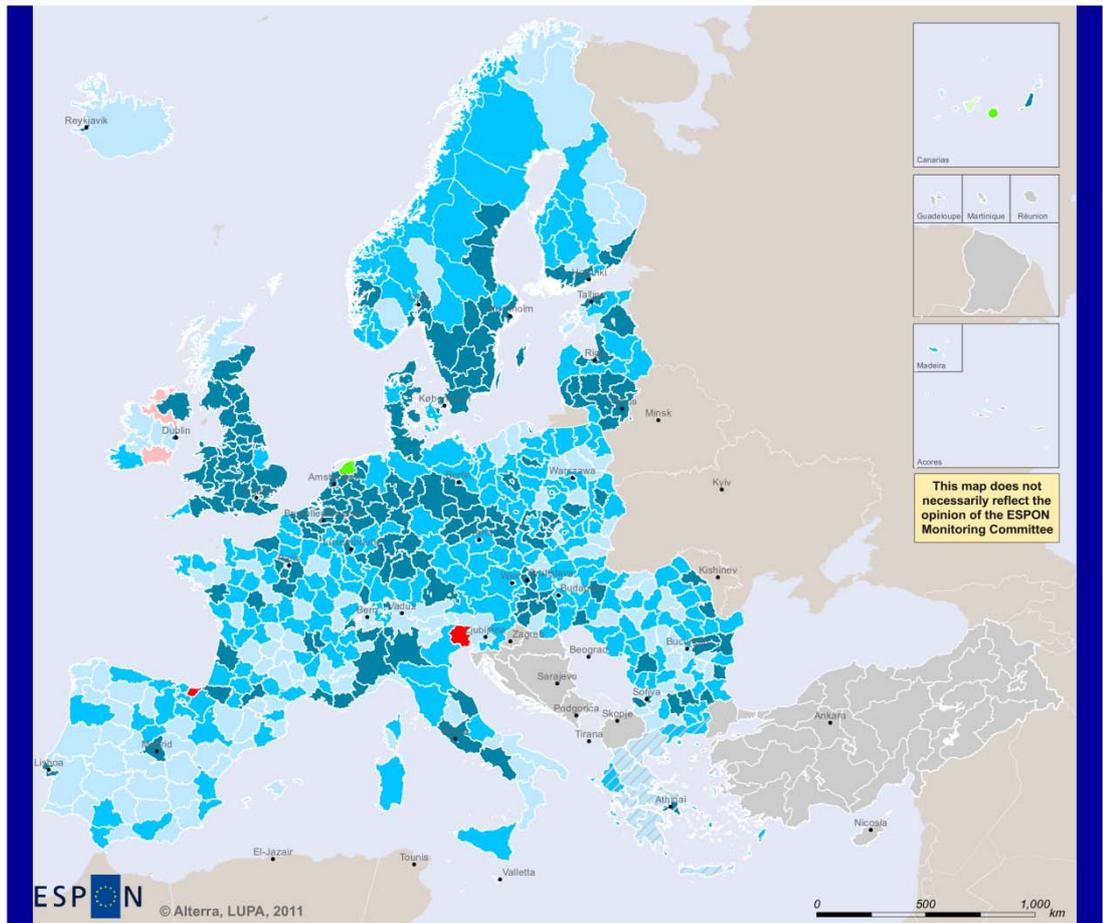


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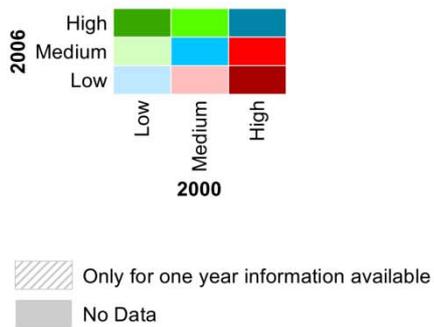
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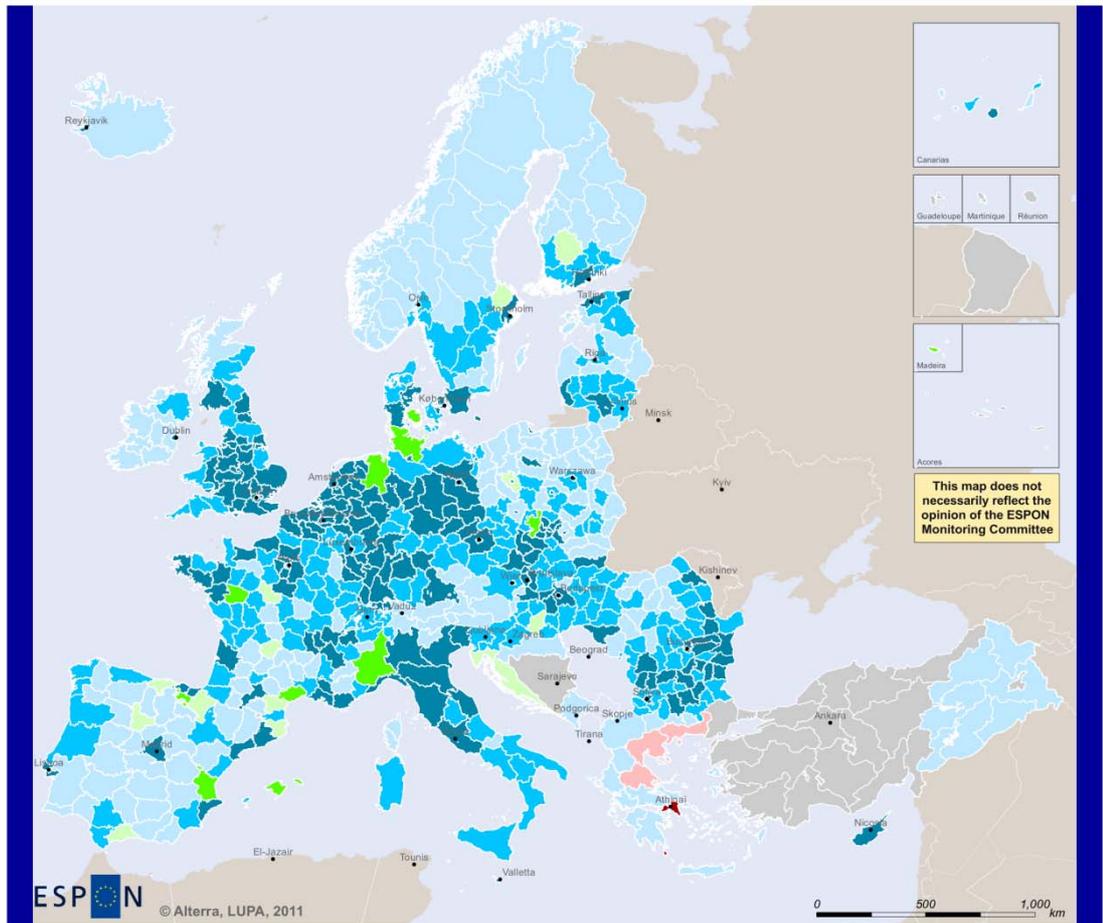
Indicator 8: Gross value added at basic prices - total (2006)





Indicator 9: Green urban areas (2006)

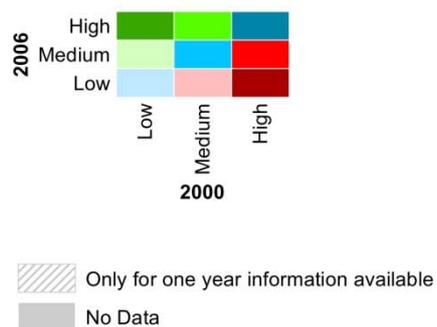


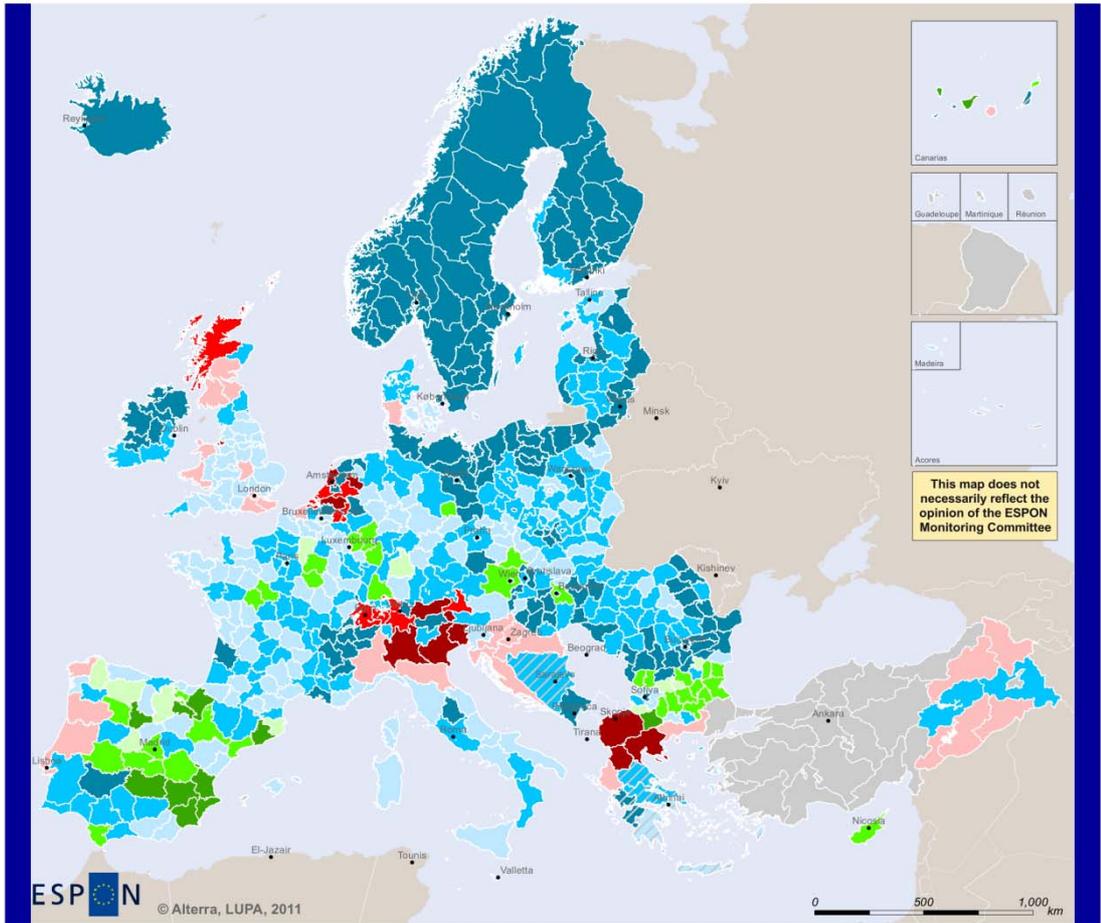


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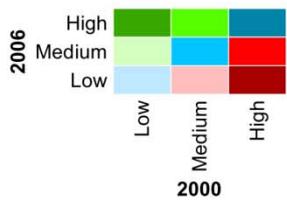
Indicator 10: Industry and commercial areas (2006)



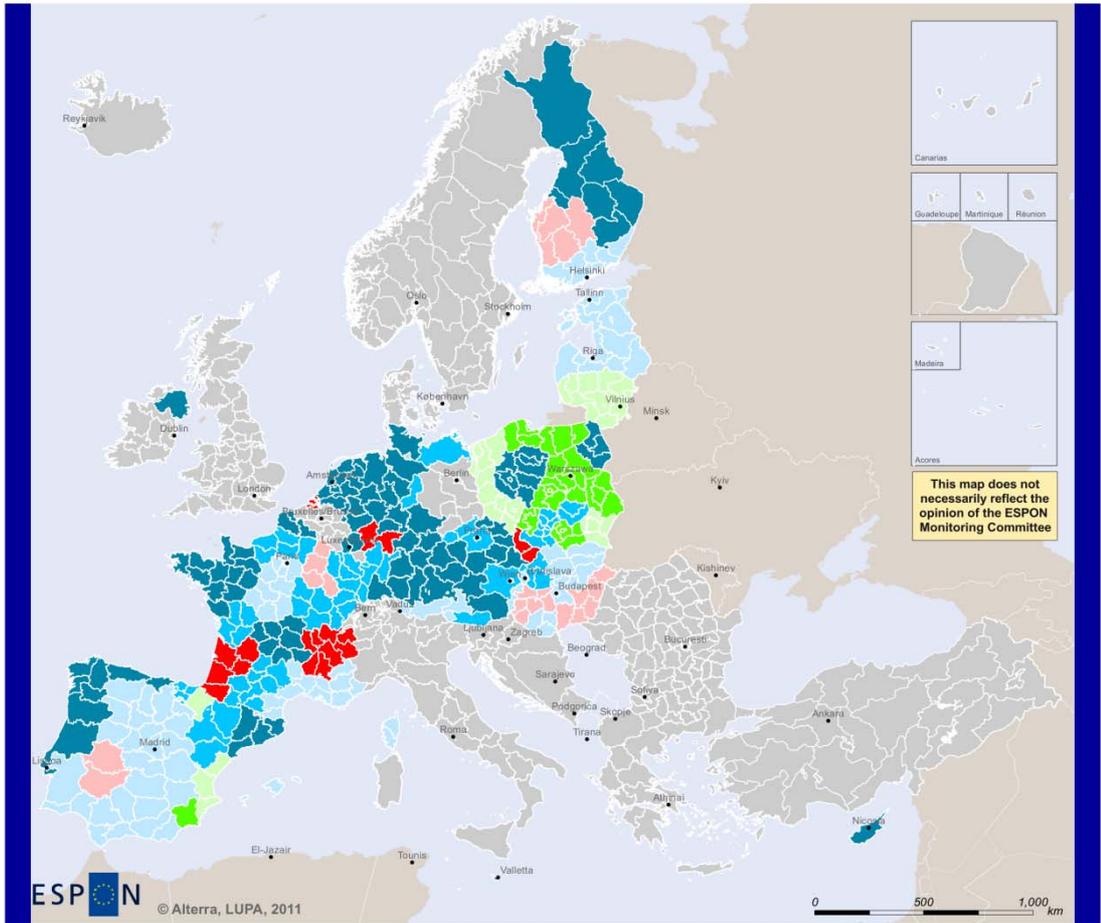


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Indicator 11: Natural leisure (2006)



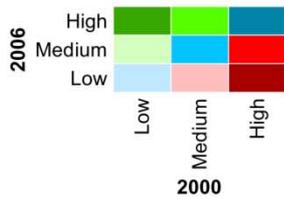
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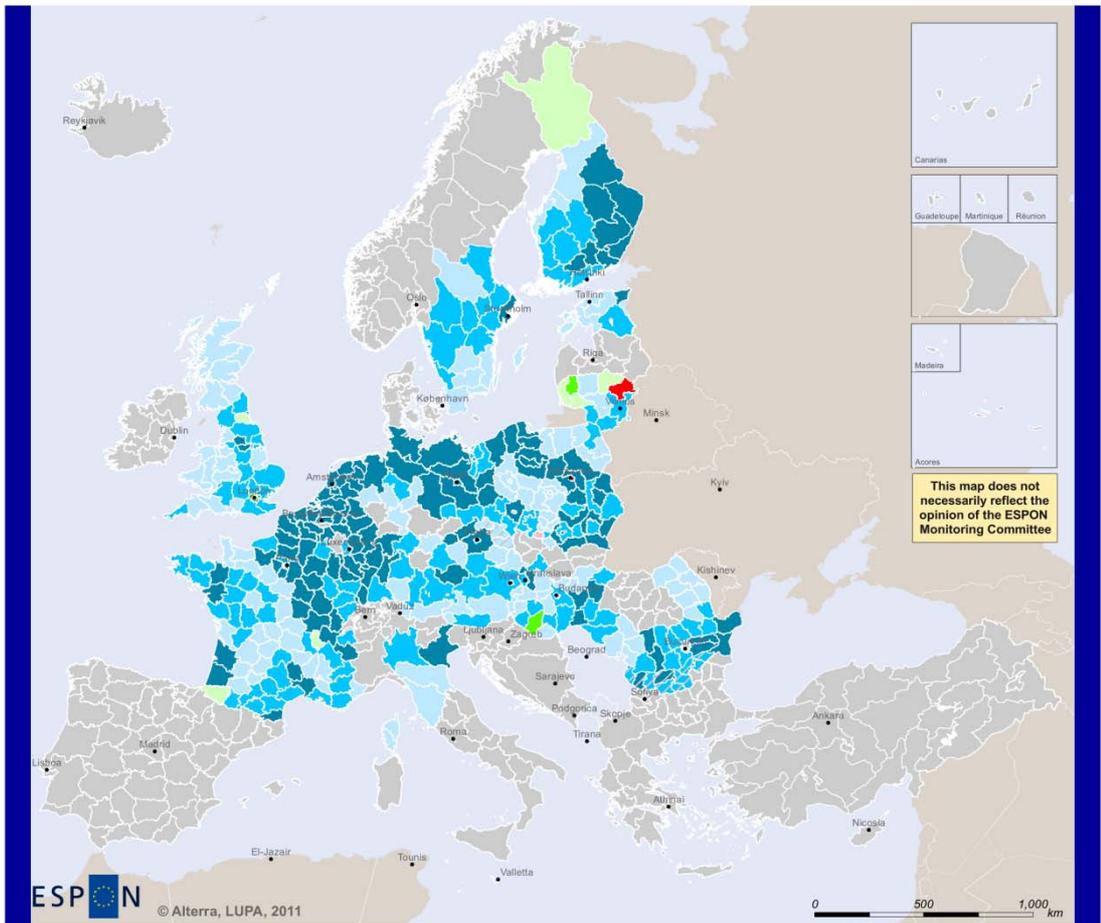
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Indicator 12: NH3 emission (kg N/ha) (2006)



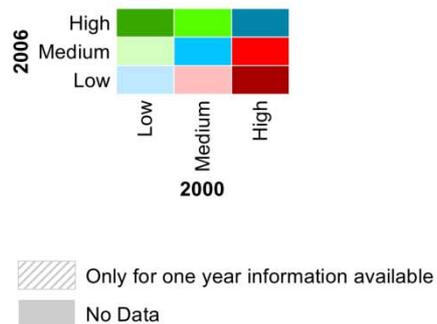
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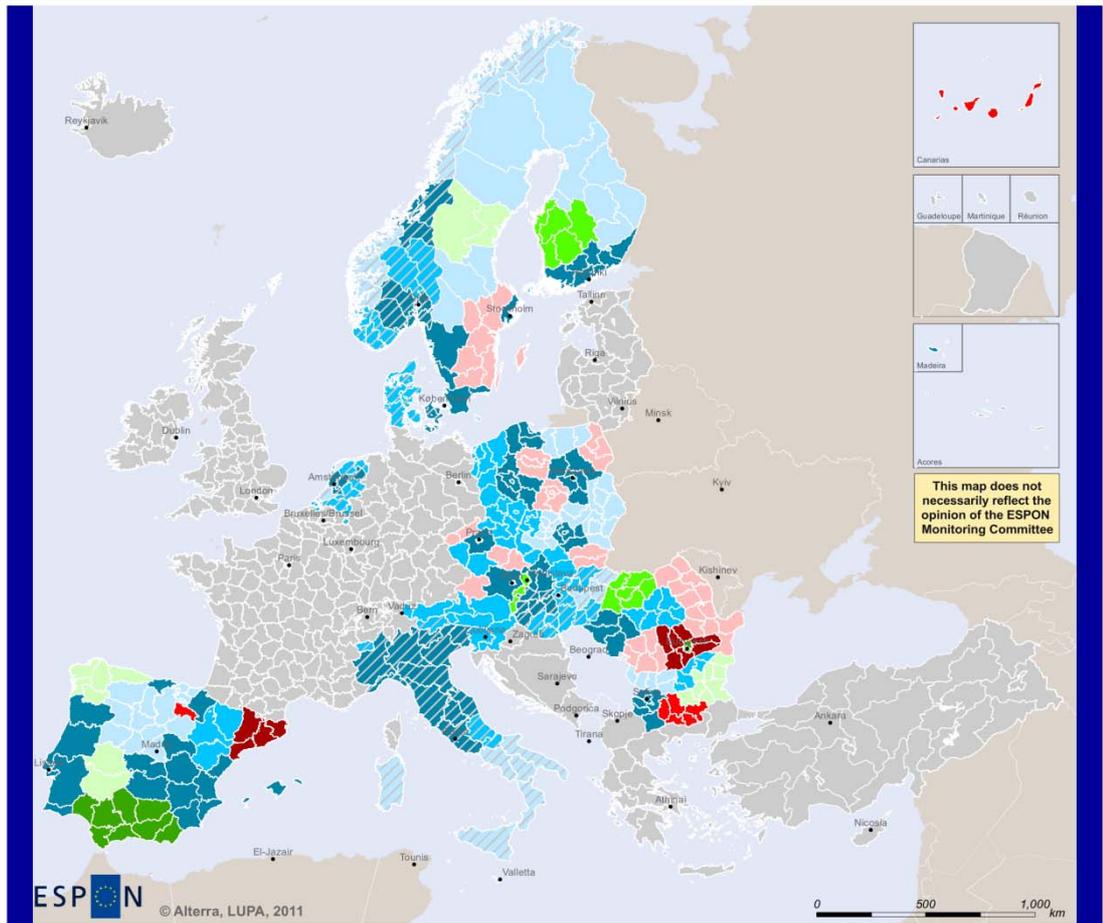


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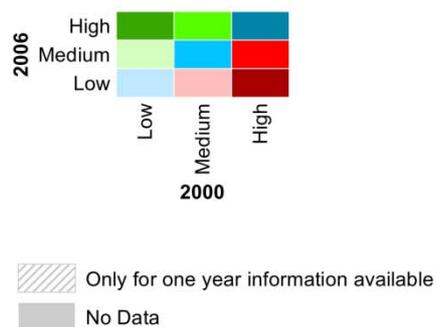
Indicator 13: Navigable rivers and canals (2006)

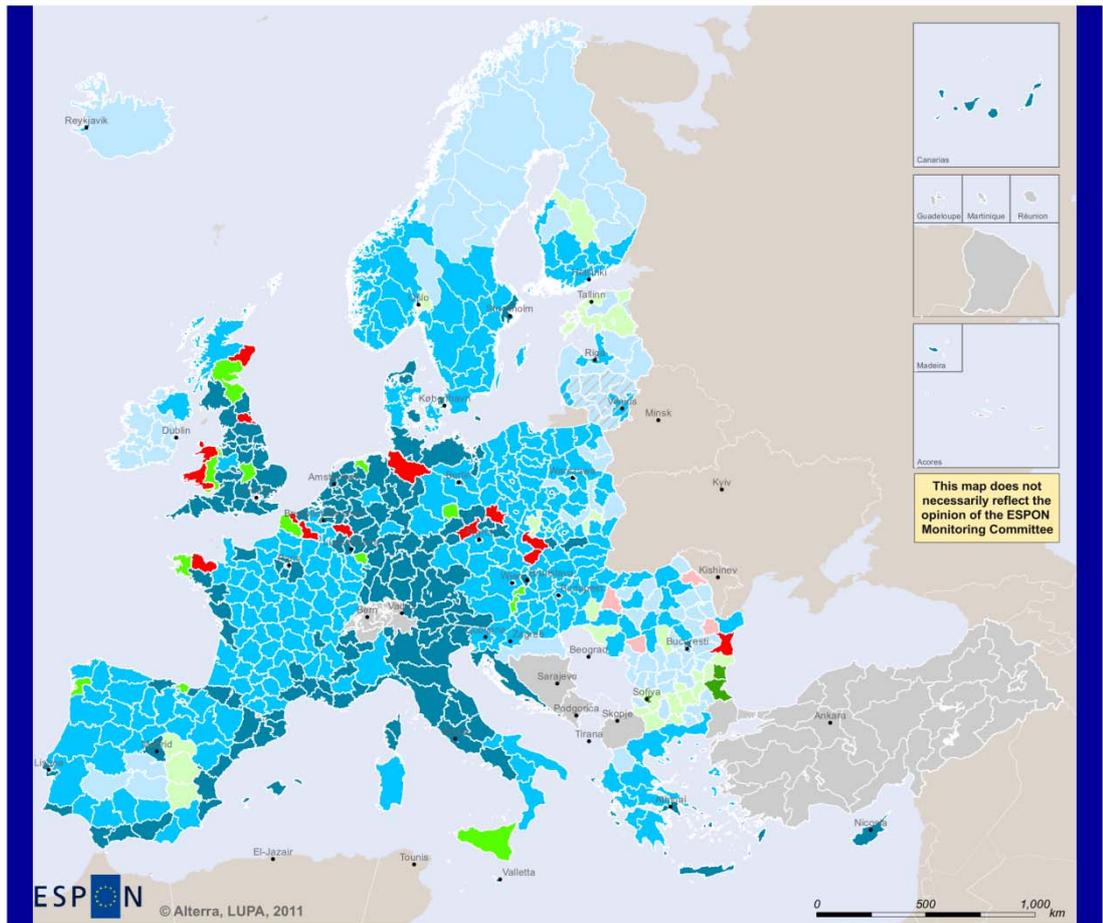




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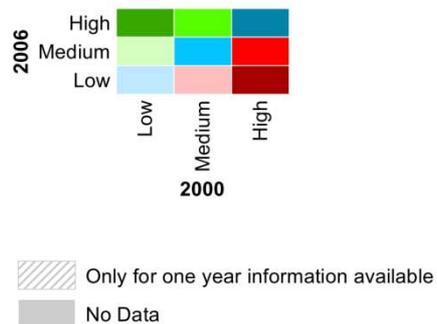
Indicator 14: Net. migration (2006)

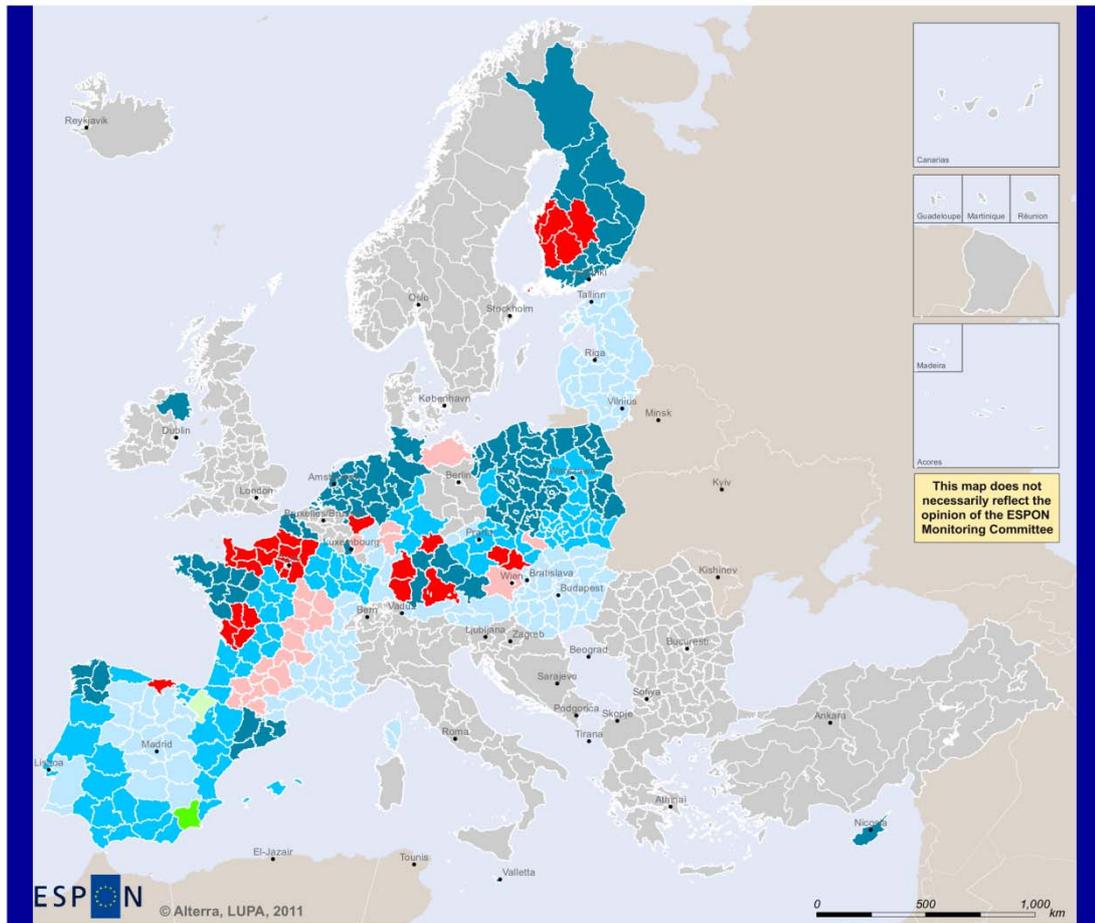




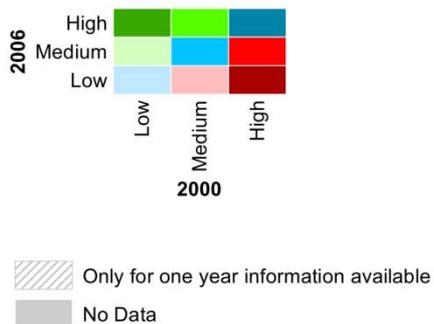
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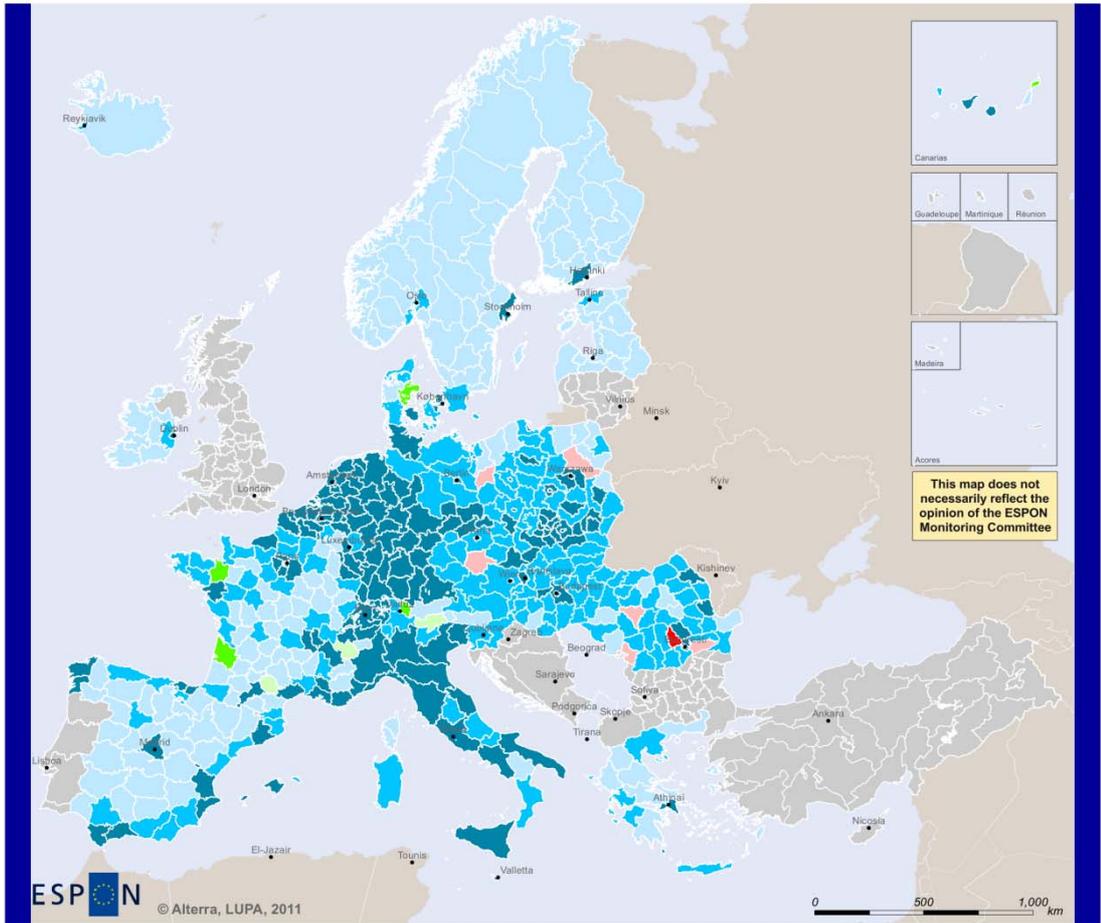
Indicator 15: Nights spent in tourist accommodations (2006)





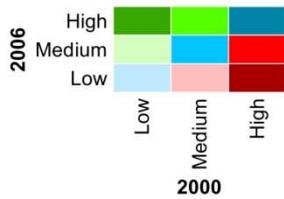
Indicator 16: N-surplus (2006)



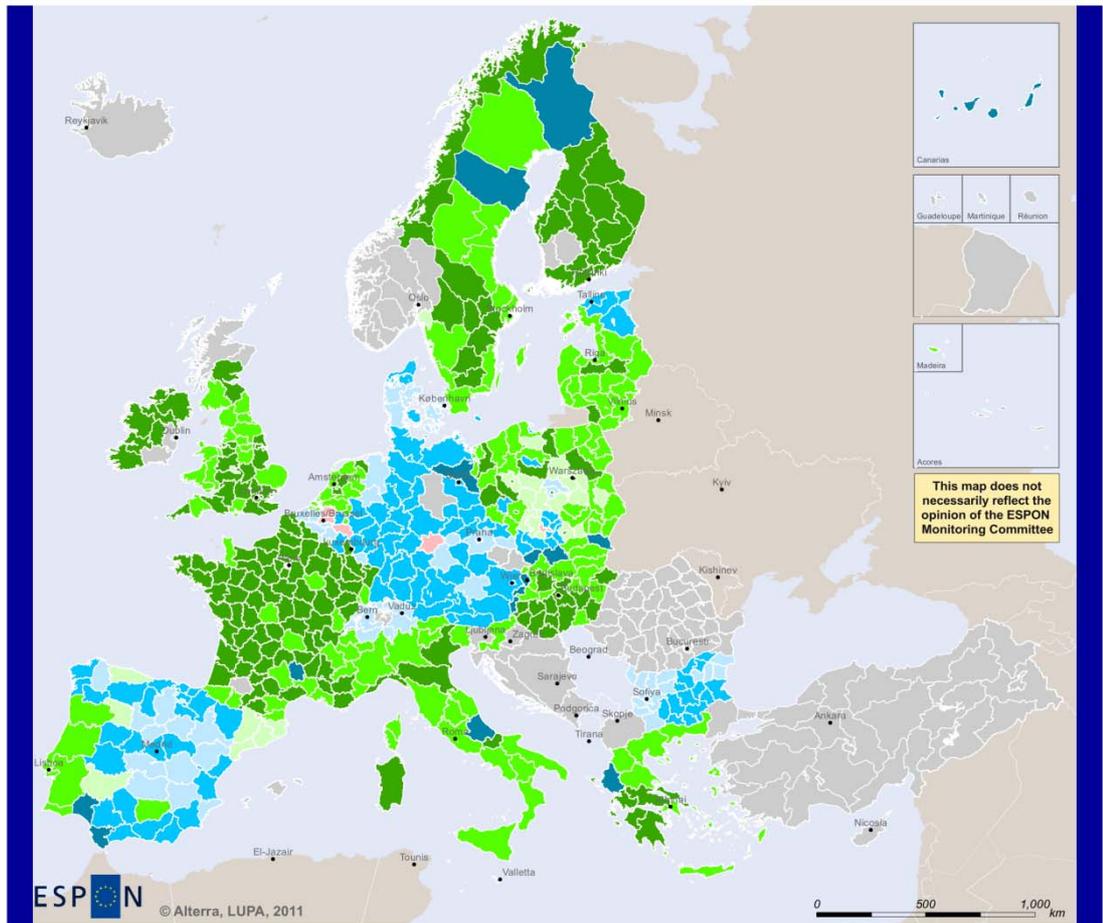


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Indicator 17: Population density (2006)



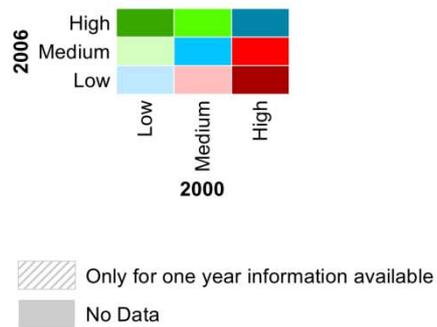
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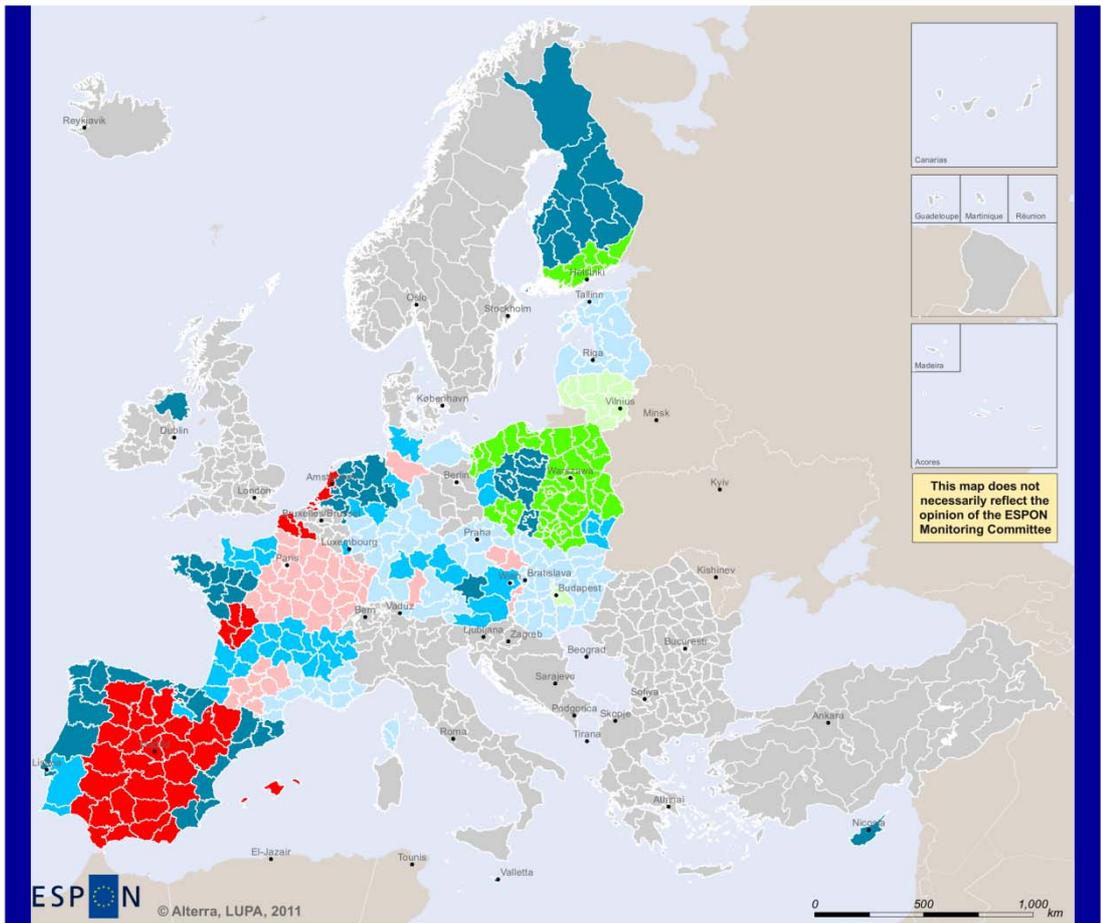


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Indicator 18: Natural protected areas - CDDA and Natura2000 (2006)



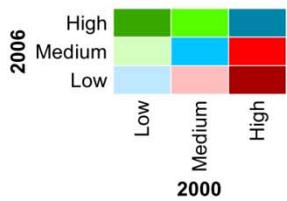


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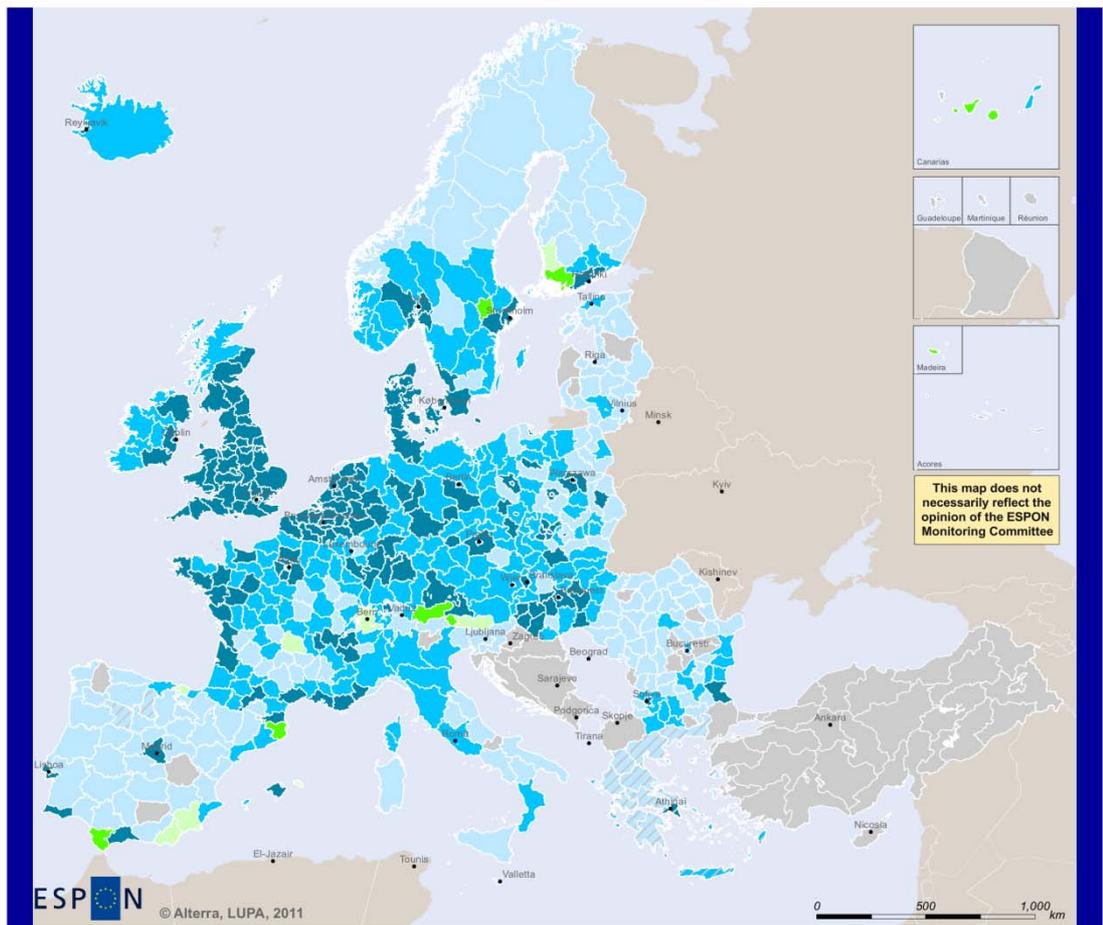
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Indicator 19: P-surplus (2006)



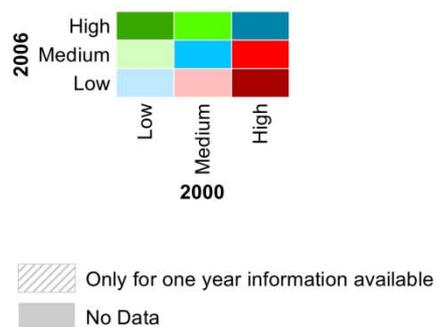
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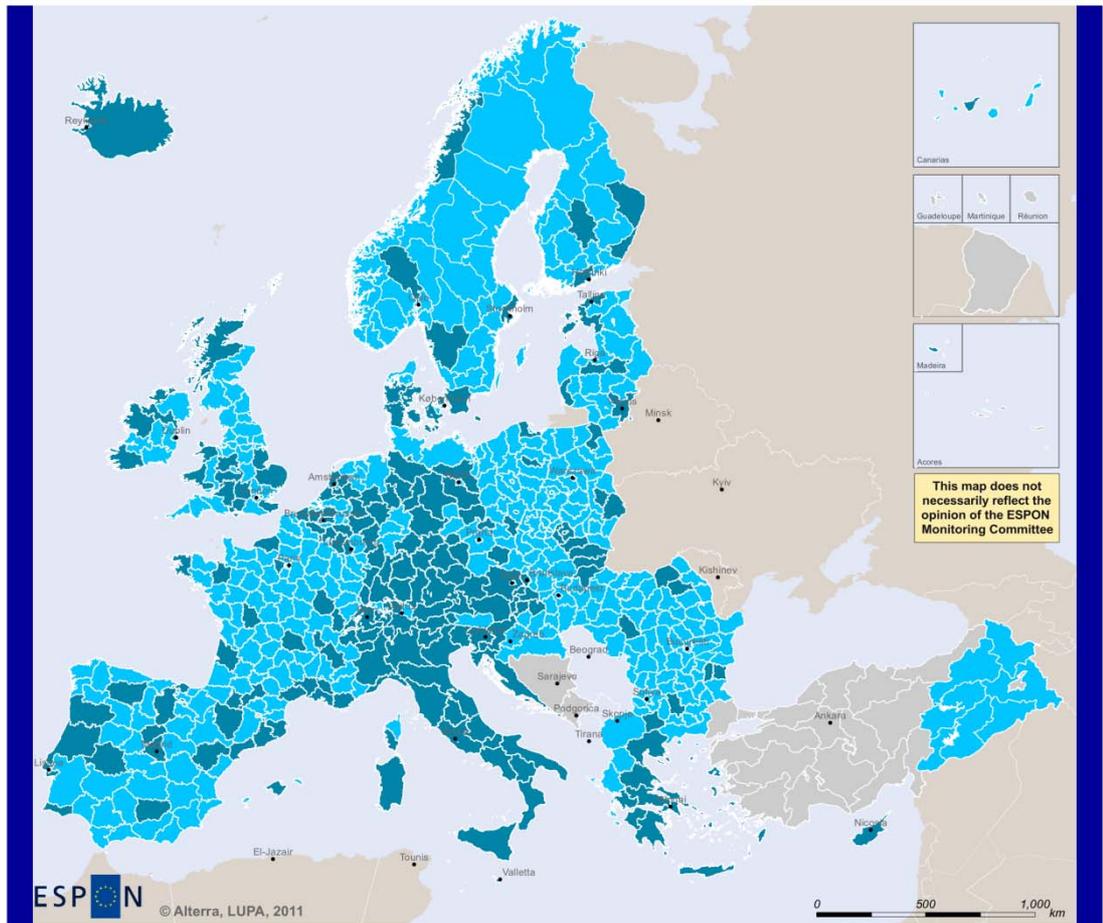


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Indicator 20: Artificial leisure areas (2006)



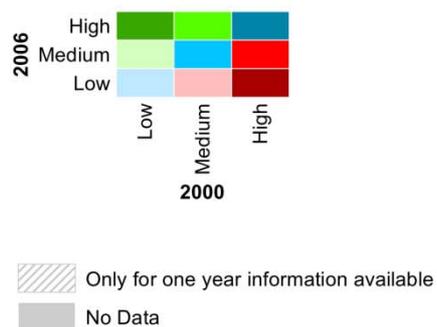


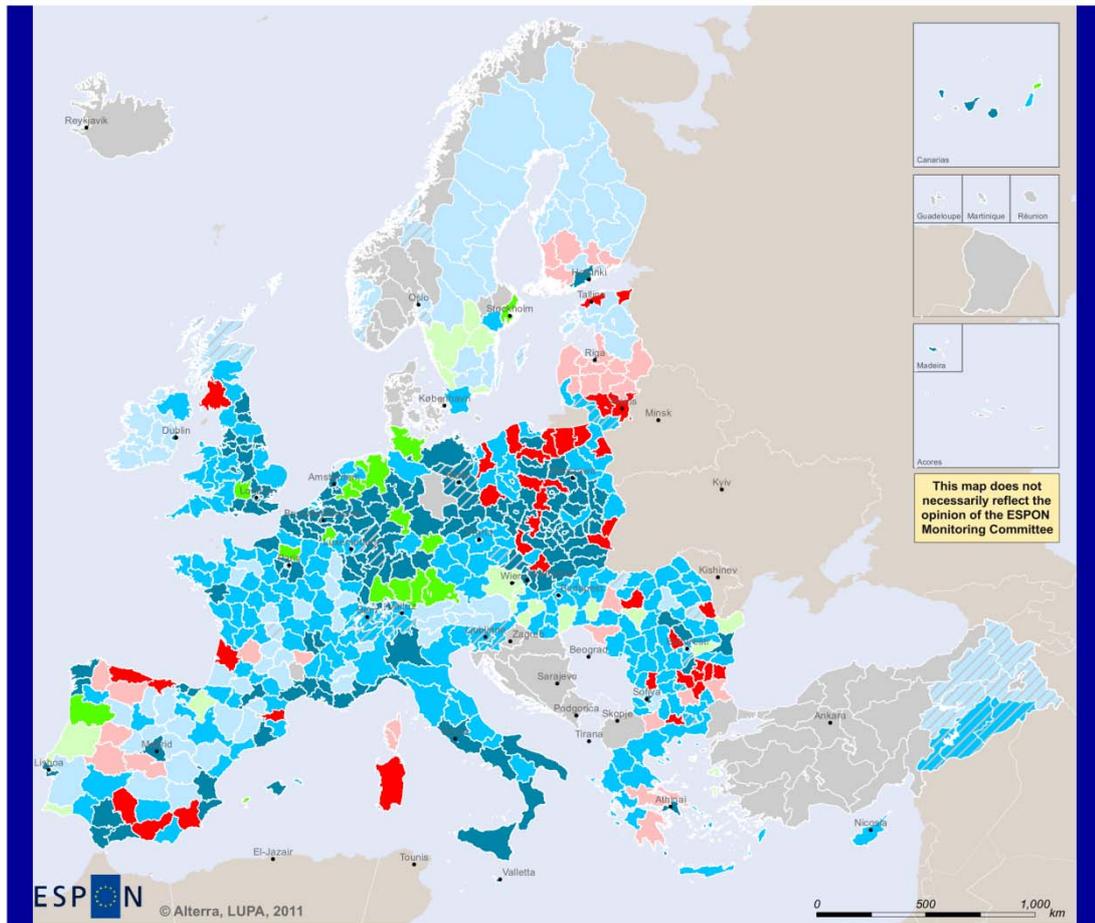
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Indicator 21: Number of tourist sights (2006)

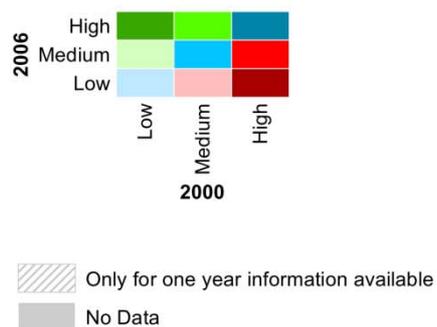


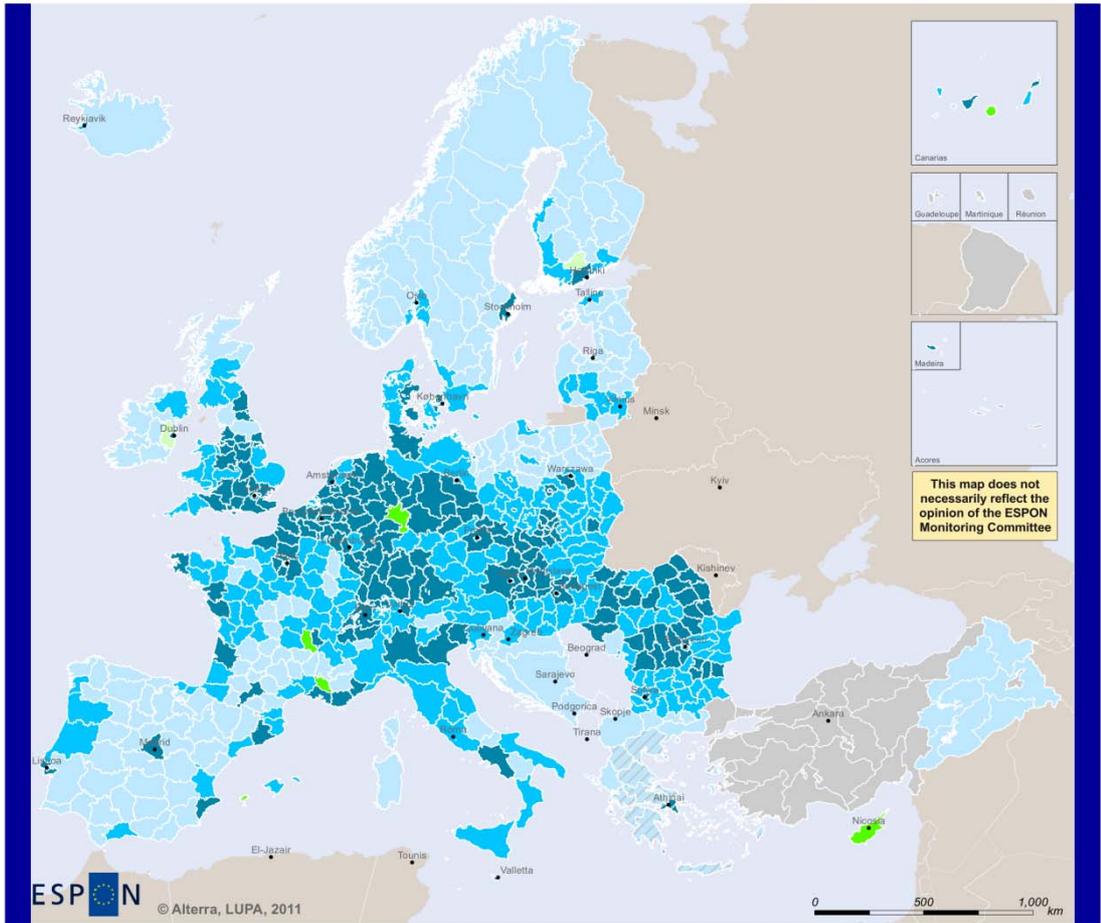


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Indicator 22: Unemployment rates > 14 years old (2006)

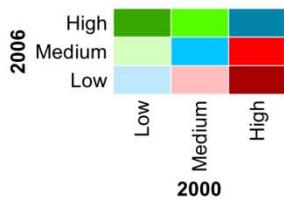




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Indicator 23: Build up areas (2006)



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Annex 6: Policy targets and possible links to indicators

LUFs Indicators	Performance indicator	Policy	Policy target	Comments to policies	Efficiency
Gross domestic product (Purchasing Power Standard)	GDP per person employed, index EU27=100	Lisbon treaty and Gotteborg objectives	Social cohesion EU27 Average		Very difficult to relate to a certain land use
Gross domestic product (Purchasing Power Standard)	Growth rate of real GDP per capita	European Strategy of Sustainable Development	Socio-economic development EU27 Average		Very difficult to relate to a certain land use
Multimodal potential accessibility		Territorial cohesion	Not found		It could be feasible using lenght of roads
Net migration			Not found		It could be related to an increase in built-up/residential area
NH3 emission		National Emission Ceilings Directive	Policy targets per country		Very difficult to relate to a certain land use
Nights spent in tourist accommodations		It does not relate to any policy			
N-surplus	NO3 level in water	Directive 91/676/EEC on pollution caused by nitrates from agricultural sources ("nitrate" Directive)	The Nitrates Directive requires MS to monitor surface waters and groundwater for nitrate pollution against a maximum limit of 50mg. NO3 .	The Directive seeks to reduce or prevent the pollution of water caused by the application and storage of inorganic fertiliser and manure on farmland. It is designed both to safeguard drinking water supplies and to prevent wider ecological damage in the form of the eutrophication of freshwater and marine waters generally. Where this level of pollution is reached, land draining into the affected waters (and which contribute to pollution) must be designated as a Nitrate Vulnerable Zone (NVZ).	As an alternative indicator we could use the NVZs.
P-surplus			not found		
Status of coastal bathing water		Directive 2000/60/EC Water framework directive			It is very difficult to relate to certain land cover classes. We may assume that bathign water quality is a result of inputs (agriculture+industry+households) - treatments. The WaterBase already provides good information on water treatment plants (inputs and outputs) which is relatively independent of the land use (it has more to do with implementation at national and local level being other factors relevant -policy context, technologies,...)
Status of inland bathing water		Directive 2000/60/EC Water framework directive			It is very difficult to relate to certain land cover classes. We may assume that bathign water quality is a result of inputs (agriculture+industry+households) - treatments. The WaterBase already provides good information on water treatment plants (inputs and outputs) which is relatively independent of the land use (it has more to do with implementation at national and local level being other factors relevant -policy context, technologies,...)
Unemployment rates (age >=15)	Dispersion of regional unemployment rates	Lisbon treaty and Gotteborg objectives; no clear policy target.	Social cohesion EU27 Average		There is no link in the database between UNemployment and employment (per sector) therefore we don't know if somebody is unemployed in a certain sector.
Unemployment rates (age >=15)	Employment rate by gender, age group 20-64	Europe 2020 Strategy	75 % of the population aged 20-64 should be employed		There is no link in the database between UNemployment and employment (per
	Gross domestic expenditure on R&D (GERD)	Europe 2020 Strategy	3% of the EU's GDP should be invested in R&D		
CO2 emissions	Greenhouse gas emissions, base year: 1990	Europe 2020 Strategy	The "20/20/20" climate/energy targets should be met (including an increase to 30% of emissions reduction if the conditions are right) EU27 target 80		
	Share of renewables in gross final energy consumption	Europe 2020 Strategy			We don't have data on area used for renewable energy. It maybe possible for biofuels in some countries, but we have not found data covering all Europe in terms of solar energy, neither wind mills (there is only some data for offshore).
	Energy intensity of the economy (proxy indicator for Energy savings which is under development)	Europe 2020 Strategy			
	Early leavers from education and training by gender	Europe 2020 Strategy	The share of early school leavers should be under 10% and at least 40% of 30-34 years old should have completed a tertiary or equivalent education		
	Tertiary educational attainment by gender, age group 30-34	Europe 2020 Strategy			
	Population at risk of poverty or exclusion (union of the three sub-indicators below)	Europe 2020 Strategy	Reduction of poverty by aiming to lift at least 20 million people out of the risk of poverty or exclusion		
	Persons living in households with very low work intensity	Europe 2020 Strategy			
	Persons at risk of poverty after social transfers	Europe 2020 Strategy			
	Severely materially deprived persons	Europe 2020 Strategy			
	Resource productivity	European Strategy of Sustainable Development	Sustainable consumption and production EU27 Average		
	Healthy life years and life expectancy at birth, by gender	European Strategy of Sustainable Development	Public health EU27 Average		
	Energy consumption of transport relative to GDP	European Strategy of Sustainable Development	Sustainable transport EU27 Average		
	Common bird index	European Strategy of Sustainable Development	Natural resources EU27 Average		Protected area
	Fish catches taken from stocks outside safe biological limits				
	Official development assistance as share of gross national income	European Strategy of Sustainable Development	Global partnership EU27 Average		

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ISBN

EU-LUPA European Land Use Patterns

Applied Research 2013/1/8

CHAPTER 3 Policy Options and Recommendations

Draft Final Report Part C Scientific report
Version 01/June/2012

This report presents the draft final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

Information on the ESPON Programme and projects can be found on www.espon.eu

The web site provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

This basic report exists only in an electronic version.

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PREFACE

A common approach or strategy for the development of policy options and recommendations is being outlined as part of Task 2.5.

In the EU-LUPA project, land use changes and dynamics in Europe are going to be approached as a policy driven processes in the context of the European Spatial Development, although the evaluation of policy impacts is definitely out of its scope.

Nowadays, the diversity of geographic features, social, economic and environmental characteristics, and use planning traditions and competences, technical and legal frameworks, governance structures and systems, among and within regions and countries in the European context, is more than evident.

With this premise in mind, the main objective of the EU LUPA project is *to provide a consistent methodology to analyse comparable information about European regions based on data from different sources and different levels [...] integrating physical dimension (land cover) with social-economic (land use) and environmental, in order to understand and obtain a clear view on land use changes [...] identifying main challenges and potentials [...] and defining policy options accordingly.*

Policy makers should rely on research evidences in order to define the most appropriate measures and policies responses in line with the EU development principles and objectives (mainly under the EU Cohesion Policy, EU2020 Strategy and the Territorial Agenda),

- on one hand to monitor land use intensity to support **responsible land management** and to resolve conflicting land use demands affecting the economic, social and environmental performance of a region
- and on the other hand to **identify the potentials for improving regional competitiveness and territorial cohesion towards sustainability**

The project should strive to achieve a better understanding of the following key policy questions,

- What does the **current European land use** look like, what are the **current land use patterns** on the European territory, where are certain **patterns dominant** and in what **particular types of regions** or countries?
- What are the **changes of land use, the main dynamics and trends, over the last 16 years (1990-2000-2006)**? Where are the main changes in typical land use patterns? And what are the **main driving forces behind** these land use and land use pattern changes?
- **To what extent are existing land use patterns throughout Europe in line with the general spatial development principles as formulated in most territorial policy documents** (e.g. ESDP)? How will this picture look like if no extra policy action is taken and new territorial dynamics come into play?
- What are the **relations between land use patterns** (and more specifically urban land use patterns) **and drivers of development** such as geographical, demographic and cultural influences, climate change, transport, employment, GDP and other economic structures? How and to what extent **are land use patterns efficient** in relation to these aspects? And what are the **relations between urban areas and open space** (non-build areas)?

- Are there typical **land use developments and patterns in particular types of regions such as border regions**? How can these developments, e.g. through cooperation initiatives, be coordinated and create a development potential?

Based on sound scientific basis, the EU-LUPA project provides:

- **Awareness-raising** in form of key messages on how the land use dynamics and economic, social and environmental performance relate (e.g. “fast urbanizing areas face social and environmental problems”)
- **Indication of potential and challenges** in the regions in relation to the land use patterns found
- **Formulation of policy measures and recommendations** for European, national, regional (and local when appropriate-mainly as case study level) authorities to face the challenges and take advantage of the potentials, anchored in the EU Cohesion Policy and the Territorial Agenda policy objectives.

The strategy described in this paper aims a better understanding of the project, its methodological flow and the interrelationship between the different tasks that are being carried out.

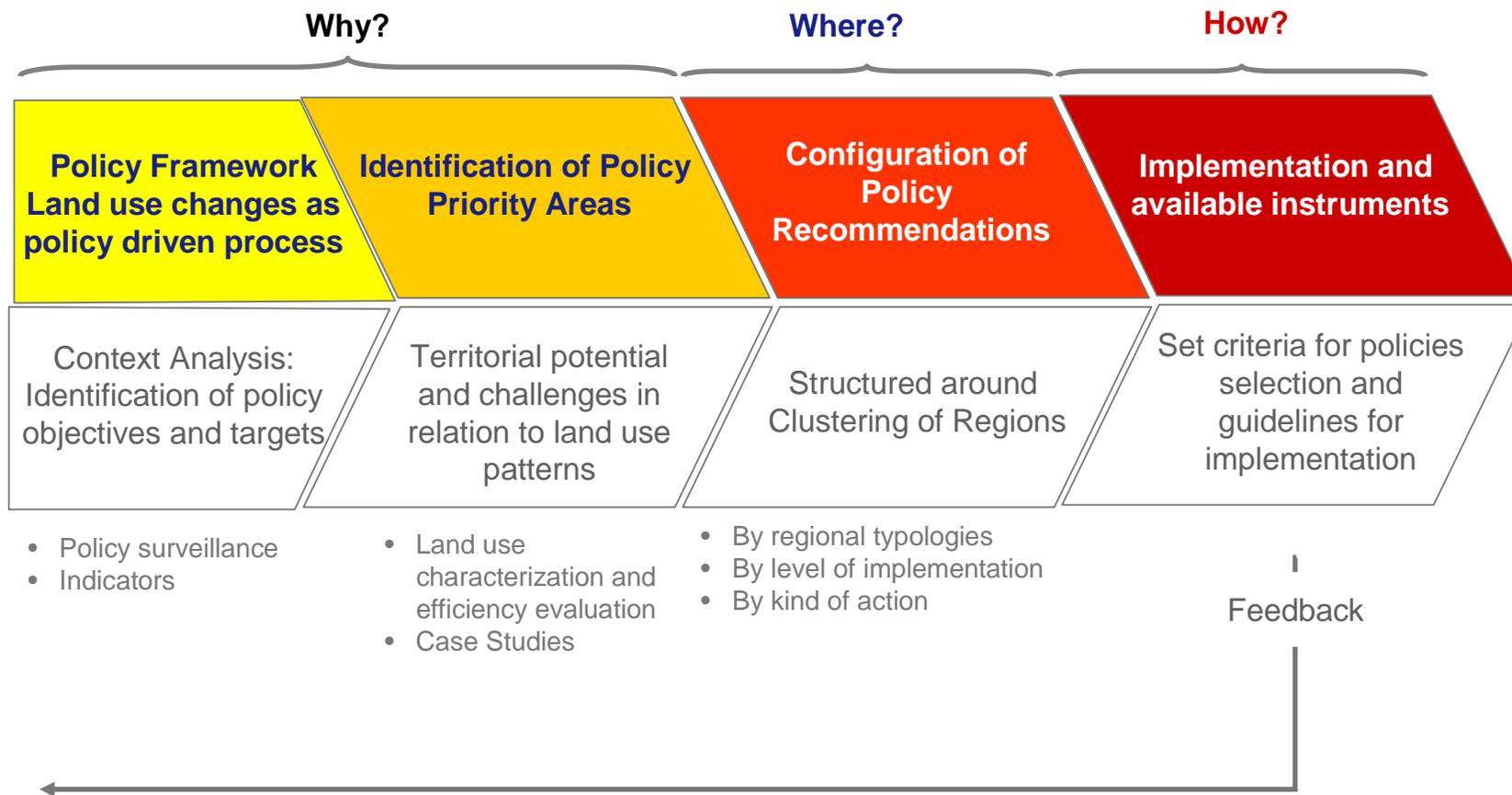


Figure 1 A common approach or strategy for the development of policy options and recommendations is being outlined as part of Task 2.5.

1. OUTLINE OF METHODOLOGY

The methodology sketched for the definition of policy recommendations in the EU-LUPA project consists of four phases that are described in the following sections. α

1.1. PHASE I European Policy Framework

The starting point of this activity is the identification of the most relevant EU policies, strategies and institutional reports and the elaboration of the policy context regarding Land Use in Europe.

The definition of the European policy framework is being understood as a transversal activity. All along the project development, there will be a continuous follow up of European policies and especially those related to regional development policy.

The aim of the definition of the policy framework is:

- **Contextualization of the land use change and land use dynamics** as a policy driven processes
- **Policy relevance of the indicators used in the characterization of land use changes in EU** (as an input to Task 2.2).
- **Identification of policy objectives, indicators and thresholds** as an input for the evaluation of Territorial Performance (Task 2.3.1).

The key result of this Phase is the Review of EU policies, policy options and strategies as key drivers for land use configuration in Europe. (See Chapter 2.1 of the present report)

1.2. PHASE II Identification of policy priority areas: Potential and challenges in relation to land use patterns

The next step in the strategy is the identification of the **policy priority issues** by means of the assessment of the potential and challenges in the EU regions with regard to their land use patterns, towards the key territorial priorities stated in the EU political agenda¹.

1. Promote polycentric and balanced territorial development
2. Encouraging integrated development in cities, rural and specific regions
3. Territorial integration in cross-border and transnational functional regions
4. Ensuring global competitiveness of the regions based on strong local economies
5. Improving territorial connectivity for individuals, communities and enterprises
6. Managing and connecting ecological, landscape and cultural values of regions

Taking account of the cross-cutting nature of the land use, the idea is to prioritize the relevant **topics, themes and subjects** where policy recommendations are potentially more needed and therefore where policy makers should allocate their efforts.

Our hypothesis is that a qualitative analysis of the scientific evidences resulting from the exercise of land use characterization in Task 2.2 and an integrated evaluation of the land use efficiency by means of the correlation between land use patterns and territorial

¹ Territorial Agenda of the European Union 2020: Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions

performance in Task 2.3 is leading us to the identification of such regional potential and challenges.

But how to identify potential level of relationship between the drivers/ pressures and the identified land use patterns? This is a methodological issue still unresolved.

In order to better organize the analysis of these evidences, a DPSIR conceptual model (EEA, 1999; OECD, 1993) is suggested.

This conceptual model could provide an appropriate integrated approach for the evaluation of the driving forces and associated pressures that are behind certain land use dynamics, the impacts generated (performance) by some land use changes and patterns (state) and the responses (policy options) in place aiming at rectifying undesirable situations and trends or strengthen good practices .

Note that the selection of the working scale is important in the development of DPSIR models. Working at macro scale could lead to a model which could be too general to be applied at micro-scale where pressures or impacts identified at macro level are in fact, the driving forces for example.

For the project purposes the DPSIR model has been elaborated at meso-scale.

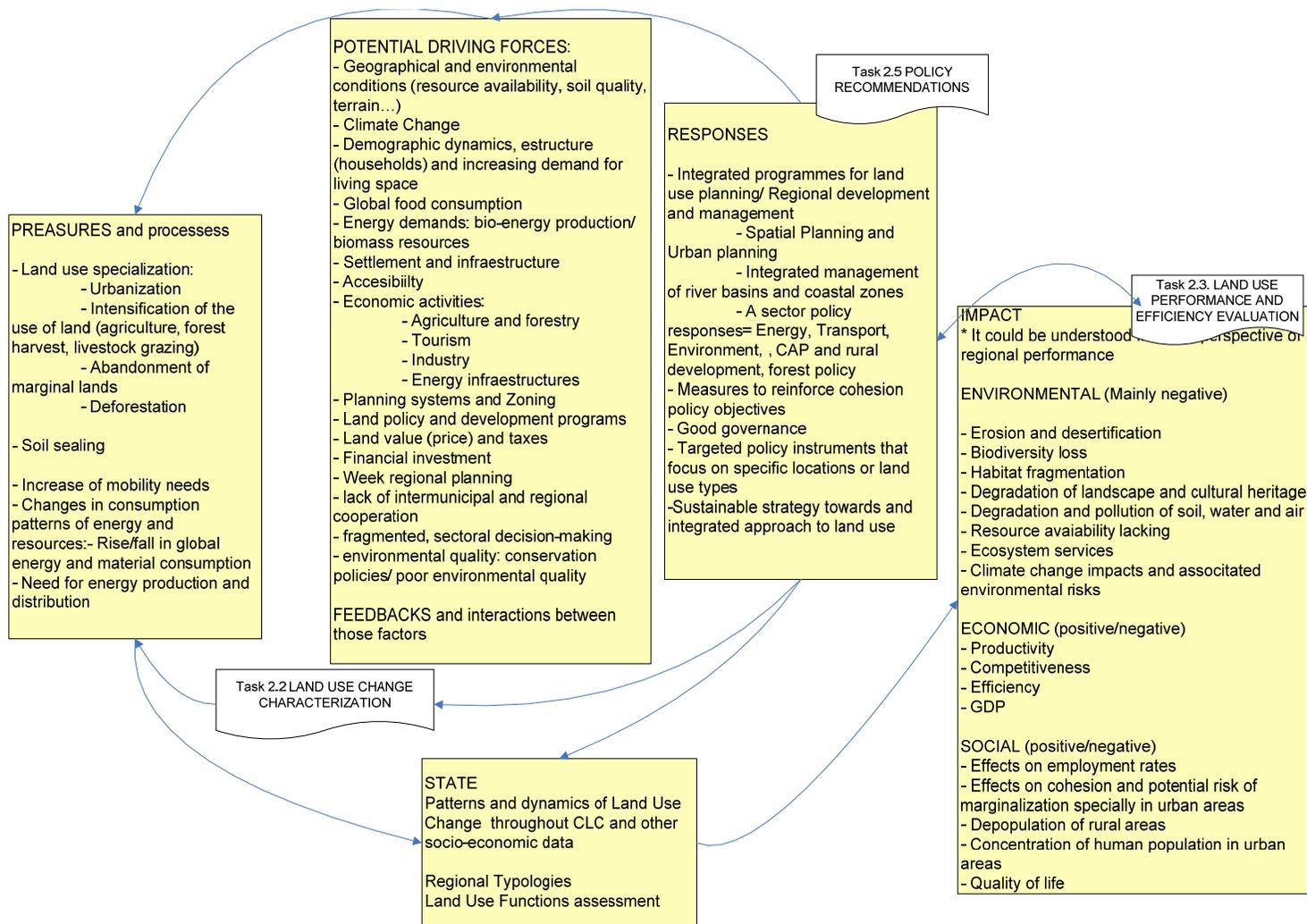


Figure 2 Adaptation of DPSIR model to EU-LUPA project. Based on OSE Report Land Use Changes in Spain. Implications for the sustainability, 2006 (Prepared by Tecnalía.)

1.3. PHASE III Structure for the configuration of policy recommendations

It is expected that the diversity between the regional realities within the European territory could be also reflected in their land use dynamics which in principle would obligate the analysis of each reality independently in order to be able to define meaningful policy recommendations.

However, it is out of the EU-LUPA project scope to provide a place-based approach to policy making unless for the case studies.

The hypothesis is that regions with similar characteristics may be addressed by a common set of recommendations and general awareness.

However, it could be argued that some measures that could have been implemented in a particular region without any success could imply a major successful change in others, depending on their specific regional features and we must definitely have this premise in mind.

As stated in the introductory chapter of the present document, based on sound scientific basis, the EU-LUPA project is providing:

- Awareness-raising
- Indication of potential and challenges in relation to land use patterns
- Formulation of policy recommendations

In order to systematize the process, the following step in the strategy focuses on the construction of a three-dimensional matrix which will constitute the skeleton for the configuration of policy recommendations.

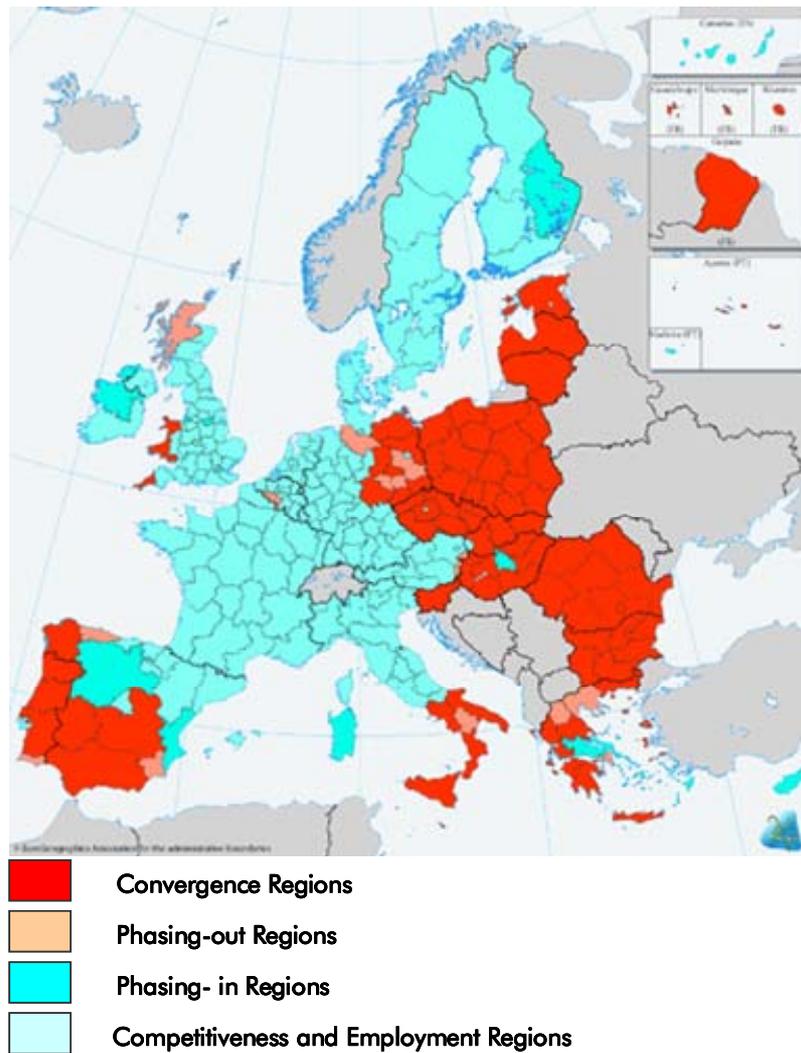
1.3.1. By Regional Typologies

Having in mind the assumption that regions with similar characteristics may be addressed by a common set of recommendations and general awareness, the policy recommendations will be primarily associated to the different profiles of land use patterns obtained in Task 2.2 Regional Typologies.

It is important that the project will be able to detect territories with complementary potentials, often neighbouring, which can join forces and explore their comparative advantages together creating additional development potential.

Apart from the variables used for the clustering exercise, from the policy perspective we would add the following attributes to the regional typologies:

- Planning systems and/or governance structures
- Cohesion policy: identify the category of each region



Map 1 Cohesion Policy 2007-2013: Convergence and Regional Competitiveness Objectives².

1.3.2. By Kind of Action

- to support responsible land management and to resolve conflicting land use demands affecting the economic, social and environmental performance of a region
- for improving regional competitiveness and territorial cohesion towards sustainability based on the region potentials

The actions will be understood as process and as product.

→ As process: GOVERNANCE coordination

- Among different levels: vertical / multilevel, subsidiary / proportionality
- Between policies: horizontal coordination
- Between actors: public and private stakeholders and local communities (partnership)
- Between territories: rural-urban partnerships, metropolitan governance, city and regional networks....

² http://ec.europa.eu/regional_policy/atlas2007/index_es.htm

→ As product: policy messages, guidance for development of instruments, plans, strategies, procedures, normative and other recommendations.

1.3.3. By the Level of Implementation

Territorial dimension on land use competences: within this group we will consider administrative boundaries for decision-making on “European, state and regional”, to the three-level spatial classification adopted by ESPON (macro, meso and micro-scales). In the EU, land use planning depends on different administrative levels. Thus, in some countries land use policy is the sole competence of central government (state-level) while in other cases decision making is divided between state, regional and local agents.

*Time scale should be also considered: short term and long term. The matrix will therefore help to define the adequate level of policy makers to be included for each country in the EU 27+4.

1.4. PHASE IV Preparation of policy recommendation document

The policy recommendations document will be delivered in the Final Report. In September 2012 a stakeholder’s workshop will be held in Warsaw (Poland) hosted by the project partner 5 IGSO. The outcomes of the workshop will constitute the final input for the configuration of the policy recommendations document.

The document will enclose a non-binding battery of policy recommendations to be used by decision-makers, structured in the following chapters:

- Chapter 1. Policy background

This chapter encompasses results from Phase I Policy Surveillance.

- Chapter 2. Policy priorities
- Chapter 3. Case studies and identification of best practices

This chapter will mainly cover the key findings in case studies evaluation and also best practices identified within those case studies.

- Chapter 4. Proposal for policy recommendations anchored in the EU Cohesion Policy and the Territorial Agenda policy objectives

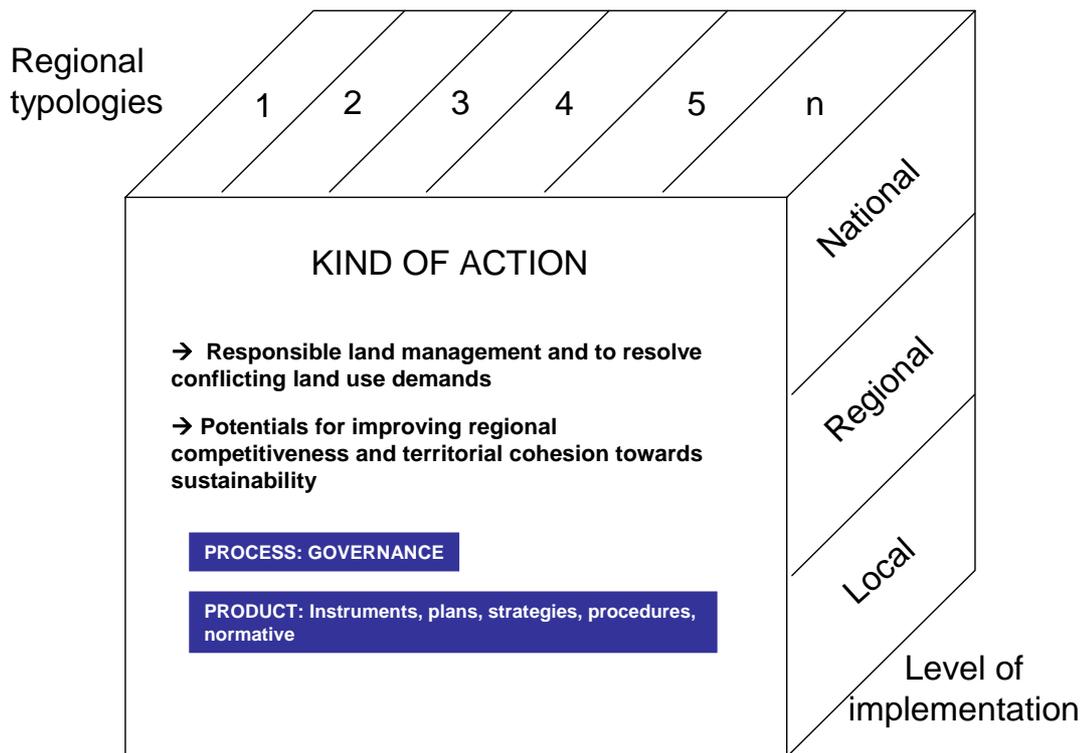


Figure 3 EU-LUPA Policy recommendations cube

Policy options should be in line with the objectives of the European Territorial Agenda:

Solidarity between regions and territories is in line with § 3 and § 8 of the Territorial Agenda. The adoption of this principle reinforces solidarity between States and regions and expresses the commitment to apply a cohesive and integrated approach adapted to territorial diversity when influencing or deciding on the priorities and funding of territorial and urban development policies at European Union, national, regional and local levels.

Multi-level governance is in line with § 5 and § 17 of the Territorial Agenda. The adoption of this principle expresses the commitment to structure proper channels of communication, participation and cooperation in order to make the territorial assessment, planning and management a fully democratic, transparent and efficient process.

Integration of policies is in line with § 10, § 11, § 23 and § 27 of the Territorial Agenda. The adoption of this principle expresses the acknowledgement of the specific responsibilities of sectoral policy-makers and the will to cooperate with and influence them in order to ensure a stronger territorial and urban focus when conceiving and delivering the thematic policies. The goal is to better fine-tune specific thematic actions, to facilitate their coordination and to reduce undesired externalities.

Cooperation on territorial matters is in line with § 35 of the Territorial Agenda. The adoption of this principle recognises the importance to develop and support interregional, transnational and cross-border cooperation initiatives, aimed to actively promote territorial integration. Territorial cooperation must consider the territorial and urban dimensions of economic and social development and include the EU neighbouring countries, namely in the context of EU Programmes for European Territorial Cooperation

Subsidiarity is in line with § 30 and § 33 of the Territorial Agenda. The adoption of this principle states that the full and efficient achievement of the aims of the Territorial Agenda can best be pursued according to the institutional arrangements within each Member State, through a strong involvement of national, regional and local powers and stakeholders and a dialogue with the European Commission and the other European institutions.

The Implementation of actions within the Territorial Agenda aims to:

- Better coordination between the spatial policies of the Member States by introducing a European dimension and defining and implementing common priorities;
- Improved coherence between European Union policies and the spatial development policies within the Member States by influencing European Union policies from a territorial cohesion point of view;
- Better understanding of the spatial system and territorial trends at European Union level;
- Improved vertical and horizontal coordination and participation of private and public sectors towards a more responsive territorial governance.

The diagram in the next page explains the interrelationships between the different phases.

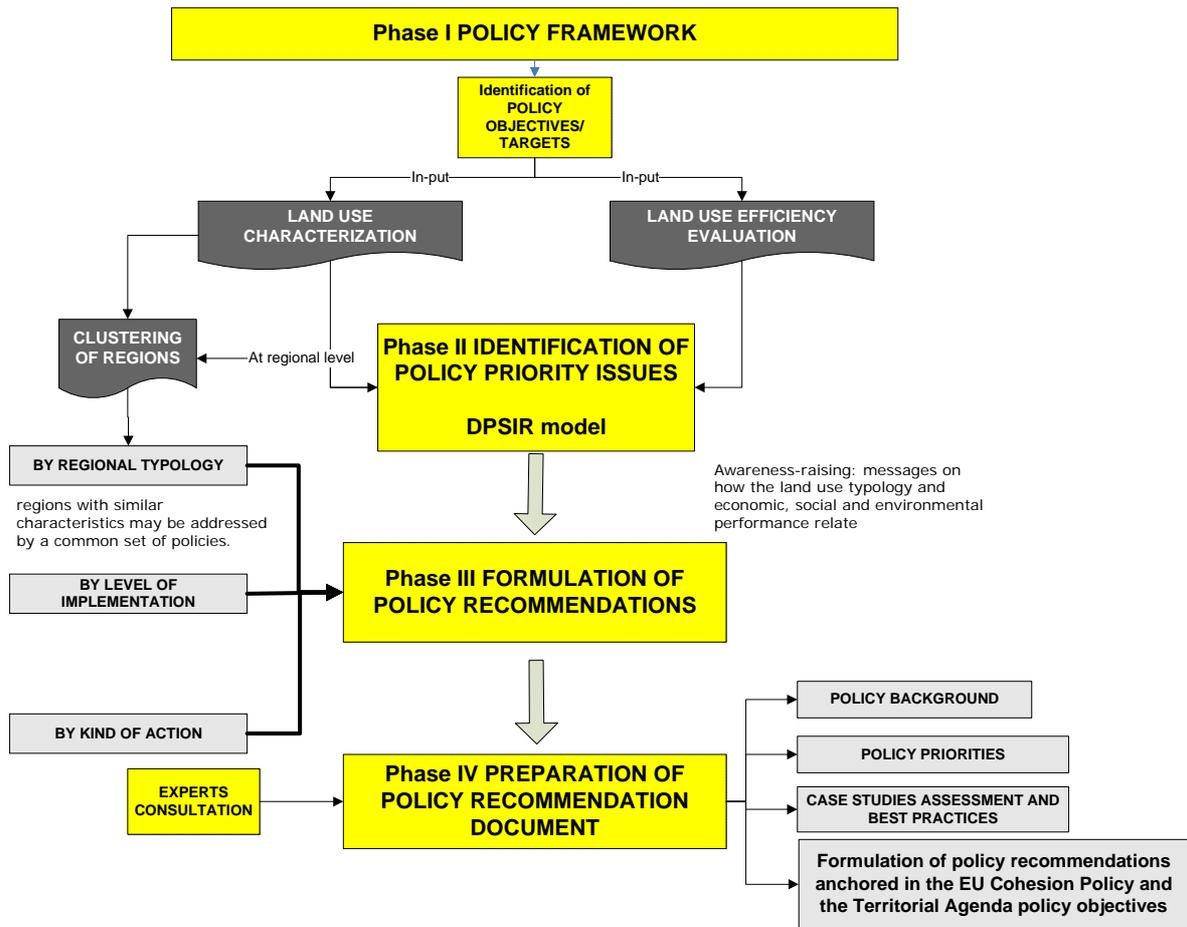


Figure 4 Methodological approach for policy recommendations task

2. EU POLICY FRAMEWORK: Review of EU strategies, policies and policy options as key drivers of land use configuration in EU

The aim of territorial cohesion for the European cooperation towards sustainable development is on the core of the EU political agenda, revealing an increasing interest of policy makers in a territorial approach with deeper horizontal policy integration and cross-sector perspective, over the last decades.

Although European policy does not have spatial planning responsibility or competence for planning *per se*, it sets the framing conditions of planning through different strategies and instruments.

Land-use planning and management decisions are usually made at local or regional level. However, the European Commission has a role to play in ensuring Member States take environmental concerns into account in their land-use development plans. The goals are:

- To analyse the environmental impact of proposed developments
- To improve the geographic information flow about land-use issues
- To develop and implement European urban environment strategy
- To improve the planning, management and use of Europe's coastal zones

Land use implications on the compliance of the key EU policy objectives and targets is crucial due to its cross-cutting nature touching upon many different territorial challenges such as urbanization and rural-urban relationships, climate change mitigation and adaptation, natural resource management, energy, transport, regional competitiveness and cohesion.

Back in 1999 the European Spatial Development Perspective (ESDP), a non-binding framework aiming at coordinate various European regional policy impacts, already advocated the development of a sustainable, polycentric urban system and balanced territorial development in Europe. The ESDP resulted in European policy orientations for territorial balance and cohesion, improved competitiveness, urban system with compact cities and strengthening of the partnerships between urban and rural areas; parity of access to markets and knowledge, as well as wiser management of natural and cultural resources.

Ever since, the territorial dimension is being addressed in the EU political agenda and EU policies, also at regional level, are increasingly focused on harmonious territorial development towards sustainability.

In 2007 the enlarged EU adopted a **Territorial Agenda for the European Union** which modernized the policy orientations of the ESDP and added stronger emphasis on:

- Competitiveness of regions and cities including creation of innovative clusters,
- Climate change concerns and
- Territorial cooperation and multilevel governance.

The Territorial Agenda has been followed up by an ambitious Action Plan 1, currently under implementation. The Territorial Agenda has been recently reviewed in the first half of 2011. Some actions are related to the themes of ESPON applied research, others are being supported by ESPON targeted analyses.

The **Leipzig Charter** (2007) builds on a process of cooperation aimed at strengthening urban development in the European context. With the Leipzig Charter the Ministers agreed on common principles and strategies for an integrated approach to urban development policy and on the need for action in socially and economically deprived urban areas as well as in cities as a whole. The complementarities between the Leipzig Charter and of the Territorial Agenda are addressed in First Action Programme.

The Leipzig charter particularly stressed the need for proposals and strategies for sustainable EU cities calling for a European polycentric urban structure.

In 2008 the Commission launched a debate publishing a **Green Paper on Territorial Cohesion**. This document puts a territorial perspective on economic and social cohesion setting the objective of a more balanced and harmonious development of the European territory. It focuses on 3 key territorial development dynamics: (1) Concentration, (2) Connections and (3) Cooperation. It pays as well particular attention to regions with specific geographical features. Mountain regions, island regions and sparsely populated areas may heavily suffer from the likely impacts of climate change, demographic change, accessibility, regional integration and energy supply.

The Green Paper on Territorial Cohesion is accompanied by a Staff Working Document and poses questions for a European wide debate that will run until 28 February 2009. This has first been visible in the 4th Cohesion Report that for the first time mentioned a new concept of “territorial cohesion” which in 2009 was ratified with the Lisbon Treaty.

The Lisbon Strategy is a dynamic strategy in which sustainability has been taken on board (climate change, energy, financial and social sustainability) making sustainable development a key objective for the EU and, in 2010, the EU renewed a number of environmental Directives to ensure they comply with it.

With the adoption of the Lisbon Treaty, territorial cohesion is added to the goals of economic and social cohesion. This new element adds and underlines a number of issues.

- It emphasizes the territorial dimension of access to services of general economic interest;
- It underlines the importance of environmental sustainability;
- It underscores the importance of functional geographies, of the problems of territories with specific geographical features, of the role of city, and of local development approaches;
- It strengthens the role of territorial cooperation and highlights the potential of macro-regional strategies.

Besides, the **Gothenburg Strategy (2009)** defines a number of key environmental objectives and target dates, both political and legislative. Major priorities include climate change, sustainable transport, public health and natural resources management.

The **Sustainable Development Strategy (reviewed in 2009)** has had an important impact on the EU political agenda as revealed by the EU's climate change and energy policies.

The EU has started to integrate the sustainability dimension in many other policy fields also. Climate change and clean energy, sustainable transport, sustainable consumption and production, conservation and management of natural resources, public health, social inclusion, demography and migration, global poverty and sustainable development challenges, education and training, research and development, financing and economic instruments.

Consequently successful management of land use is crucial in order to comply with the main goals of European sustainable development particularly in:

- Contributing to a rapid shift to a low-carbon and low-input economy, based on energy and resource-efficient technologies and sustainable transport and shifts towards sustainable consumption behaviour;
- Intensifying environmental efforts for the protection of biodiversity, water and other natural resources. Evidence shows that the destruction of biodiversity is continuing at a worrying rate. Degradation of ecosystems not only reduces the quality of our lives and the lives of future generations, it also stands in the way of sustainable, long-term economic development;

The next step in defining the future EU Cohesion Policy after 2013 is envisaged by a **5th Cohesion Report** published by the European Commission in October 2010, stressing the importance of providing more support for the less developed EU regions in line with the Union's strong commitment to solidarity and its Treaty aim of reducing regional disparities in levels of development, to foster territorial cooperation in its three dimensions (cross-border, transnational, and inter-regional) and concentration of social exclusion in urban areas.

Within the EU policies we could find specific responses to land use and land take. For instance there are specific reference in a Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development (COM(2001)264); the Commission Communication 'Towards a Thematic Strategy on the Urban Environment' (COM(2004)60); the European Social Fund and the Cohesion Fund Council Regulation (EC) No 1083/2006 as well as the concept of territorial cohesion; Territorial Agenda 2020 - changes in land use (urbanisation, mass tourism, etc.) threaten landscapes and lead to fragmentation of natural habitats and ecological corridors; the Territorial Agenda Action Plan Specific actions relevant in the field of 'Land', in particular are action 2.1d: 'Urban sprawl' and action 2.2 'Territorial impact of EU policies'; the Cohesion Policy (2014-2020) – thematic objective: environmental protection and resource efficiency. Funds flow to infrastructure developments (e.g. in 2000-2006 period – 5100 km road built, 8400 km rail built, etc.); the Cohesion Policy and cities: the urban contribution to growth and jobs in the regions (COM(2006)385), the Europe 2020 (COM(2010)2020), general provisions on the European Regional Development Fund; the Roadmap on Resource Efficient Europe – milestone: sets the goal of no net land-take by 2050. Yet this mandate will mostly likely work against the goals of a number of regions; particularly those seeking to ascend the socio-economic ranks toward the most established European nations; the Rural Development Policy (towards 2020) - priorities include restoring, preserving, and enhancing ecosystems e.g. N2000,

landscapes, soil management, etc.; the Common Transport Policy - development of transport services must take account of their possible effects on the environment; the white paper on transport, the energy efficiency plan and the communication of the EC A Roadmap for moving to a competitive low carbon economy by 2050 constitute the key deliverables under the Resource Efficiency flagship. (COM (2011)112 final)

It outlines the need for raising land use productivity sustainably: improved agricultural and forestry practices increasing the capacity of the sector to reduce GHG and preserve and sequester carbon on soils and forests. This can be achieved for instance through targeted measures to maintain grasslands, restore wetlands and peat lands, low or zero-tillage, to reduce erosion and allow for the development of forests. Agriculture and forestry are also providing the resources for bio-energy and industrial feedstock's.

The European Landscape Convention (Council of Europe, 2000) that deals with the protection, management and planning of all landscapes in Europe.

The European Commission adopted on 17 June 2010 the **Europe 2020 Strategy** the growth strategy for the coming decade. This policy document sets out a vision of Europe's economy for the 21st century. It shows how the EU can come out stronger from the crisis and how it can be turned into a smart, sustainable and inclusive economy delivering high levels of employment, productivity and social cohesion. These three mutually reinforcing priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion. The strategy has five ambitious objectives - on employment, innovation, education, social inclusion and climate/energy.

Considering its objective on climate and energy the EU member states have committed themselves to reduce greenhouse emissions by 20%, increasing the share of renewables in the EU's energy mix to 20% and achieving the 20% energy efficiency target by 2020.

In February 2011 the EU council reconfirmed the EU objective of reducing GHG by 80-95% by 2050 compared to 1990 in the context of necessary reductions according to the Intergovernmental panel on climate change by developed countries as a group.

Although the cohesion policy has already significantly reduced economic, social and environmental disparities within the EU it has been observed that it could be more effective and it could play a crucial role in the context of the current economic crisis and to guarantee the compliance with the EU strategy 2020.

The commission intends to adopt a Common Strategic Framework delineating a comprehensive investment strategy, which translates the targets and objectives of Europe 2020 into investment priorities for Cohesion policy, covering structural funds, the cohesion fund, European fisheries fund and the European agricultural fund for rural development. Each member state would present their overall strategy for cohesion policy in line with the national reform programmes and the thematic and country specific recommendations for Europe 2020.

Land as a resource

European economies depend on natural resources, including raw materials and space (land resources). The EU thematic strategy on the sustainable use of natural resources

includes space as a resource. It applies to areas of land and maritime space that are needed for production purposes (e.g. minerals, timber, food,..) and for various socio-economic activities. These interests are often competing for the same territorial resource.

Policy decisions that shape land-use involve trade-offs between sectoral interests, including industry, transport, energy, mining, agriculture, forestry (SOER, 2010) as well as protection/ conservation and recreation activities. There is a lack of a comprehensive and integrated approach that takes those trade-offs between many sectoral, social and environmental issues into consideration.

We could suggest many examples of trade-offs between different land uses and territorial conflicts. For instance, the territorial conflicts between hydropower generation and goals of the Water Framework Directive, the indirect land-use effects of bioenergy production, the wind power generation and landscape or and impacts on bird life, and at a large scale the urban sprawl phenomena and the goal of polycentrism.

According to the EEA, “these trade-offs can be tackled through integrated planning for land use and territorial planning, sectoral policies, as well as targeted policy instruments, such as protected area networks.” (EEA, 2010: 5). Similarly it is expected that the integration of the European Landscape Convention as a tool in territorial planning would become an important contribution to the planning process. Along these lines, institutional arrangements dictating land use policy in Europe include the EU objective for Territorial Cohesion – with which this project is closely connected to – the Water Framework Directive, Common Agricultural Policy (CAP), Natura 2000, and with an increasing importance, Energy 2020. Important tools for informing, monitoring and evaluating these policies and programmes are Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), and most importantly, the advent of the Corine land cover inventory (EEA, 2010).

2.1. EU Strategies

Topic: Sustainable Development Strategies

EU Strategy for Sustainable Development

Objectives:

- Sustainable development is linked to a successful management of land use.
- The EU's climate change and energy policies are evidence of the impact that sustainable development strategy has had on the political agenda.
- The EU has started to integrate the sustainability dimension in many other policy fields also.
- Climate change and clean energy, Sustainable transport, Sustainable consumption and production, Conservation and management of natural resources, Public health, Social inclusion, demography and migration, Global

poverty and sustainable development challenges, Education and training, Research and development, Financing and economic instruments.

- Main goals:
 - Contributing to a rapid shift to a low-carbon and low-input economy, based on energy and resource-efficient technologies and sustainable transport and shifts towards sustainable consumption behaviour;
 - Intensifying environmental efforts for the protection of biodiversity, water and other natural resources. Evidence shows that the destruction of biodiversity is continuing at a worrying rate. Degradation of ecosystems not only reduces the quality of our lives and the lives of future generations, it also stands in the way of sustainable, long-term economic development;
 - Promoting social inclusion. The most vulnerable in society are at risk of being the most badly hit by the economic crisis and its effects may linger longest for them unless effective measures are provided.
 - Strengthening the international dimension of sustainable development and intensifying efforts to combat global poverty.

Potential indicators:

The Sustainable Development Indicators (SDIs) are used to monitor the EU Sustainable Development Strategy (EU SDS) in a report published by Eurostat every two years. They are presented in ten themes.

Headline indicators

Of more than 100 indicators, eleven have been identified as headline indicators. They are intended to give an overall picture of whether the European Union has achieved progress towards sustainable development in terms of the objectives and targets defined in the strategy. For a more complete picture it is necessary to look at the progress of all indicators within a theme.

- Growth rate of real GDP per capita.
- Resource productivity.
- Population at-risk-of-poverty or exclusion.
- Employment rate of older workers.
- Healthy life years and life expectancy at birth, by gender.
- Greenhouse gas emissions.
- Share of renewable energy in gross final energy consumption.
- Energy consumption of transport relative to GDP.
- Common bird index.
- Fish catches taken from stocks outside safe biological limits.
- Official development assistance as share of gross national income.

Reference source: <http://ec.europa.eu/environment/eusd/>

Regional reference: NUTS 0 National level.

Time reference: 1990 -2009. On 2010 midterm review of the EU Rural Development Policy.

Significance for EU-LUPA: Basis for the indicators used in the characterization of land use functions at NUTSX in the European territory and their policy relevance.

Sustainable development strategies at country level could give light to case studies interpretation. Besides at Supra-national level there are two interesting documents that could be addressed: Agenda 21 for the Baltic Sea Region - Baltic 21 (1998)³ ; Mediterrean Strategy for Sustainable Development (2005)⁴ ; Nordic Strategy for Sustainable Development (2005)⁵

Topic: Territorial Development

European Spatial Development Perspective (ESDP)

Objectives: Long term sustainability of Europe's land use.

The objectives of the ESDP are in line with the three following fundamental goals of European policy:

- Economic and social cohesion;
- Conservation of natural resources and cultural heritage; and
- More balanced competitiveness of the European territory.
- Development of a balanced and polycentric urban system and a new urban-rural relationship;
- Securing parity of access to infrastructure and knowledge; and
- Sustainable development, prudent management and protection of nature and cultural heritage.

Potential indicators: See ESPON project 2.3.1.

Reference source:

http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/som_en.htm

Regional reference: The objectives set out in the ESDP should be pursued by the European institutions and government and administrative authorities at national, regional and local level.

Time reference: 1999.

Significance for EU-LUPA: Understanding sustainability of land use in Europe.

Territorial Agenda of the European Union (TAEU)

Objectives:

The Ministers of the European Union responsible for spatial planning and development, on the occasion of the Informal Ministerial Meeting on Urban Development and Territorial Cohesion,

³ http://www.baltic21.org/attachments/b21_main_report__no._1_98____english.pdf

⁴ http://www.mzopu.hr/doc/Mediterranean_str_28022006.pdf

⁵ <http://www.norden.org/pub/ovrigt/baeredygtig/uk/ANP2004782.pdf>

held under the German EU Presidency in Leipzig on 24 / 25 May 2007, agreed on the Territorial Agenda of the European Union (TA) and entrusted Portugal with the task of preparing the First Action Programme (AP1) for its implementation.

This agreement culminates a process of cooperation between the Ministers aimed at establishing a common policy framework for addressing territorial matters within the European Union. In June 2006, a dialogue with the major stakeholders was started, giving the TA a broad basis of consensus. The TA takes on and relates in different ways to several other relevant EU policy documents. Key aims are:

- Strengthen territorial cohesion
 - Development of a balance and polycentric urban system.
 - Strengthening polycentric development and Innovation throughout networking of cities and regions.
 - New forms of partnerships and territorial governance between rural and urban areas.
 - Securing parity access to knowledge and infrastructure.
 - Promote regional clusters of competition and innovation in Europe.

- Strengthen trans-European networks
 - Sustainable development, prudent management and protection of nature and cultural heritage.
 - Trans-European risk management including the impacts of the climate change.

- Strengthen ecological structures and cultural resources as the added value for development

Potential indicators: n/a

Reference source: <http://www.eu-territorial-agenda.eu>

Regional reference: European institutions and government and administrative authorities at national, regional and local level.

Time reference: 2007-2011.

Significance for EU-LUPA: Changes in land use (urbanisation, mass tourism, etc.) threaten landscapes and lead to fragmentation of natural habitats and ecological corridors. Framing land use and land use changes within spatial planning and development.

Action programme for the implementation of the Territorial Agenda of the European Union

Objectives:

Solidarity between regions and territories

The adoption of this principle reinforces solidarity between States and regions and expresses the commitment to apply a cohesive and integrated approach adapted to

territorial diversity when influencing or deciding on the priorities and funding of territorial and urban development policies at European Union, national, regional and local levels.

Multi-level governance

The adoption of this principle expresses the commitment to structure proper channels of communication, participation and cooperation in order to make the territorial assessment, planning and management a fully democratic, transparent and efficient process.

Integration of policies

The adoption of this principle expresses the acknowledgement of the specific responsibilities of sectoral policy-makers and the will to cooperate with and influence them in order to ensure a stronger territorial and urban focus when conceiving and delivering the thematic policies. The goal is to better fine-tune specific thematic actions, to facilitate their coordination and to reduce undesired externalities.

Cooperation on territorial matters

The adoption of this principle recognises the importance to develop and support interregional, transnational and cross-border cooperation initiatives, aimed to actively promote territorial integration. Territorial cooperation must consider the territorial and urban dimensions of economic and social development and include the EU neighbouring countries, namely in the context of EU Programmes for European Territorial Cooperation.

Subsidiarity

The adoption of this principle states that the full and efficient achievement of the aims of the Territorial Agenda can best be pursued according to the institutional arrangements within each Member State, through a strong involvement of national, regional and local powers and stakeholders and a dialogue with the European Commission and the other European institutions.

Potential indicators:

Action Plan 1, currently under implementation. The main purpose of the First Action Programme (AP1) is to provide a framework to facilitate the implementation of the Territorial Agenda. First Action Programme takes in consideration the review of the Territorial Agenda in the first half of 2011.

Reference source: <http://www.eu-territorial-agenda.eu>

Regional reference: European institutions and government and administrative authorities at national, regional and local level.

Time reference: 2007.

Significance for EU-LUPA: understanding land use and land use changes within spatial planning and development

The Lisbon Treaty

Objectives:

The Lisbon Strategy aims at improving the competitiveness of the European economy in parallel with a clear commitment to the European social model and to the management of environmental pressures and conflicts. The Lisbon Strategy emphasises the objectives of growth and jobs, setting out a large number of measures and goals in a wide range of different areas. While to date territorial cohesion is not explicitly considered within the objectives of the Lisbon Strategy, its evaluation stresses the relevance of the territorial approach and the role of the regional and local administrative levels in achieving the Lisbon's objectives First Action Programme for the Implementation of the Territorial Agenda of the European Union and goals. A multi-level and coordinated approach between the European, national and regional/local levels, in line with the subsidiarity principle, is seen as a key factor of success for territorial governance, an issue that is central and cross-cutting in the implementation of the Territorial Agenda.

The Lisbon Strategy is a dynamic strategy in which sustainability has been taken on board (climate change, energy, financial and social sustainability).

With the adoption of the Lisbon Treaty, territorial cohesion is added to the goals of economic and social cohesion. This new element adds and underlines a number of issues.

- It emphasizes the territorial dimension of access to services of general economic interest.
- It underlines the importance of environmental sustainability.
- It underscores the importance of functional geographies, of the problems of territories with specific geographical features, of the role of city, and of local development approaches.
- It strengthens the role of territorial cooperation and highlights the potential of macroregional strategies.

The Lisbon Treaty (2007) made sustainable development a key objective for the EU and, in 2010, the EU renewed a number of environmental Directives to ensure they comply with the Lisbon Treaty.

Potential indicators:

See ESPON Project 3.3 y TO 3. Indicators:

- GDP/capita.
- GDP/person employed.
- Employment rate of 15-64 (EU 2020 range 20-64).
- Employment rate of elderly.
- Gross expenditure on research and development.
- Dispersion of regional unemployment rates.
- Long-term unemployment rate.
- Regional Unemployment, 2008.
- R&D Expenditure as Percentage of GDP, 2006.
- Composite Economic Lisbon Performance, 2006; Change in Composite Lisbon Performance 2000-2006.
- Tertiary Educated People in Labour Force, 2007.

- Share of Renewables in Gross Final Consumption, 2005.
- Wind Power Potential, 2005.

Reference source: http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=FXAC07306

Regional reference: NUTS 2.

Time reference: 2009.

Significance for EU-LUPA: Basis for the indicators used in the land use characterization in the European territory and their policy relevance. Evaluation of Land Use Efficiency by means of the correlation between land use change patterns and trends with regional performance.

Gotteborg objectives

Objectives:

The Gothenburg Strategy defines a number of key environmental objectives and target dates, both political and legislative. Major priorities include climate change, sustainable transport, public health and natural resources management. These areas are most relevant to the territorial challenges and priorities set in the Territorial Agenda.

Potential indicators:

See ESPON Project 3.3 y TO 3. Indicators:

- GDP/capita.
- GDP/person employed.
- Employment rate of 15-64 (EU 2020 range 20-64).
- Employment rate of elderly.
- Gross expenditure on research and development.
- Dispersion of regional unemployment rates.
- Long-term unemployment rate.
- Regional Unemployment, 2008.
- R&D Expenditure as Percentage of GDP, 2006.
- Composite Economic Lisbon Performance, 2006; Change in Composite Lisbon Performance 2000-2006.
- Tertiary Educated People in Labour Force, 2007.
- Share of Renewables in Gross Final Consumption, 2005.
- Wind Power Potential, 2005.

Reference source: http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=FXAC07306

Regional reference: NUTS 2.

Time reference: 2009.

Significance for EU-LUPA: Basis for the indicators used in the land use characterization in the European territory and their policy relevance. Evaluation of Land Use Efficiency by means of the correlation between land use change patterns and trends with regional performance.

Europe 2020 strategy

Objectives:

Europe 2020 is the EU's growth strategy for the coming decade. In a changing world, we want the EU to become a smart, sustainable and inclusive economy. These three mutually reinforcing priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion.

Five ambitious objectives on employment, innovation, education, social inclusion and climate/energy.

Potential indicators: The strategy provides the following indicators:

- Employment rate by gender, age group 20-64.
- Gross domestic expenditure on R&D (GERD).
- Greenhouse gas emissions, base year 1990.
- Share of renewables in gross final energy consumption.
- Energy intensity of the economy (proxy indicator for Energy savings, which is under development).
- Early leavers from education and training by gender.
- Tertiary educational attainment by gender, age group 30-34.
- Population at risk of poverty or exclusion (union of the three sub-indicators below).
- Persons living in households with very low work intensity.
- Persons at risk of poverty after social transfers.
- Severely materially deprived persons.

Reference source: http://europa.eu/press_room/pdf/complet_en_barroso_007_-_europe_2020_-_en_version.pdf

Regional reference: NUTS 1 National level.

Time reference: 2010.

A Resource Efficient Europe 2011: Flagship initiative under the Europe 2020 Strategy
Milestone: sets the goal of no net land-take by 2050. Yet this mandate will mostly likely work against the goals of a number of regions; particularly those seeking to ascend the socio-economic ranks toward the most established European nations.

Significance for EU-LUPA: Basis for the indicators used in the land use characterization in the European territory and their policy relevance. Evaluation of Land Use Efficiency by means of the correlation between land use change patterns and trends with regional performance.

Thematic strategy on the sustainable use of natural resources

Objectives:

European economies depend on natural resources, including raw materials and space (land resources). The EU thematic strategy on the sustainable use of natural resources includes space as a resource. It applies to areas of land and maritime space that are

needed for production purposes (e.g. minerals, timber, food) and for various socio-economic activities. These interests are often competing for the same territorial resource.

It aims to launch a debate on a framework for using resources which supports the objectives of the Lisbon strategy and the EU's sustainable development strategy.

Potential indicators:

The relations between resource use and environmental impact are only partially known at present. Furthermore they change with time, for example, as a result of technical or social developments. Differences in regional conditions and use patterns need also to be considered. In addition, environmental impacts related to the use of different resources vary widely. So, initially the strategy has to determine which resources at any given time are of biggest concern, e.g. the resources with the greatest potential for environmental improvement, taking into account technological possibilities and socio-economic aspects. To perform the functions described above, and to take account of continuously evolving patterns of environmental impacts of resource use, the strategy will comprise three strategic elements that will apply continuously throughout its life:

Knowledge gathering

The entire life-cycle of resources, from their extraction, through their use in the production of goods and services and the subsequent use phase, to the waste phase, gives rise to environmental impacts. Any given raw material can take numerous different pathways through the economy. Aluminium, for example, can be transformed into goods as diverse as window-frames, aircraft bodies and beverage cans, and these all interact in very different ways with the environment. Knowledge about these pathways and impacts is presently dispersed between many actors, and significant gaps exist. The Resources Strategy has to ensure that knowledge is readily available to decision-makers and that gaps are being filled.

Policy assessment

The use of natural resources is influenced by numerous environmental policies, including for example strategies on the marine environment, soil protection, biodiversity and the urban environment, as well as climate change policy, the water framework directive and many others. In addition, many non-environmental policies strongly influence resource use - sometimes unintentionally. Examples include fiscal, transport, agricultural and energy policies. However, there is currently no mechanism for assessing how far policy-choices in these different areas are compatible with the overall aim of decoupling economic growth from the impacts of resource use. The Resources Strategy will make these assessments, raise awareness of potential trade-offs, and suggest alternatives wherever possible.

Policy integration

To bring the strategy to life, concrete actions will need to be taken on the basis of the information generated by the previous two strategic elements. This will involve political judgements on the relative importance of different impacts and

environmental targets, taking into account wider sustainable development considerations and identifying measures with the greatest potential for environmental improvement of resource use. The Resources Strategy will therefore work towards increasing the integration of resource-related environmental issues into other policies that influence the environmental impacts of the use of natural resources, in particular under the Cardiff Process.

Reference source: <http://ec.europa.eu/environment/natres/>

Regional reference: n/a

Time reference: 2005.

Significance for EU-LUPA: Potential challenges in relation to land use consumption as natural resource.

Thematic strategy on the urban environment

Objectives:

The Thematic Strategy on the Urban Environment was adopted by the Commission on 11 January 2006.

The Strategy is accompanied by an Impact Assessment covering its social, economic and environmental consequences.

The Strategy is based on the results of extensive consultations with a wide range of stakeholders. Consultations began in 2002 with expert working groups on different issues, a large meeting with stakeholders and research reports. See here for details.

An interim Communication "Towards a Thematic Strategy on the Urban Environment" was adopted in February 2004 to seek the views of stakeholders on the ideas under consideration.

To develop further some of the key ideas contained in the interim Communication, expert working groups were established in 2004 to consider technical issues for environmental management plans, sustainable urban transport plans and for future priorities for research and training. An additional public consultation exercise was held in autumn 2005.

Throughout the development of the Thematic Strategy, the EU Expert Group on the Urban Environment has also been consulted.

Potential indicators:

The main actions under the strategy are:

- Guidance on integrated environmental management and on sustainable urban transport plans. The guidance will be based on cities' experiences, expert views and research, and will help ensure full implementation of EU legislation. It will provide sources of further information to help prepare and implement action plans.
- Training. A number of Community programmes will provide opportunities for training and capacity-building for local authorities to develop the skills needed for managing the urban environment. Moreover, support will be

offered for local authorities to work together and learn from each other. These should be exploited both by the Member States and local authorities.

- Support for EU wide exchange of best practices. Consideration will be given for the establishment of a new European programme to exchange knowledge and experience on urban issues under the new Cohesion Policy. The Commission will closely cooperate with Member States and local authorities. This work will be based on a pilot network of focal points on urban issues (the “European Knowledge Platform”) which offers advice to local authorities across Europe.
- Commission internet portal for local authorities. The feasibility of creating a new internet portal for local authorities on the Europe website will be explored to provide better access to the latest information.

Reference source: http://ec.europa.eu/environment/urban/thematic_strategy.htm

Regional reference: n/a

Time reference: 2006.

Significance for EU-LUPA: Policy context with regard to urban environment.

2.2. EU Policies

Topic: Regional Policy

Cohesion Policy 2007-2013

Objectives:

Cohesion Policy has one single objective: to promote the harmonious development of the Union and its regions. The policy supports this development with a clear investment strategy that increases competitiveness, expands employment and improves well-being, and protects and enhances the environment.

This approach provides a close link to the Europe 2020 objectives of smart, inclusive and sustainable growth.

While the overall objective is the same in all Member States and regions, Cohesion Policy provides more support for the less developed EU regions in line with the Union's strong commitment to solidarity and its Treaty aim of reducing regional disparities in levels of development.

Cohesion Policy will continue to foster territorial cooperation in its three dimensions (cross-border, transnational, and inter-regional).

Urban problems either related to environmental degradation or social exclusion deserve a particular response and a direct involvement of the level of governments directly concerned.

Cohesion Policy (2014-2020) – thematic objective: environmental protection and resource efficiency. Funds flow to infrastructure developments (e.g. in 2000-2006 period – 5100 km road built, 8400 km rail built, etc.)

Potential indicators: EU 2020 Indicators.

Main challenges with territorial dimension: accelerating globalization and market integration, ageing and migration, climate change and changing energy paradigm.

Reference source: http://ec.europa.eu/regional_policy 5th Cohesion Report.

ESPON 2.2.1 addressed the spatial impacts of Structural Funds with a particular focus on polycentricity and territorial cohesion in Europe.

TERCO & INTERCO ESPON Projects.

Regional reference: NUTS 2.

Time reference: up to date 2010.

Significance for EU-LUPA:

Structural Funds Eligible areas in the EU under the Convergence Objective and the European Competitiveness and Employment Objective.

Identification of linkages between certain land use patterns and regions under the convergence objective.

Territorial impacts of structural funds. Cohesion Policy as driver of Land Use Changes.

The European Fund for Regional Development (EFRD)

Regional policies: the European Social Fund (ESF)

Regional policies: Cohesion Fund

Objectives:

Convergence objective is to promote growth-enhancing conditions and factors leading to real convergence for the least-developed Member States and regions.

Regional Competitiveness and Employment objective aims at strengthening competitiveness and attractiveness, as well as employment, through a two-fold approach. First, development programmes will help regions to anticipate and promote economic change through innovation and the promotion of the knowledge society, entrepreneurship, the protection of the environment, and the improvement of their accessibility. Second, more and better jobs will be supported by adapting the workforce and by investing in human resources.

European Territorial Co-operation objective will strengthen cross-border co-operation through joint local and regional initiatives, trans-national co-operation aiming at integrated territorial development, and interregional co-operation and exchange of experience.

Potential indicators:

- Regionalization of EU27 according to Convergence objective.
- Percentage of population living in cross-border areas .

Reference source: http://ec.europa.eu/regional_policy/funds/feder/index_en.htm

Regional reference: NUTS 2.

Time reference: 2000-2006.

Significance for EU-LUPA: Investments as potential driver of land use changes.

Topic: Rural development

Rural Development policy 2007-2013

Objectives:

Council Regulation (EC) No. 1698/2005.

Under this Regulation, rural development policy for 2007 to 2013 is focused on three themes (known as "thematic axes"). These are:

- Improving the competitiveness of the agricultural and forestry sector.
- Improving the environment and the countryside.
- Improving the quality of life in rural areas and encouraging diversification of the rural economy.

The Strategic Guidelines for Rural Development 2007-2013 consider that rural development policies must complement other policies, such as cohesion and employment policies, while also playing an important role in the sustainable development of rural areas and in the achievement of a more balanced territorial model within the European Union.

Rural Development Policy (towards 2020) - priorities include restoring, preserving, and enhancing ecosystems e.g. N2000 , *landscapes*, soil management, etc.

Potential indicators: to be defined.

Reference source: http://ec.europa.eu/agriculture/rurdev/index_en.htm

Regional reference: NUTS 2

Time reference: 2007-2013. On 2010 midterm review of the EU Rural Development Policy.

Significance for EU-LUPA: Territorial Impact of agricultural policies on the environment and land uses. CAP and Rural Development Policy as driving forces behind land use changes and dynamics.

Common Agricultural Policy (CAP)

Objectives:

The initial objectives were set out in Article 39 of the Treaty of Rome:

1. To increase productivity, by promoting technical progress and ensuring the optimum use of the factors of production, in particular labour;
2. To ensure a fair standard of living for the agricultural Community;
3. To stabilise markets;
4. To secure availability of supplies;
5. To provide consumers with food at reasonable prices.

The CAP recognised the need to take account of the social structure of agriculture and of the structural and natural disparities between the various agricultural regions and to effect the appropriate adjustments by degrees.

The CAP needs reforming (2008-2013): so as to better address the challenges of: food security; climate change and sustainable management of natural resources; and keeping the rural economy alive.

- To help the farming sector become more competitive and to deal with the economic crisis and increasingly unstable farm-gate prices.
- To make the policy fairer, greener, more efficient and more effective and more understandable.

From the financial perspective, the CAP along side the Cohesion Funds, is the most important policy measure of the EU.

Potential indicators: Measures to maintain grasslands, restore wetlands and peat lands, low or zero tillage, to reduce erosion and allow for the development of forests. Agriculture and forestry are also providing the resources for bio-energy and industrial feedstocks are addressed in the CAP legislative proposals for 2013, of which the positive impacts have not yet been taken into account in the analysis.

Reference source: <http://www.europolitics.info/sectoral-policies/agriculture-a-fisheries.html?view=contenu>

Regional reference: See ESPON 2.1.3: Territorial impact of CAP and Rural Development Policy.

Time reference: 2008-2013.

Significance for EU-LUPA: Territorial Impact of agricultural policies on the environment and land uses. CAP and Rural Development Policy as driving forces behind land use changes and dynamics.

Topic: Energy policy

Energy policy for a competitive Europe

Objectives:

Energy policy for a competitive Europe: The Treaty of Lisbon places energy at the heart of European activity. It effectively gives it a new legal basis which it lacked in the

previous treaties (Article 194 of the Treaty on the Functioning of the European Union (TFEU)).

The aims of the policy are supported by market-based tools (mainly taxes, subsidies and the CO2 emissions trading scheme), by developing energy technologies (especially technologies for energy efficiency and renewable or low-carbon energy) and by Community financial instruments. Furthermore, in December 2008 the EU adopted a series of measures with the objective of reducing the EU's contribution to global warming and guaranteeing energy supply.

- Renewal energy.
- Energy efficiency.
- Security of supply.
- Technology and innovation.
- Trans-European Networks (TEN).

Potential indicators:

- *Renewable potential:* Map 16 Wind potential on NUTS 0 (source EWEA, Meteotest, WASP www.wasp.dk). Map 22 Biomass potential at NUTS 3 in 2002 (GJ).
- *Energy efficiency:* Map 34 Number of Regional Energy Agencies by NUTS 2. Source: European Commission, ManagEnergy Initiative. Table 7 Summary of main energy features for new Member States.
- *Security of supply:* to be defined.
- *Technology and innovation:* to be defined.
- *Energy infrastructures:*
 - Making Europe's electricity grid fit for 2020.
 - Diversified gas supplies to a fully interconnected and flexible EU gas network.
 - Ensuring the security of oil supply.
 - Roll-out of smart grid technologies.

Reference source: http://ec.europa.eu/energy/index_en.htm

Energy infrastructures:

http://ec.europa.eu/energy/infrastructure/strategy/2020_en.htm

Regional reference: See ESPON 2.1.4. Territorial trends of energy services and networks and territorial impact of EU energy policy. *Energy infrastructures:* See TIPTAP - Territorial Impact Package for Transport and Agricultural Policies (July 2008- October 2009) under Priority 1 of the ESPON 2013 Programme.

Time reference: 2002 and 2010 for *energy infrastructures*.

Significance for EU-LUPA: Evaluation of Land Use Efficiency by means of the correlation between land use change patterns and trends with regional performance. Infrastructures as driving forcers behind land use changes and dynamics.

Topic: Transport

Transport Policy

Objectives:

Transport is one of the European Union's (EU) foremost common policies. It is governed by Title VI (Articles 90 to 100) of the Treaty on the Functioning of the European Union. Since the Rome Treaty's entry into force in 1958, this policy has been focused on removing borders between Member States and thus contributing to the free movement of individuals and of goods. Its principal aims are to complete the internal market, ensure sustainable development, extend transport networks throughout Europe, maximise use of space, enhance safety and promote international cooperation. The Single Market signalled a veritable turning point in the common policy in the area of transport. Since the 2001 White Paper, which was revised in 2006, this policy area has been oriented towards harmoniously and simultaneously developing the different modes of transport, in particular with co-modality, which is a way of making use of each means of transport (ground, waterborne or aerial) to its best effect.

Trans-European Networks (TEN): Development of the TENs is contributing to economic and social cohesion. The requirements of the peripheral regions have been taken into account in this development, and the emphasis placed on airports on islands and in remote areas. The next step is to enhance the role of ports so as to assist the integration of shipping into a global network. It is also necessary, in the peripheral regions, to undertake complementary investment in secondary networks, in order that those regions may gain maximum benefit from the TENs.

Potential indicators:

See Cohesion and Transport policy

http://europa.eu/legislation_summaries/transport/bodies_objectives/l24207_en.htm

Land take by transport infrastructure (<http://www.eea.europa.eu/data-and-maps/indicators/land-take-by-transport-infrastructure-1>)

Reference source:

http://europa.eu/legislation_summaries/transport/bodies_objectives/l24484_en.htm

Regional reference: n/a

Time reference: 2007.

Significance for EU-LUPA: Transport policy and urban sprawl.

Green Paper: Towards a new culture for urban mobility

Objectives:

This Green Paper is the product of wide public consultation initiated in 2007. It opens up a second consultation process which lasts until 15 March 2008. With urban mobility being an asset for growth and employment, as well as an essential condition for a sustainable development policy, the Commission will use the consultation undertaken to subsequently propose an overall strategy in the form of an action plan.

The target audience for the consultation process is vast: it includes people living in towns and cities, transport users, transport company employers and employees, industry, public authorities and relevant associations. The resulting strategy will also be supported by the experience acquired by the Commission in this field with the CIVITAS initiative and with the 1995 Green Paper and its communication on "a Citizens Network".

A central idea of the forthcoming strategy is the need to integrate the various urban mobility policies in a single approach. Examples of European added value could be to:

- Promote the exchange of good practice at all levels: local, regional, national and European.
- Underpin the establishment of common standards and harmonisation.
- Offer financial support to those who are in greatest need of such support.
- Encourage research, the application of which would enable an improvement in mobility.
- Simplify legislation, if necessary.

The Commission proposes to encourage the emergence of a real "urban mobility culture" integrating economic development, accessibility and improvement to quality of life and the environment.

Potential indicators:

For this purpose, the Green Paper identifies five challenges:

- Improve fluidity in towns.
- Reduce pollution.
- Intelligent urban transportation.
- Accessibility.
- Safety and security.

The Green Paper also stresses the need to elicit an urban mobility culture by means of education, training and raising awareness.

Reference source:

http://europa.eu/legislation_summaries/transport/bodies_objectives/l24484_en.htm

Regional reference: n/a

Time reference: 2007.

Significance for EU-LUPA: Transport policy and urban sprawl

White paper: European transport policy for 2010

Objectives:

This document aims to strike a balance between economic development and the quality and safety demands made by society in order to develop a modern, sustainable transport system for 2010.

The Commission has proposed 60 or so measures to develop a transport system capable of shifting the balance between modes of transport, revitalising the railways, promoting transport by sea and inland waterway and controlling the growth in air transport. In this way, the White Paper fits in with the sustainable development strategy adopted by the European Council in Gothenburg in June 2001.

The European Community found it difficult to implement the common transport policy provided for by the Treaty of Rome. The Treaty of Maastricht therefore reinforced the political, institutional and budgetary foundations for transport policy, inter alia by introducing the concept of the trans-European network (TEN).

The Commission's first White Paper on the future development of the common transport policy, published in December 1992, put the accent on opening up the transport market. Ten years later, road cabotage has become a reality, air safety standards in the European Union are now the best in the world and personal mobility has increased from 17 km a day in 1970 to 35 km in 1998. In this context, the research framework programmes have been developing the most modern techniques to meet two major challenges: the trans-European high-speed rail network and the Galileo satellite navigation programme.

However, the more or less rapid implementation of Community decisions according to modes of transport explains the existence of certain difficulties, such as:

- Unequal growth in the different modes of transport. Road now takes 44% of the goods transport market compared with 8% for rail and 4% for inland waterways. On the passenger transport market, road accounts for 79%, air for 5% and rail for 6%.
- Congestion on the main road and rail routes, in cities and at certain airports.
- Harmful effects on the environment and public health and poor road safety.

Economic development combined with enlargement of the European Union could exacerbate these trends.

Potential indicators: n/a

Reference source:

http://europa.eu/legislation_summaries/transport/bodies_objectives/l24007_en.htm

Regional reference: n/a

Time reference: 2010

Significance for EU-LUPA: Transport policy and territorial cohesion.

Topic: Environmental Policy

The European Environment Agency (EEA): Indicators and fact sheets about Europe's environment. <http://www.eea.europa.eu/data-and-maps/indicators/#Outlook>

Climate Change

Objectives:

EU policies on climate change adaptation are directly relevant to current and future land-use practices and economic sectors depending on this.

EU Climate Change policy key objectives: mitigation throughout reduction of CO₂ emissions and adaptation strategies

Potential indicators: Renewal energy production and greenhouse gas emissions.

Reference source: <http://www.eea.europa.eu/themes/climate/policy-context>

Regional reference: unknown.

Time reference: 2007.

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

Land use changes are one of the key drivers of environmental change.

Land use impacts on climate, biodiversity and ecosystems services. It can also cause degradation and pollution of water, soil and air: It has a major role in climate change at the global, regional and local scales, by increasing the release of CO₂ to the atmosphere when soils and natural vegetation are disturbed. But also with regard to the emissions of other green house gasses, especially methane (by alteration of surface hydrology and elimination of forest cover), and nitrous oxide (through agriculture).

On the other hand environmental policy is a driver for land use changes in Europe and also the cross-cutting nature of land use is emphasized by the Environmental policies.

Water Framework Directive 2000/60

Objectives:

Integrated river basin management for Europe. The key objectives of the WFD are the following:

- Prevent deterioration of the status of waters.
- Protect, enhance and restore all bodies of surface waters and ground waters.
- Promote sustainable water use (through effective pricing of water services).
- Progressively reduce discharges of priority substances and cease or phase discharges of priority hazardous substances for surface waters.
- Ensure progressive reduction of pollution of groundwater.
- Mitigate the effects of floods and droughts.
- Ensure sufficient supply of water.
- Protect the marine environment.

Efforts to modify land-use practices to reduce non-point pollution to water include integrated river basin management and in particular the Nitrates Directive.

Integrated river basin management plans are mandatory and need to include land use in the catchments.

Potential indicators: to be identified; in relation to mitigation of floods and droughts.

Reference source: http://ec.europa.eu/environment/policies_en.htm

Regional reference: unknown.

Time reference: 2000.

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

Land use changes are one of the key drivers of environmental change.

Land use impacts on climate- precipitation, biodiversity and water ecosystems services. It can also cause degradation and pollution of water, alteration of surface hydrology and elimination. On the other hand environmental policy is a driver for land use changes in Europe and also the cross-cutting nature of land use is emphasized by the Environmental policies.

EU Floods Directive

Objectives:

Flooding caused by the construction of impervious surfaces (e.g. buildings and roads) and provoked by extreme weather events is addressed by a new European Floods Directive.

Directive 2007/60/EC on the assessment and management of flood risks entered into force on 26 November 2007. This Directive now requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.

The directive requires flood risk mapping and affects land use through flood management plans for affected floodplain areas.

Potential indicators: to be identified: in relation to mitigation of flood risk.

Reference source: http://ec.europa.eu/environment/water/flood_risk/index.htm

Regional reference: unknown.

Time reference: 2007

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

Land use changes are one of the key drivers of environmental change.

Environmental policy is a driver for land use changes in Europe and the cross-cutting nature of land use is emphasized by the Environmental policies.

Coastal zone policy

Objectives: Integrated Coastal Zone Management (ICZM).

The main objective is to improve the planning, management and use of Europe's coastal zones, which promotes sustainable management through co-operation and integrated planning, involving all the relevant players at the appropriate geographic level.

During 2006 and the beginning of 2007 the Commission reviewed the experience with the implementation of the EU ICZM Recommendation. The Commission Communication of 7 June 2007, COM(2007)308 final presents the conclusions of this evaluation exercise and sets out the main policy directions for further promotion on ICZM in Europe:

Commission Communication on the evaluation of Integrated Coastal Zone Management (ICZM) in Europe, COM(2007)308 final of 7 June 2007.

Potential indicators: to be identified.

Reference source: <http://ec.europa.eu/environment/iczm/home.htm>

Regional reference: unknown.

Time reference: 2007.

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

Land use changes are one of the key drivers of environmental change.

Environmental policy is a driver for land use changes in Europe and also the cross-cutting nature of land use is emphasized by the Environmental policies.

EU Landfill Directive

Objectives:

The aim of the Directive is to provide for measures, procedures and guidance to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment including the greenhouse effect, as well as any resulting risk to human health, from land filling of waste, during the whole life-cycle of the landfill. This is to be achieved through stringent operational and technical requirements on the waste and landfills.

Potential indicators: Landfill waste levels.

Reference source: http://ec.europa.eu/environment/policies_en.htm

Regional reference: n/a

Time reference: 1999.

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

Nature conservation and Environmental Protection

Objectives:

NATURA 2000 network and LIFE programme contains provisions which put particular emphasis on links with spatial development and, in particular, land use. The EU-wide designation of protected areas is intended to establish a coherent integrated biological network which intervenes in land use.

Potential indicators: Spatial distribution of Natura 2000 sites, LIC's & ZEPA's. Correlation between land use changes and Natura 2000 network.

Reference source: <http://www.natura.org>

Regional reference: ESPON 2.4.1 interpreted the CORINE Land Cover data, combined socio-economic data, information on infrastructure and data of the Natura 2000 network and proposed a feasible. Spatial information (vector) NUTS 3.

Time reference: up to date 2010.

Significance for EU-LUPA:

Identification of environmental challenges derived from land use patterns that should be addressed by policy recommendations

On the other hand environmental policy is a driver for land use changes in Europe and also the cross-cutting nature of land use is emphasized by the Environmental policies.

EU Landscape convention

Objectives:

The European Landscape Convention - also known as the Florence Convention, - promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues.

Potential indicators: quality, protection and management objectives

Reference source:

http://www.coe.int/t/dg4/cultureheritage/heritage/Landscape/default_en.asp

Regional reference: unknown

Time reference: came into force in 2004

Significance for EU-LUPA: multifunctionality of land use

2.3. Institutional reports

Topic: Cohesion policy and territorial development

Green Paper on Territorial Cohesion

Objectives:

The green paper constitutes an open debate on territorial cohesion, in response to the demands from the European Parliament, the ministerial meeting in Leipzig in 2007 and the contributions that many stakeholders made during the public consultation on the 4th Cohesion Report. The paper also builds on the Territorial Agenda and its Action Programme, during 2007.

The goal a better and shared understanding of territorial cohesion and its implications for policy.

Potential indicators:

Territorial diversity of the EU is seen as a vital asset that can contribute to the sustainable development of the EU as whole. To turn this diversity into strength, we have to address territorial cohesion through focusing on new themes, new sets of relationships binding EU territories at different levels and new forms of cooperation, coordination and partnerships. These ideas constituted the main issues for the proposed debate.

- Viewing cohesion from a territorial angle calls attention to themes such as sustainable development and access to services. Also underlining that many issues do not respect administrative boundaries and may require a coordinated response from several regions or countries, while others need to be addressed at a local or neighbourhood level. Building on the experience of the European Territorial Cooperation objective we can now look at the ways to further improve the co-operation between regions within the Union and with the neighbouring regions outside.
- An integrated place-based approach pursued by Cohesion Policy is ideally suited to respond to complex and strongly embedded issues, such as regional development but in order to maximise synergies better coordination with sectoral policies is necessary. Territorial cohesion also stresses the added value of partnership with a strong local dimension, which ensures that policies are designed and implemented with local knowledge.

Reference source: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0616:FIN:EN:PDF>

Regional reference: n/a

Time reference: 2008.

Significance for EU-LUPA: Policy context. Policy relevance of the indicators used within the project for the characterization of land uses in EU and identification of potential indicators to evaluate territorial performance.

Conclusions of the 5^o Cohesion report

Objectives:

Cohesion policy could play a crucial role in the context of the current economic crisis and to guarantee the compliance with the EU strategy 2020. Although the cohesion policy has already significantly reduced economic, social and environmental disparities within the EU it has been observed that it could be more effective.

Potential indicators:

The most relevant issues addressed are the following:

- The cohesion policy needs to be closely coordinated with the Europe 2020 strategy.
- Be more focused on few key priorities closely linked to EU 2020 to be more effective, especially in the more developed regions, be more selective.
- It would be necessary an ex-ante definition of clear and measurable objectives, targets and indicators (per member programme).
- On-going evaluation (monitoring) to assess performance towards these objectives. The idea is strengthening performance throughout incentives and conditions.
- Strength territorial cohesion, already addressed by the Lisbon treaty along side the goals of economic and social cohesion, with particular emphasis on the role of cities, local development and the macro-regional strategies.

The commission intends to adopt a Common Strategic Framework delineating a comprehensive investment strategy, which translates the targets and objectives of Europe 2020 into investment priorities for Cohesion policy, covering structural funds, the cohesion fund, European fisheries fund and the European agricultural fund for rural development. Each member state would present their overall strategy for cohesion policy in line with the national reform programmes and the thematic and country specific recommendations for Europe 2020.

The Coordination of structural funds is crucial but not enough. The commission intends also to significantly strengthen the involvement of other EU policies in preparing the strategic documents.

Reference source:

http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion5/index_en.cfm

Regional reference: n/a

Time reference: 2010.

Significance for EU-LUPA:Policy context. Policy relevance of the indicators used within the project for the characterization of land uses in EU and identification of potential indicators to evaluate territorial performance.

EEAC conference 2010 on sustainable land use

Objectives:

The EEAC believes that the concept of “sustainable land use” is a crucial component for sustainable development, as it involves integrating the different uses that are being made of natural resources and their interaction within relevant scales. It also provides new insights on how the governance of natural resources can be improved – at the landscape or other appropriate territorial levels (such a watersheds) – as part of balancing the involvement of multiple interests. We therefore recommend that the concept of “sustainable land use” should form one of the main topics to be taken forward within the context of the EU Sustainable Development Strategy.

Potential indicators:

Sustainable land use depends on functioning governance structures and adequate policies at all levels.

Land use has a cross-cutting nature so apart from Environment policies other EU policies have implications for sustainable land use.

The CAP is a crucial policy field in relation to sustainable land use. Sustainable land use is not yet sufficiently incentivised in such a way that farmers, foresters and other land managers and workers are adequately rewarded for the protection and enhancement of biodiversity, climate change adaptation and mitigation and the provision of water management services.

Scientific methodology and datasets required.

EU Strategy on Green Infrastructure after 2010, as a key tool to address the ecosystem services dimension of biodiversity.

Reference source: <http://www.eeac-net.org>

Regional reference: n/a

Time reference: 2010.

Significance for EU-LUPA:Policy context. Policy relevance of the indicators used within the project for the characterization of land uses in EU and identification of potential indicators to evaluate territorial performance.

A roadmap for moving to a competitive low carbon economy in 2050

Objectives:

Intergovernmental work done by Belgium for the Territorial Agenda and the revised Territorial Agenda itself expected to be ready spring 2011.

Transition towards a competitive low carbon economy.

It represents a roadmap for possible action up to 2050 which could enable the EU to deliver greenhouse gas reductions in line with the EU objective of reducing GHG by 80-95% by 2050.

Potential indicators:

This will build on the established EU energy policy and the EU 2020 Strategy.

It outlines the need for raising land use productivity sustainably: by improved agricultural and forestry practices can increase the capacity of the sector to reduce GHG and preserve and sequester carbon on soils and forests. This can be achieved for instance through targeted measures to maintain grasslands, restore wetlands and peat lands, low or zero tillage, to reduce erosion and allow for the development of forests. Agriculture and forestry are also providing the resources for bio-energy and industrial feedstocks.

Reference source: http://ec.europa.eu/clima/policies/roadmap/index_en.htm

Regional reference: n/a

Time reference: 2011.

Significance for EU-LUPA: Policy context. Policy relevance of the indicators used within the project for the characterization of land uses in EU and identification of potential indicators to evaluate territorial performance.

Topic: Urban dimension

Leipzig Charter for an integrated sustainable urban development

Objectives:

The Leipzig Charter builds on a process of cooperation aimed at strengthening urban development in the European context. With the Leipzig Charter the Ministers agreed on common principles and strategies for an integrated approach to urban development policy and on the need for action in socially and economically deprived urban areas as well as in cities as a whole. The complementarities between the Leipzig Charter and of the Territorial Agenda are addressed in First Action Programme.

The Leipzig charter is a document of the member states, that commit themselves to:

- Initiate a political debate in their states on how to integrate the proposals and strategies of the Leipzig charter on sustainable EU cities into national, regional and local development policies.
- To use the tool of integrated urban development and the related governance for its implementation and establish any necessary framework at national level.
- To promote the establishment of a balance territorial organization based on European polycentric urban structure.

Potential indicators:

Making greater use of integrated urban development policies approaches.

Strategies for action:

- Creating and ensuring high quality public spaces.
- Modernizing infrastructure networks and improving energy efficiency.
- Proactive innovation and educational policies.
- Special attention to deprived neighbourhoods. Strategies for:
 - Upgrading the physical environment.
 - Strengthen the local economy and the local labour market policy.
 - Proactive education and training policies for youngs and children.
 - Promotion of efficient and affordable public transport.

Reference source: http://www.eu2007.de/en/News/download_docs/Mai/0524-AN/075DokumentLeipzigCharta.pdf

Regional reference: n/a

Time reference: 2007.

Significance for EU-LUPA: Policy relevance of the Urban dimension. Identification of policy challenges.

Promoting sustainable urban development in Europe - April 2009

Objectives: DG Regio reports on the urban dimension.

The Commission communication to the Council and the Parliament “Cohesion Policy and cities: the urban contribution to growth and jobs in the region” (COM (2006) 385, 13.07.06) stresses that cities concentrate both needs and opportunities. While attracting investments and jobs and supporting innovation, entrepreneurship and the knowledge economy, cities face important problems in the context of the evolution of the global economy: unemployment, migration, social exclusion, increasing disparities within cities. New forms of territorial governance are required to foster a better integrated approach and a flexible cooperation between different territorial levels.

Potential indicators: n/a

Reference source:

http://ec.europa.eu/regional_policy/sources/docgener/presenta/urban2009/urban2009_en.pdf

Regional reference: n/a

Time reference: 2009.

Significance for EU-LUPA: Policy relevance of the Urban dimension. Identification of policy challenges.

Fostering the urban dimension: Analysis of the Operational Programmes co-financed by the European Regional Development Fund 2007-2013. November 2008

Objectives: DG Regio reports on the urban dimension.

The Commission communication to the Council and the Parliament “Cohesion Policy and cities: the urban contribution to growth and jobs in the region” (COM (2006) 385, 13.07.06) stresses that cities concentrate both needs and opportunities. While attracting investments and jobs and supporting innovation, entrepreneurship and the knowledge economy, cities face important problems in the context of the evolution of the global economy: unemployment, migration, social exclusion, increasing disparities within cities. New forms of territorial governance are required to foster a better integrated approach and a flexible cooperation between different territorial levels.

Potential indicators: n/a

Reference source:

http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/urban_dimension_en.pdf

Regional reference: n/a

Time reference: 2008.

Significance for EU-LUPA: Policy relevance of the Urban dimension. Identification of policy challenges.

The urban dimension in Community policies for the period 2007-2013. February 2010.

Objectives: DG Regio reports on the urban dimension.

The Commission communication to the Council and the Parliament “Cohesion Policy and cities: the urban contribution to growth and jobs in the region” (COM (2006) 385, 13.07.06) stresses that cities concentrate both needs and opportunities. While attracting investments and jobs and supporting innovation, entrepreneurship and the knowledge economy, cities face important problems in the context of the evolution of the global economy: unemployment, migration, social exclusion, increasing disparities within cities. New forms of territorial governance are required to foster a better integrated approach and a flexible cooperation between different territorial levels.

Potential indicators: n/a

Reference source:

http://ec.europa.eu/regional_policy/sources/docgener/guides/urban/index_en.htm

Regional reference: n/a

Time reference: 2010.

Significance for EU-LUPA: Policy relevance of the Urban dimension. Identification of policy challenges.

Topic: Environmental dimension

Sixth Environment Action Programme of the European Community 2002-2012

Objectives: The European environment – state and outlook 2010: synthesis.

The SOER 2010 Synthesis provides an overview of the European environment's state, trends and prospects, integrating the main findings of SOER 2010.

Potential indicators:

The key issues addressed are:

- Climate change: impacts, vulnerability and adaptation.
- Nature and biodiversity: natural capital and ecosystems. Land conversion drivers biodiversity loss and degrades soil functions.
- Natural resources and waste. natural resources management and its links to other environmental and socio-economic issues.
- Environmental health and quality of life.
- EU Environmental challenges in the global context.
- Future Environmental priorities.

Reference source: <http://www.eea.europa.eu/soer/synthesis/synthesis>

Regional reference: n/a

Time reference: 2010.

Significance for EU-LUPA: Thematic assessment on Land Use provides in put on:

- State and trends (land cover changes and urban land-take based on CLC 2000-2006).
- Impacts (land use intensity, greenhouse gas sinks, impacts of environmental change, recreational and cultural aspects of land use).
- Responses (regional planning, examples of targeted policy instruments, policy challenges and priorities).

3. CHALLENGES AND POTENTIALS FOR TERRITORIAL DEVELOPMENT IN EU

The policy relevance of the indicators used in the characterization of land use changes and patterns in Europe is being assessed.

- The development of the European territory is facing several ongoing mega trends and impacts of policies
- The integration of the EU in global economic competition is accelerating, offering regions and larger territories more options to decide their development path, as development is no longer a zero sum game for Europe.
- Interaction is growing within the EU territory and between the surrounding neighbour countries and other parts of the world. This is apparent through e.g. migration pressure on more developed countries, which are themselves confronted with population decline, and by access to and investment in new markets.
- Market forces and the evolution of society in general support a geographical concentration of activities.
- The ongoing demographic changes with an ageing European population, in addition to migration, affect regions differently and increase the competition for skilled labour.
- The occurrence of hazards due to climate change is increasing and different parts of Europe experience different types of hazards.
- Increasing energy prices and the emergence of a new energy paradigm have significant territorial impacts, some regions being more affected than others.
This presents particular development opportunities for the production of renewable energy sources.
- The enlargement of the EU to 27 Member States, and potentially more, presents an unprecedented challenge for the competitiveness and internal cohesion of the Union.

Several ESPON results to date have revealed that territorial capital and opportunities for development are inherent in the regional diversity that is a characteristic of Europe. Consequently, different types of territories are endowed with diverse combinations of resources, putting them in different positions for contributing to the achievement of the Lisbon and Gothenburg Agendas, as well as to Cohesion Policy.

Territorial diversity, especially in the economic base, implies that strategies other than opting for a knowledge-based economy might be more appropriate and viable for some regions.

Key challenges that EU is facing according to Territorial Agenda 2020:

- Increased exposure to globalisation: structural changes after the global economic crisis
- Challenges of EU integration and the growing interdependences of regions
- Territorially diverse demographic and social challenges, segregation of vulnerable groups
- Climate change and environmental risks: geographically diverse impacts
- Energy challenges come to the fore and threaten regional competitiveness
- Loss of biodiversity, vulnerable natural, landscape and cultural heritage

EU policies, strategies and institutional reports consulted, have been organized by topics and providing information about their objectives, reference source, spatial and time scale and significance for EU-LUPA project.

Due to the cross-cutting nature of the land use we have selected those policies, strategies and institutional reports that have been considered most relevant for the project development.

To date, policy objectives and targets have been identified from three key relevant documents in the EU political agenda:

- Lisbon Strategy,
- European Strategy for Sustainable Development and
- Strategy Europe 2020

The indicators stated below are used to measure the regions' success in relation to the Lisbon Strategy:

Headline targets	Indicators
Average of all individual quartiles of performance of seven regionalised Lisbon short list indicators	GDP/capita
	GDP/person employed
	employment rate of 15-64 (EU 2020 range 20-64)
	employment rate of elderly
	gross expenditure on research and development
	dispersion of regional unemployment rates
	long-term unemployment rate.
Average of all individual quartiles	Regional Unemployment, 2008
	R&D Expenditure as Percentage of GDP, 2006
	Composite Economic Lisbon Performance, 2006; Change in Composite
	Tertiary Educated People in Labour Force, 2007
	Share of Renewables in Gross Final Consumption, 2005
	Wind Power Potential, 2005

Table 1 Lisbon Strategy and Gotteborg objectives: indicators and headline targets

The European Strategy for Sustainable Development also provide a set of indicators attached to headline targets some of which are already included in the Lisbon and Gotteborg objectives.

Headline targets	Indicators
Socio-economic development EU27 Average	Growth rate of real GDP per capita
Sustainable consumption and production EU27 Average	Resource productivity
Social inclusion	Population at-risk-of-poverty or exclusion
Demographic changes	Employment rate of older workers
Public health EU27 Average	Healthy life years and life expectancy at birth, by gender
Climate change and energy	Greenhouse gas emissions
	Share of renewable energy in gross final energy consumption
Sustainable transport EU27 Average	Energy consumption of transport relative to GDP
Natural resources EU27 Average	Common bird index
	Fish catches taken from stocks outside safe biological limits
Global partnership EU27 Average	Official development assistance as share of gross national income

Table 2 European Strategy of Sustainable Development headline targets and indicators

For the EU-LUPA project we have decided to focus on the EU2020 objectives for the assessment of the territorial performance at regional level.

Headline targets	Indicators
75 % of the population aged 20-64 should be employed	Employment rate by gender, age group 20-64
3% of the EU's GDP should be invested in R&D	Gross domestic expenditure on R&D (GERD)
The "20/20/20" climate/energy targets should be met (including an increase to 30% of emissions reduction if the conditions are right) EU27 target 80	Greenhouse gas emissions, base year 1990
	Share of renewables in gross final energy consumption
	Energy intensity of the economy (proxy indicator for <i>Energy savings</i> , which is under development)
The share of early school leavers should be under 10% and at least 40% of 30-34 years old should have	Early leavers from education and training by gender
	Tertiary educational attainment by gender, age group 30-34
Reduction of poverty by aiming to lift at least 20 million people out of the risk of poverty or exclusion	Population at risk of poverty or exclusion (<i>union of the three sub-indicators</i>)
	Persons living in households with very low work intensity
	Persons at risk of poverty after social transfers
	Severely materially deprived persons

Table 3 Indicators suggested evaluating territorial performance based on Europe 2020 headline targets and indicators

The potential correlation between the performance of regions assessed by means of those indicators and the land use changes and trends found, could lead us to the evaluation of the land use efficiency at regional level.

3.1. PERFORMANCE AND EFFICIENCY EVALUATION

Land Use Performance within the EU-LUPA project is understood as *a semi-quantitative assessment showing to what extent certain "patterns of Land Use" have been effective in achieving policy goals towards sustainable development in the European regions.*

The policy goals should be clearly defined and could be simple (e.g. job provision, air quality, soil quality) or combined (e.g. job-to-housing ratio). The policy goals should be ideally available at national or regional level. However, many policy targets are disconnected to the direct land use or data is not enough relevant

Efficiency has a wide variation in meaning for different disciplines. In general terms, efficiency describes the extent to which time or effort is well used for the intended task or purpose. In the case of land use science, this definition could be translated as the extent to which land is well used for the intended policy target considered.

A broad evaluation of the potential relationship between certain socioeconomic indicators particularly those set in the EU2020 Strategy and Cohesion Policy and the land take at NUTS2 level, based on CLC data, have provided some interesting results. Scatter plots exercise has been undertaken.

EU2020 Strategy is the one for the EU's growth for the coming decade for a smart, sustainable and inclusive economy. These three mutually reinforcing priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion.

Five ambitious objectives - on employment, innovation, education, social inclusion and climate/energy have been established.

Ideally we should have been able to assess the potential relationship between those objectives and land use patterns observed in Europe but we have identified two major handicaps:

- Data availability. Most of the indicators set by the EU2020 strategy are available at NUTS2 level and even at national level for certain indicators on Climate and Energy.
- On the other hand, from the 5 objectives set by the EU2020 it is very difficult to find a coherent link with land use patterns, particularly those on education and social inclusion

That is why we have selected a set of indicators to be analysed where we could identify some kind of policy relevance directly or indirectly to land use:

- Population growth
- Employment rates 15-64
- Long term unemployment rates
- Gross Domestic Product at current market prices
- Share of renewal energy in final energy consumption
- RTD expenditure (as percentage of GDP)

Two kind of analysis have been carried out:

- Static analysis comparing the state of the indicators in 2006 and land in take in the same year (Corine Land Cover 2006, sum of classes 11+12+13+14) at NUTS2

Land take assumes changes, therefore we have two options:

- Compare built-up area 2006 with state indicators
- Land take in the immediately previous period and the static indicator.
- Dynamic analysis comparing the average progress of those indicators for the period 2000-2006 and the average annual growth rate of land take (Land take 2000-06. LCF2 Changes 00-06: Urban residential sprawl +LCF3 Changes 00-06: Sprawl of economic sites and infrastructures)

Although statistically speaking there is a weak correlation between the variables analysed there are several outliers that could provide relevant insights on how land consumption in certain regions explain socioeconomic behaviour and viceversa.

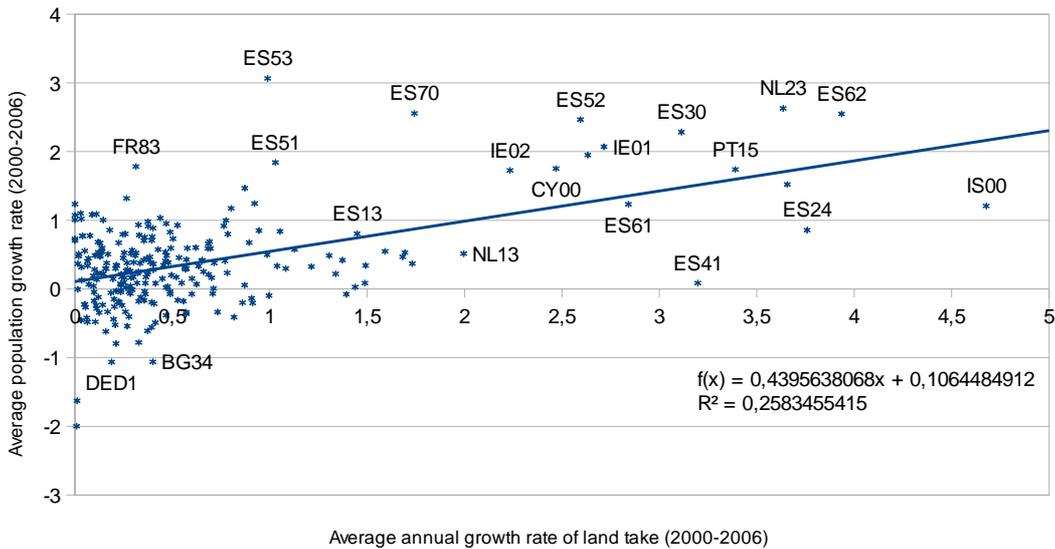
The linear regression represents:

- General trend assuming that there is a linear process
- When there are strong deviations we should see if they are systematic (e.g. all regions for a certain country) and if the assumption of linearity is correct

Land take by the expansion of residential areas and construction sites is the main cause of the increase in the coverage of urban land at the European level. Agricultural zones and, to a lesser extent, forests and semi-natural and natural areas, are disappearing in favour of the development of artificial surfaces. (EEA, Land Take GDI 5 March 2012)

At the European level, housing, services and recreation made up a third of the overall increase in urban and other artificial area between 2000 and 2006. (LEAC Database (based on Corine Land Cover 2000-2006 changes, version 13, 02/2010), ETC/LUSI)

Correlation between population growth rates and land take (2000-2006) - demo_r_d2jan sobre AV_LT



In most regions the pattern has been that the increase in the average population growth has gone together with an increase in the average annual growth rate of land take.

It is interesting to see that the slope of the regression is not 1 (growing at the same rate). **Land take is growing faster than population.**

Maybe changing the scale of X to log is better to see the relationship.

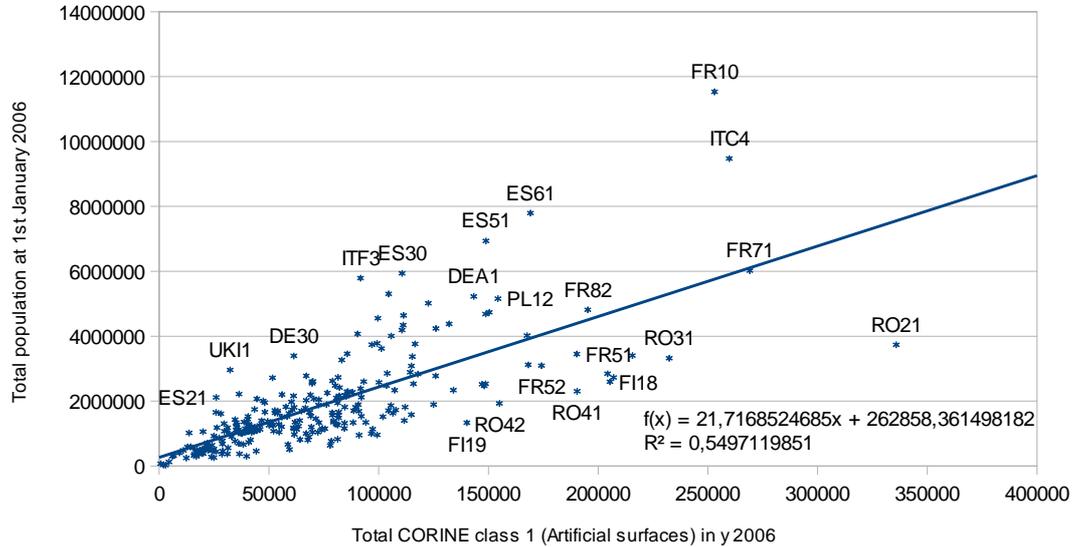
However in certain regions mainly of Spain, The Netherlands and Ireland, the urban development has been a fast phenomenon particularly during the analysed period with irrelevant population growth. At the European level, housing, services and recreation made up a third of the overall increase in urban and other artificial area between 2000 and 2006. (LEAC Database (based on Corine Land Cover 2000-2006 changes, version 13, 02/2010), ETC/LUSI, (EEA, Land Take GDI 5 March 2012))

In western European countries but in particular in Spain, Ireland, Portugal suffered an unsustainable rise in the price of real state from the 1990s to 2008, commonly known as **property bubble**.

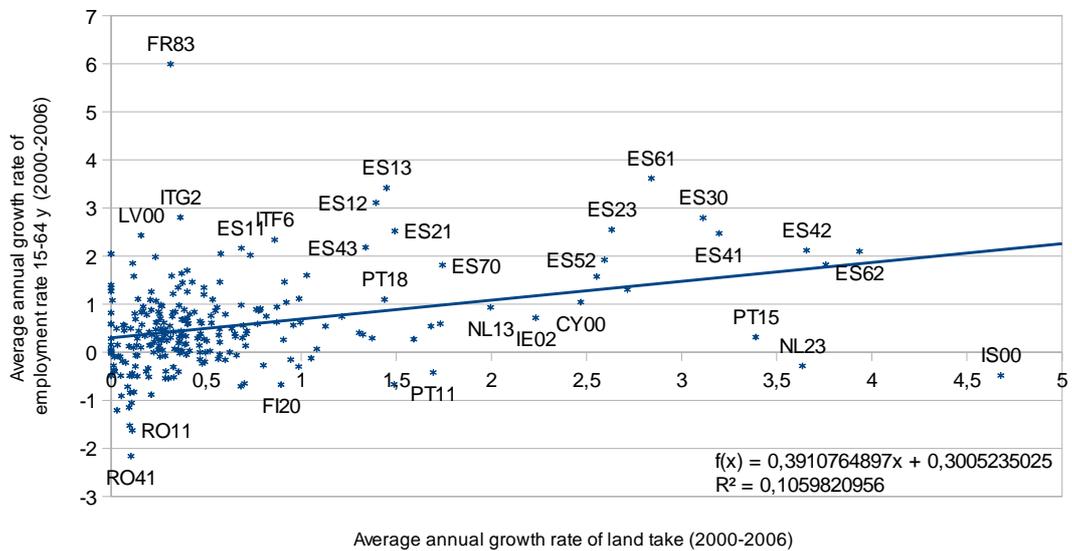
House ownership in Spain is above 80%. The desire to own one's own home was encouraged by governments in the 60s and 70s, and has thus become part of the Spanish psyche. In addition, tax regulation encourages ownership: 15% of mortgage payments are deductible from personal income taxes.

Static analysis

Correlation between total population and built-up area (artificial surfaces, 2006) - demo_r_d2jan_2006 sobre LC_2006_data



Labour efficiency of land take (2000-2006) - lfst_r_lfe2emprrt sobre AV_LT

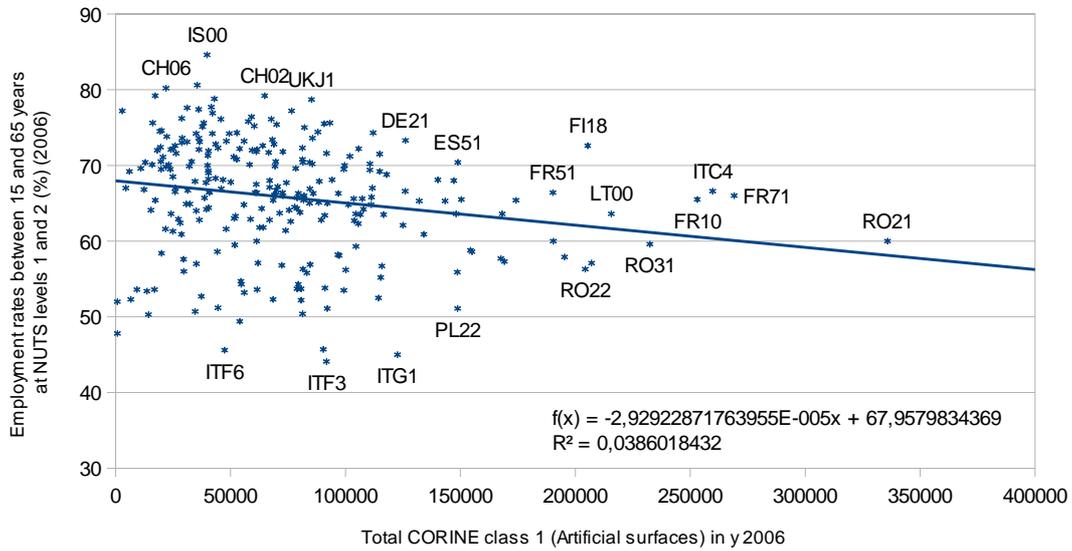


Certain parallelisms between increase in employment rates and land artificialization could be seen in several spanish, irish and portuguese regions.

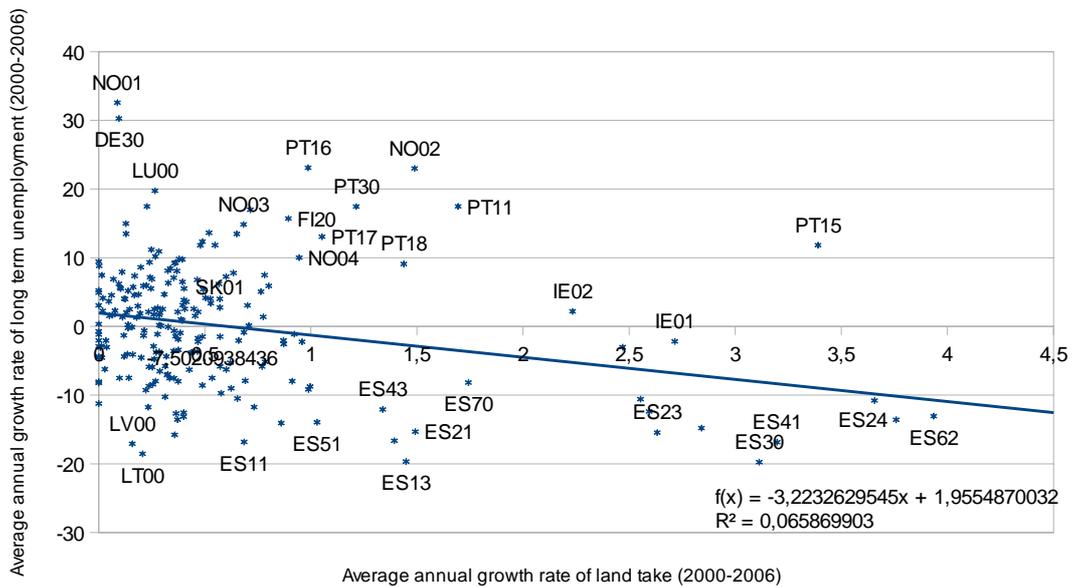
Again this could be explained due to those countries dependency on construction/building sector.

Static analysis

Correlation between employment rates and land take (artificial surfaces, 2006) - lfst_r_lfe2emprt_data_2006 sobre LC_2006_data

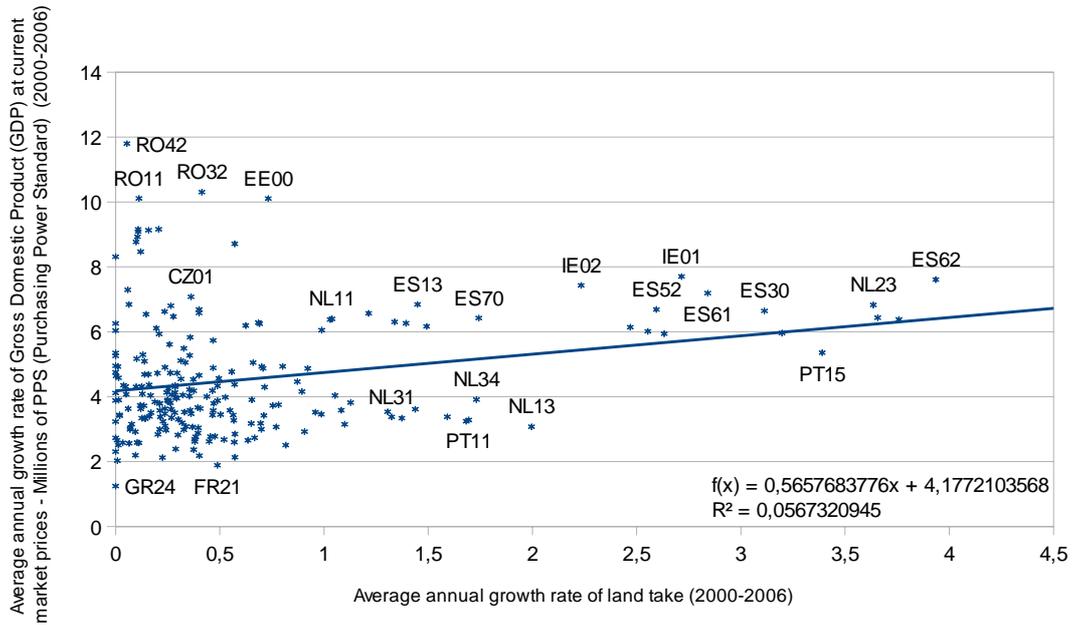


Correlation between long term unemployment and land take (2000-2006) - lfst_r_lfu2ltu_NBR sobre AV_LT

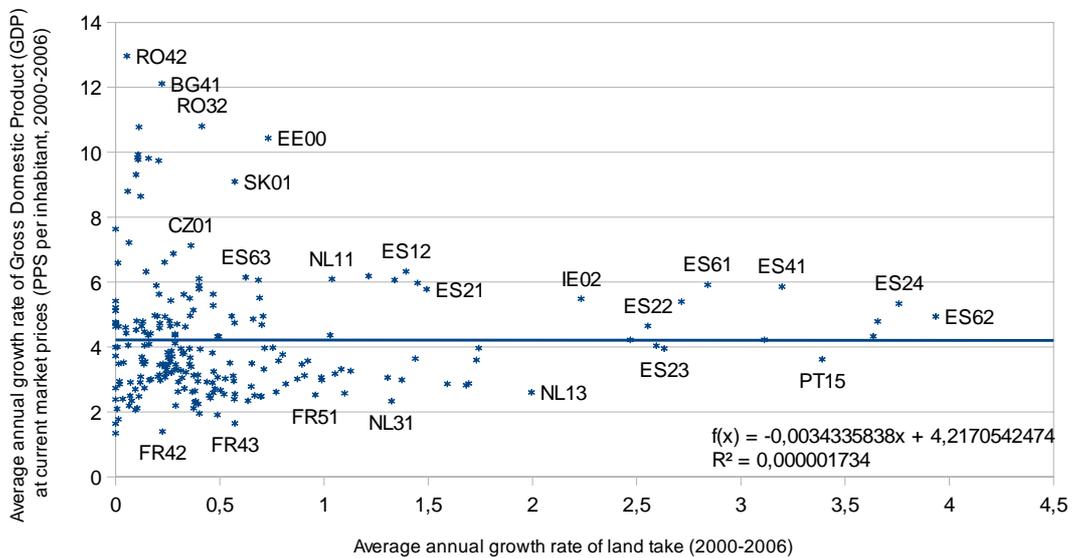


Looking at long term unemployment rates, a negative correlation is identified with respect to land take.

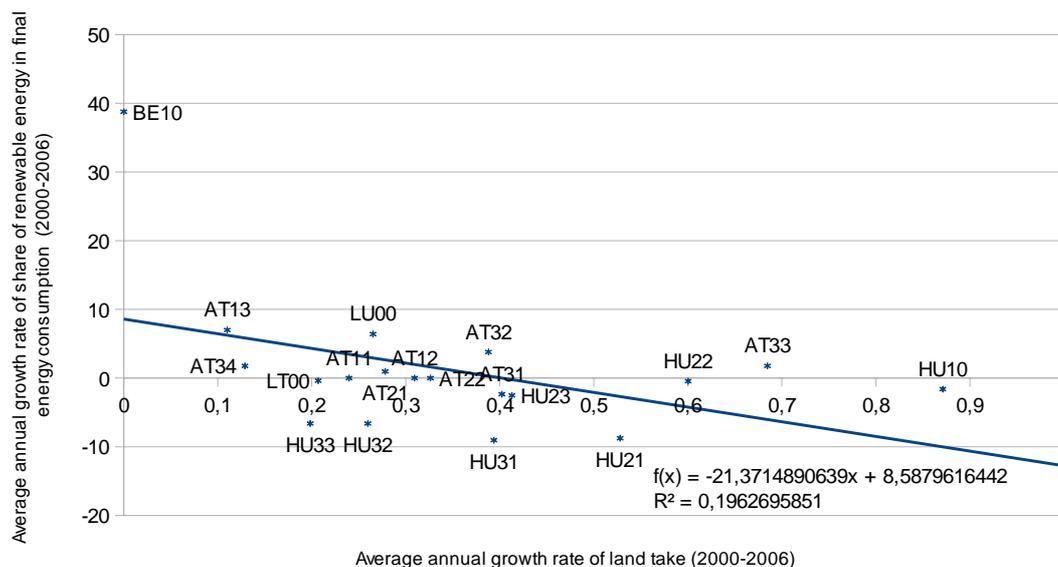
Correlation between absolute GDP growth and land take (2000-2006) -
 nama_r_e2gdp_mio_pps sobre AV_LT



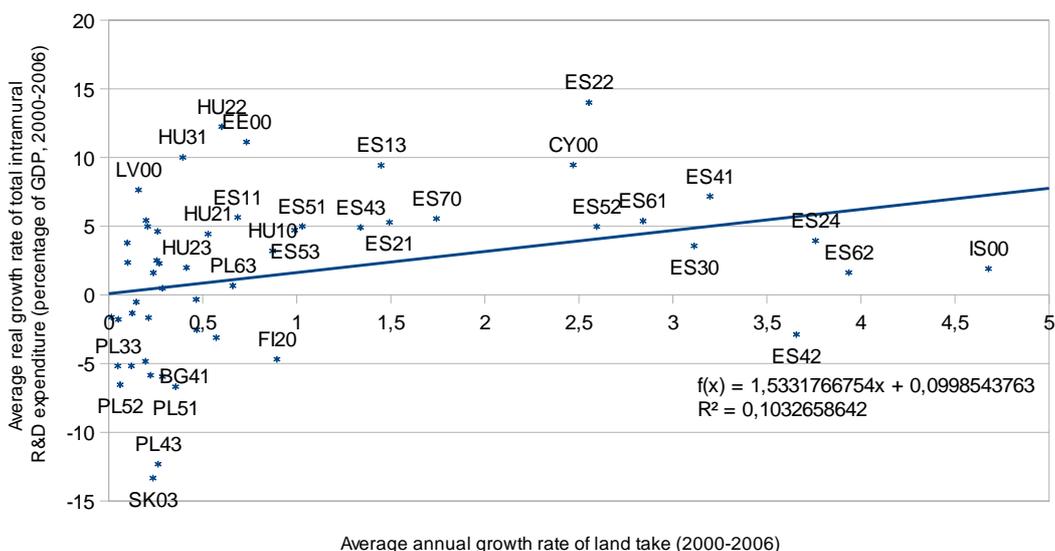
Correlation between GDP per capita growth rates and land take (2000-2006) -
 nama_r_e2gdp_pps_hab sobre AV_LT



Correlation between energy efficiency and land take (2000-2006) - env_rfec sobre AV_LT



Correlation between R&D growth rates and land take (2000-2006) - rd_e_gerdreg sobre AV_LT



KEY CHALLENGES and REMAINING QUESTIONS

There are several challenges and questions that remain unresolved or in need of further explanation and rationalization

- Data availability at NUTS3 in order to evaluate the potential correlation between land use dynamics observed in the Land Cover Characterization and typologies and the distance to the headline targets set in the EU2020 Strategy and Cohesion Policy at NUTS2/3 level.

4. DRIVING FORCES OF LAND USE CHANGE AND THEIR TERRITORIAL ASPECTS

Assessing the driving forces behind land use and land use changes is challenging and it is necessary to analyse and explain past patterns and be able to forecast future patterns. Driving forces of land use could include almost any factor that influences human activity, including local culture (food preference, etc.), economics (demand for specific products, financial incentives), environmental conditions (soil quality, terrain, moisture availability), land policy & development programs (agricultural programs, road building, zoning), and feedbacks between these factors, including past human activity on the land (land degradation, irrigation and roads).

This is definitely out of the scope of this project to investigate the full range of drivers of land use which would require to apply different methods from the natural and social sciences, including climatology, soil science, ecology, environmental science, hydrology, geography, information systems, computer science, anthropology, sociology, and policy science.

However we have undertaken a qualitative exercise by using a DPSIR model to address this issue.

4.1. DPSIR model: description

The elements in the model could be described as follows:

4.1.1. Interacting mega-driving forces

Processes such as urbanization, agricultural intensification, afforestation, rural abandonment, land use specialization are land use processes resulting from interacting driving forces.

Geographical intrinsic features and physical conditions. The geographical features and conditions of a region determine the availability of resources, including existing land for the development of certain activities which are highly dependant on the demand of specific locations (including land productivity) such as agriculture, aquaculture, forestry, tourism, energy production (particularly renewable), and associated industrial sectors (raw material depending industries- iron and steel industries, mining activities). Most of these categories are included in the CORINE LAND COVER classification. The use of land is seen here as a means of production.

Economic growth: behaviour of macro-economic sectors: tourism, industry development, agriculture, energy (production, supply, distribution and consumption) and transport.

Population dynamics: Population growth or decline, due to both natural and migratory processes, implies changes in the need for housing, services, employment, resources including energy, food, goods and services. It is also important to bear in mind that the demand of housing units is also determined by the average number of people living in a household which is a changing variable.

Land prices: A change in the price of agricultural and forest products and also in the prices of land for housing or industrial site location, can affect landowners' decisions whether to keep

the land in those uses. For instance it could be accepted that policies aimed at supporting agricultural prices provide an incentive to keep land in farming.

Technology push and market pull

Planning systems, strategies and policies at different levels: Past and current policy decisions can influence the rate at which land use and land cover change. Our hypothesis is that different planning systems may affect land use and land cover changes in different ways. Centralized vs decentralized planning systems along side spatial planning traditions: regional economic planning approach (France, Portugal and Germany); comprehensive integrated approach (Nordic Countries and Austria); Land use management (UK, Ireland, Belgium); urbanism tradition (Mediterranean countries) (EC The EU compendium of spatial planning systems).

In the same way, good governance structures could favour responsible land use management through the coordination of sector policies and interests.

Strategies and Policies that affect Land Use/Land Cover can be divided into two categories:

a) Policies that directly affect land use/ land cover

- Spatial planning⁶ understood as the methods and instruments used by the public sector to influence the distribution of people and activities in the space. It encompasses a set of regulations and determinations that specify:
 - where different types of land use can take place aiming at preventing situations where incompatible land uses occur or conflicts between different land uses demand.
 - what type of development can occur in a zone,
 - how densely development can occur, and can place limits on building height,
 - how much open space must be provided in residential developments, and
 - how many parking spaces must be provided for commercial buildings, for example.
- Transport policy. Its principal aims are to complete the internal market, ensure sustainable development, extend transport networks throughout Europe, maximise use of space, enhance safety and promote international cooperation.
- Common Agriculture Policy CAP
- EU Water Framework Directive promoting “Integrated river basin management for Europe”.
- EU Floods Directive. The directive requires flood risk mapping and affects land use through flood management plans for affected floodplain areas
- Integrated Coastal Zone Management (ICZM). The main objective is to improve the planning, management and use of Europe’s coastal zones, which promotes sustainable management through co-operation and integrated planning, involving all the relevant players at the appropriate geographic level.

⁶ 1983 European Conference of Ministers responsible for Regional Planning (CEMAT): "*Regional/spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is at the same time a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organisation of space according to an overall strategy.*"

- Nature conservation and Environmental Protection. NATURA 2000 network and LIFE programme contains provisions which put particular emphasis on links with spatial development and, in particular, land use. The EU-wide designation of protected areas is intended to establish a coherent integrated biological network which intervenes in land use.

b) Policies that indirectly affect the land use change and shape landscapes.

- European Spatial Development Strategy
- Strategies of sustainable development
- Cohesion Policy
- European Territorial Agenda 2020
- EU policies on climate change adaptation are directly relevant to current and future land-use practices and economic sectors depending on this: mitigation throughout reduction of CO2 emissions and adaptation strategies
- Taxation and incentives

PRESSURES

The pressures are understood as the processes that occur as a consequence of the interrelation of the driving forces previously described.

Main processes identified

- Urbanization/ Concentration of human population in urban areas
- Different patterns linked to the need for housing, services, mobility needs, employment and resources including energy, food, goods and services.
- Depopulation of rural areas
- Intensification of the use of land (forest harvest, livestock grazing, agriculture),
- Abandonment of marginal land
- Infrastructures construction
- Deforestation
- Climate change
- Energy production and consumption.

ESTATE

The state of land use in EU- land use distribution, land use changes, flows and patterns (CLC and socio-economic data) - will be analysed in Task 2.2 along side the definition of regional typologies.

Having identified the main processes and dynamics with regard to land use changes in the European regions, it will be needed to explore the driving forces and pressures behind those processes, at least qualitatively in each regional typology.

IMPACT

The positive or negative effects that could be derived from land use changes⁷.

The description of the main processes taking place and their incidence on sustainability it is expected in Task 2.2 by means of Land Use Functions evaluation.

The evaluation of regional performance and land use efficiency in Task 2.3 could give also light on the kind of impacts associated to land use patterns in the EU regions.

RESPONSE

Response here is understood as the reaction by society and public sector to a situation. From a conceptual perspective, responses could be considered also driving forces once have been put in place.

⁷ From the EU-LUPA perspective it could be understood as LUFs evaluation in Task 2.2 and land use efficiency analysed in Task 2.3

Policy Priority Areas	
Planning Systems	Spatial Planning Instruments and their catalysing potential
Land policy & development programs	Cohesion policy and regional development policies and strategies
EU sector policies Most policies have significant territorial impacts, influencing the development opportunities of territories in different ways	Energy policy
	Environment policy (WFD, ICZM, Floods directive..)
	CAP Common Agriculture policy
	Transport policy
	Sustainable development
Socio-economic processes	Demography: <ul style="list-style-type: none"> • Population growth (natural) • Migration patterns • Depopulation of rural areas
	Urbanization/ Urban sprawl
	Economic development
	Industrialization
	Intensification of agriculture (vs abandonment of marginal lands)
	Energy challenges (production and supply)
	Social
	Globalization
	Growing interdependences of regions
	Regional competitiveness
Environmental conditions (including past human activity on the land)	Soil quality
	Biodiversity loss, vulnerable natural, landscape and cultural heritage
	Land degradation
	Climate change and associated environmental risks

Table 4 Policy priority areas

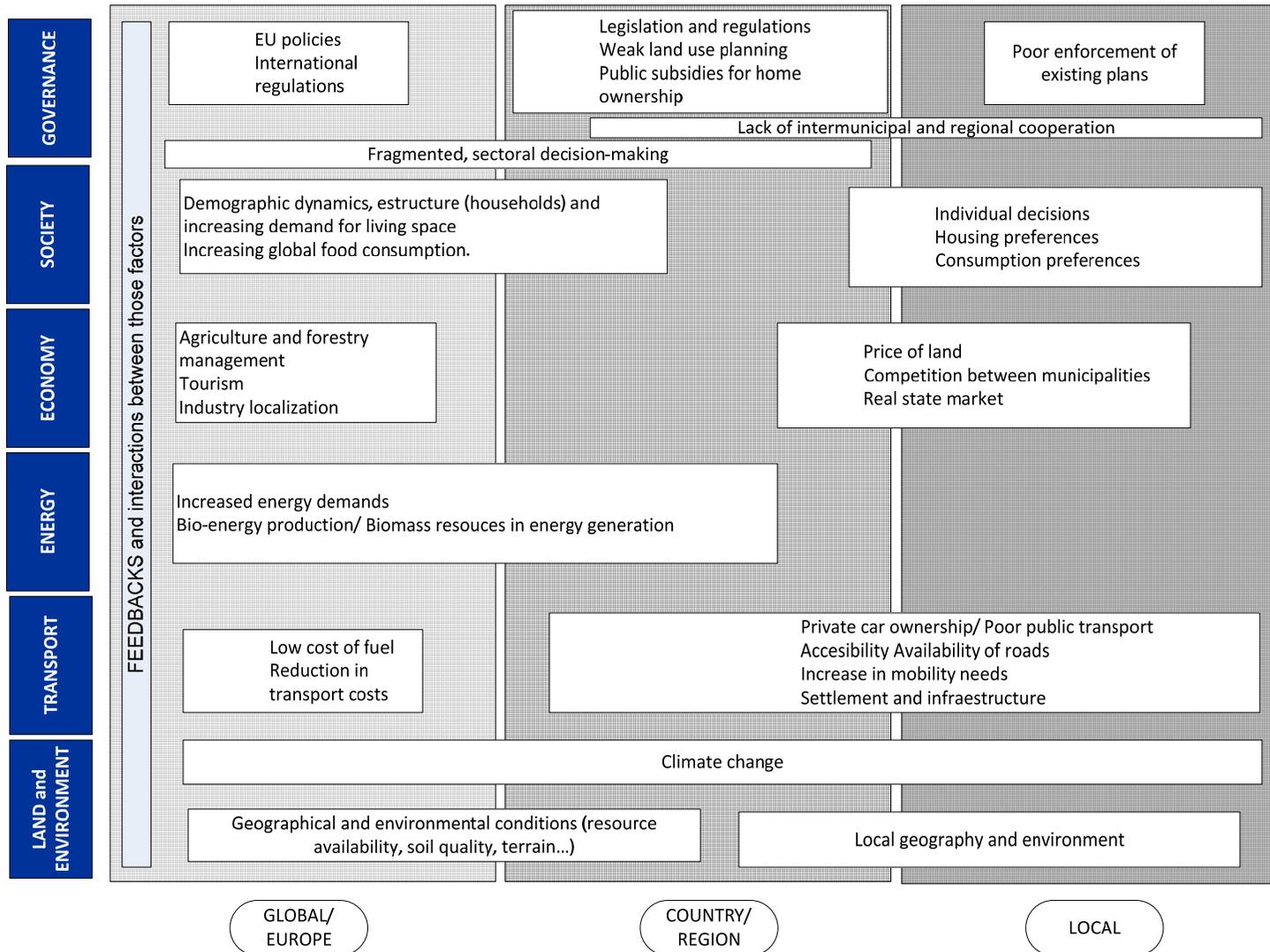


Figure 5 Drivers of Land Use Change. Own elaboration (based on EEA)

4.2. Main Processes

Changes in land use and land cover date to prehistory and are the direct and indirect consequence of human actions to secure essential resources. This may first have occurred with the burning of areas to enhance the availability of wild game and accelerated dramatically with the birth of agriculture, resulting in the extensive clearing (deforestation) and management of Earth's terrestrial surface that continues today. More recently, industrialization has encouraged the concentration of human populations within urban areas (urbanization) and the depopulation of rural areas, accompanied by the intensification of agriculture in the most productive lands and the abandonment of marginal lands. All of these causes and their consequences are observable simultaneously around the world today.

The way land is used is one of the principal drivers of environmental change, having impacts on climate, biodiversity and ecosystems services and cause degradation and pollution of water, soil and air. (EEA, 2010a) and in turn, environmental change, particularly climate change, will increasingly influence the way we use land as communities strive to adapt to and mitigate the effects of a changing climate (EEA, 2010b).

Changes in land use could be seen as a driving force and also as an impact, to the environment, biodiversity, climate change, natural resources. For instance, a change in the land use resulting from urbanization or from converting forest into agriculture, may have an impact on ecosystems, biodiversity and also on the climate (affecting carbon balance).

4.2.1. Biodiversity loss

Biodiversity is often reduced dramatically by land use changes. When land is transformed from a primary forest to a farm, the loss of forest species within deforested areas is immediate and complete. Even when unaccompanied by apparent changes in land cover, similar effects are observed whenever relatively undisturbed lands are transformed to more intensive uses, including livestock grazing, selective tree harvest and even fire prevention. The habitat suitability of forests and other ecosystems surrounding those under intensive use are also impacted by the fragmenting of existing habitat into smaller pieces (habitat fragmentation), which exposes forest edges to external influences and decreases core habitat area. Smaller habitat areas generally support fewer species (island biogeography), and for species requiring undisturbed core habitat, fragmentation can cause local and even general extinction. Research also demonstrates that species invasions by non-native plants, animals and diseases may occur more readily in areas exposed by land use changes, especially in proximity to human settlements.

The increase on the demand for food, fibres, energy, water and other resources, derived from changes in lifestyle is expected to continue although demographic scenarios for Europe forecast stabilization in the population growth over the next decades. This is putting a great pressure on biodiversity particularly derived from

intensification of land use, directly through, for example, habitat destruction and resource depletion, or indirectly through, for example, fragmentation, drainage, eutrophication, acidification and other forms of pollution.

In fact, developments in Europe might have a global scale effect, since the demand for natural resources nowadays exceeds Europe availability and production.

4.2.2. Climate Change

Land use change plays a major role in climate change at global, regional and local scales by increasing the release of carbon dioxide to the atmosphere and other green house gases by means of the alteration of soils and natural vegetation, the modification on the hydrology and the elimination of forest cover.

At global scale, land use change is responsible for releasing greenhouse gases to the atmosphere, thereby driving global warming. Land use change can increase the release of carbon dioxide to the atmosphere by disturbance of terrestrial soils and vegetation, and the major driver of this change is deforestation, especially when followed by agriculture, which causes the further release of soil carbon in response to disturbance by tillage. Changes in land use and land cover are also behind major changes in terrestrial emissions of other greenhouse gases, especially methane (altered surface hydrology: wetland drainage and rice paddies; cattle grazing), and nitrous oxide (agriculture: input of inorganic nitrogen fertilizers; irrigation; cultivation of nitrogen fixing plants; biomass combustion).

Though land use changes certainly plays a critical role in greenhouse gas emissions, the complexity and dynamic interplay of land use processes favouring net accumulation versus net release of carbon dioxide and other greenhouse gases makes it a poorly constrained component of our global budgets for these gases; an active area of current research. A further source of uncertainty in estimating the climate changes caused by land use change is the release of sulphur dioxide and particulates by biomass combustion associated with agriculture, land clearing and human settlements. These emissions are believed to cause regional and global cooling by the reflection of sunlight from particulates and aerosols, and by their effects on cloud cover.

Land cover changes that alter the reflection of sunlight from land surfaces (albedo) are another major driver of global climate change. The precise contribution of this effect to global climate change remains a controversial but growing concern. The impact of albedo changes on regional and local climates is also an active area of research, especially changes in climate in response to changes in cover by dense vegetation and built structures. These changes alter surface heat balance not only by changing surface albedo, but also by altering evaporative heat transfer caused by evapotranspiration from vegetation (highest in closed canopy forest), and by changes in surface roughness, which alter heat transfer between the relatively stagnant layer of air at Earth's surface (the boundary layer) and the troposphere. An example of this is the warmer temperatures observed within urban areas versus rural areas, known as the urban heat island effect.

Apart from comfort, there are other health problems that could be derived from climate change and influenced by changes on land use, and those are the shifts in the distribution of ticks, vectors of the Lyme disease and tick-borne encephalitis. Other examples include the extended range in Europe of the Asian tiger mosquito, a vector of several viruses, with a potential for further transmission and dispersion under the changing climate conditions.

Land use practices and development planning could have a major impact on hydro-morphological alterations and therefore on water scarcity and adverse ecological consequences and social impacts. The issues of water quantity and quality, irrigation water demand, water-use conflicts, environmental and socioeconomic aspects and risk management aspects can be better integrated in the institutional and political systems.

4.2.3. Pollution

Changes in land use and land cover are important drivers of water, soil and air pollution. Perhaps the oldest of these is land clearing for agriculture and the harvest of trees and other biomass. Vegetation removal leaves soils vulnerable to massive increases in soil erosion by wind and water, especially on steep terrain, and when accompanied by fire, also releases pollutants to the atmosphere. This not only degrades soil fertility over time, reducing the suitability of land for future agricultural use, but also releases huge quantities of phosphorus, nitrogen, and sediments to streams and other aquatic ecosystems, causing a variety of negative impacts (increased sedimentation, turbidity, eutrophication and coastal hypoxia). Mining can produce even greater impacts, including pollution by toxic metals exposed in the process. Modern agricultural practices, which include intensive inputs of nitrogen and phosphorus fertilizers and the concentration of livestock and their manures within small areas, have substantially increased the pollution of surface water by runoff and erosion and the pollution of groundwater by leaching of excess nitrogen (as nitrate). Other agricultural chemicals, including herbicides and pesticides are also released to ground and surface waters by agriculture and in some cases remain as contaminants in the soil. The burning of vegetation biomass to clear agricultural fields (crop residues, weeds) remains a potent contributor to regional air pollution wherever it occurs, and has now been banned in many areas.

4.2.4. Other impacts

Other environmental impacts of land use changes include the destruction of stratospheric ozone by nitrous oxide release from agricultural land and altered regional and local hydrology (dam construction, wetland drainage, irrigation projects, and increased impervious surfaces in urban areas). Perhaps the most important issue for most of Earth's human population is the long-term threat to future production of food and other essentials by the transformation of productive land to non-productive uses, such as the conversion of agricultural land to residential use and the degradation of rangeland by overgrazing.

ENVIRONMENTAL (Mainly negative)

- Erosion and desertification
- Biodiversity loss
- Habitat fragmentation
- Degradation of landscape and cultural heritage
- Degradation and pollution of soil, water and air
- Resource availability lacking
- Ecosystem services
- Climate change impacts and associated environmental risks

ECONOMIC (positive/negative)

- Productivity
- Competitiveness
- Efficiency
- GDP

SOCIAL (positive/negative)

- Effects on employment rates
- Effects on cohesion and potential risk of marginalization specially in urban areas
- Depopulation of rural areas
- Concentration of human population in urban areas
- Quality of life

Table 5 Potential impacts associated to land use changes (Prepared by Tecnalia)

5. CONCLUSIONS

5.1. In summary

- European policy, although having no spatial planning responsibility, sets the framing guidance for planning.
- It has been said that territorial cohesion supports the coordination of sector policies and can be regarded as a spatial representation of sustainability (EEA, 2010)
- European economies depend on natural resources, including raw materials and space. Land is a limited resource. Different sector interests are often competing for the same territorial resource.
- Policy responses are needed to help resolve conflicting land use demands and to guide land use intensity to support sustainable land management
- The way land is used has impacts on climate, biodiversity and ecosystem services. It can also cause degradation and pollution on water, soil and air.
- Monitoring and mediating the negative environmental consequences of land use while sustaining the production of essential resources is a major priority of policy-makers around the world.
- Coordination of different sector policies and various policy levels is therefore crucial: good governance.
- Land-use planning and management are powerful and essential to better reconcile land use with environmental concerns and resolve potential conflicts between sectoral interests and potential uses.
- Due to the cross-cutting nature of land use, integrated programmes are needed to guarantee the EU objective for territorial cohesion.
- Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) are the important tools for evaluating programmes and projects that have impacts on land resources.
- In the need for strengthen territorial cohesion particular emphasis should be placed on the role of cities, local development and the macro-regional strategies.
- Tailored measures and policy instruments for specific locations or land-use types are needed.
- A shift in the land management concept from linear to land use cycling has been gaining priority across the EU Member States, especially in the context of the EU 2020 Strategy.

Growth is possible without major new land in take: This is possible by reusing/optimising existing urbanised land. The coming high-level conference on 'Soil remediation and soil sealing' (DG ENV, Brussels 10-11 May) highlights the crosscutting component of this intensive use of the land. This could not be tackled by a single policy, but rather a crosscutting element that needs better integration across policies.

5.2. Key policy messages

➤ **General policy messages in support to responsible land management**

○ **Good governance to enhance integration of sectoral policies**

All the initiatives require good governance understood as a) horizontal coordination of sector administrations and policies b) vertical coordination of different levels of responsibilities and also c) public participation

➤ **General policy messages towards a more sustainable territorial management:**

Integrated programmes for land-use planning/ regional development and management (Spatial planning policies and strategies)

○ **Integrated spatial planning instruments**

It is a recommendation applicable at local scale where legal competencies derive from European directives.

The integration of cross-sector policies of land use, energy and water management into a single planning instrument at regional level, based on an understanding of territorial dynamics, will help regions to advance towards a more sustainable territorial management, in line with § 10, § 11, § 23 and § 27 of the Territorial Agenda. The adoption of this principle expresses the acknowledgement of the specific responsibilities of sectoral policy-makers and the will to cooperate with and influence them in order to ensure a stronger territorial and urban focus when conceiving and delivering the thematic policies. The goal is to better fine-tune specific thematic actions, to facilitate their coordination and to reduce undesired externalities. Initiatives with this perspective have already been established, for instance the ICZM (Integrated Coastal Zone Management). This is a necessary tool for planning the development of coastal areas, where conflicts may arise when planning off-shore wind parks or other ocean technologies, which may interfere with security issues, fishing interests, cargo traffic, tourism or protection of marine biodiversity.

See, for example, DG Environment News Service 2/2010, Special Issue on “Coastal Management”.

○ **Integration of sector policies to resolve conflicts of land use demand**

INTEGRATION OF SECTOR POLICIES WITH LAND USE PLANNING PROCESSES

- Mobility management (sustainable transport)
 - Hard measures & new sustainable developments
- Energy
- Water management (including ICZM)
- Forest management (private – Finland/ public owner)

Constraints

- Legal and technical frameworks
- Differing planning traditions

○ **Landscape approach and integration in spatial planning**

- **Sector policies focus on economic drivers for certain land use types**

- **Sustainable use of biocrops**

- It is a recommendation applicable at national scale where legal competencies derive from European directives.

- Making extended use of biofuels in the region could lead to social and ecological problems [EEA 2005]. Biocrops compete with other uses for scarce resources, such as land and water, in agriculture, forestry or natural sites. Specializing on certain types of plants with high energy yield could jeopardize other objectives of agricultural policy, such as that of promoting a higher level of regional sufficiency with regard to food production (by growing subsistence crops). Large-scale biomass plants could accelerate deforestation or endanger the local biodiversity. Apart from choosing technologies and crops that are appropriate in a given regional context and robust with regard to possible climate change impacts (droughts), attention must also be paid to the parallel development of local social and educational skills, which will be needed to manage and maintain the installed facilities.

- **Environmental protection and risk prevention**

- Integration of land-use planning & environmental policy:
 - Environmental objectives in spatial planning policy
 - Strengthen of EIA/ EEA procedures
 - Efforts to modify land-use practices to reduce non-point pollution of air and water include integrated river basin management and, in particular, the Nitrates Directive.
 - The new European Floods Directive addresses the risk of flooding caused by the construction of impervious surfaces (e.g. buildings and roads) and provoked by extreme weather events.
 - The EU rural development and regional policies also emphasised the cross-cutting nature of land use.
 - Future directions on the EU CAP and implementation of renewable energy targets will have a significant impact on forest and agricultural land use and its intensity.

- **Biodiversity loss**

- The role of green infrastructure and site protection under Natura 2000 as well as the re-use of land are also important aspects of land resource management.
 - Land use policy to reduce impacts on agriculture and forestry
 - Forest management (private – Finland/ public owner)
 - Suitability of agriculture production (selection of species vs productivity)

- **Land use policy towards adaptation to climate change impacts**

- Reinforce the role of spatial planning and development and the importance of adopting a territorially-based approach when addressing the issue of adaptation to climate change, one of the challenges mentioned in the Territorial Agenda.
 - The UNFCCC Kyoto Protocol promotes among others practices that reduce emissions of methane and nitrous oxide from agricultural land.
 - EU policies on climate change adaptation are directly relevant to current and future land-use practices and economic sectors depending on this.
 - Climate change adaptation strategies
 - Adaptation strategies include banning new construction in vulnerable areas with high risk of flooding, minimizing flashy runoff

from impervious surfaces, changing the requirements for stormwater retention structures in new developments, and protection of wetlands that buffer runoff from heavy rainstorms.

- Land use planning to reduce urban heat effects, through maintenance of green areas, use of different building materials.
- Land use policies discouraging shoreline building allowing communities to be more flexible to deal with sea level rise.
- Climate change adaptation plans

➤ **Policies to promote sustainable use of land and improving regional competitiveness**

- **Demand for new urban areas may be partly satisfied by brown-field remediation relieving pressure on rural areas and green-field sites, reducing pollution costs, and more efficient energy use and natural resource consumption, facilitating economic diversification and emerging habitat (housing) requirements (The OECD Territorial Outlook 2001). Recycling of artificial surfaces in several countries in Europe reach 30 % or more if compared to total area of land take (CORINE LC 2006 results).**
- **Establish urban planning principles for regeneration of abandoned sites**
- **Stronger links between EU urban and soil policies are needed (e.g. following up respective 6th EAP Thematic strategies).**
- **Implement Urban Metabolism procedures**

It is a recommendation applicable at local scale where legal competencies derive from European directives.

“Urban metabolism” is a new way of describing the functioning of modern cities and could be an interesting tool for local energy planning. “The concept of an urban metabolism provides a means of understanding the sustainable development of cities by drawing analogy with the metabolic processes of organisms. The parallels are strong: “Cities transform raw materials, fuel, and water into the built environment, human biomass and waste” (Decker et al. 2000). In practice the study of an urban metabolism (in urban ecology) requires quantification of the inputs, outputs and storage of energy, water, nutrients, materials and wastes. “

Procedures related to urban metabolism assess urban dynamics, services, functions, flows and cities’ capacity of response with two purposes: a) to avoid alteration of the ecological, social and economical conditions of a city and also b) to reduce vulnerability by optimizing energy consumption. This is particularly interesting in highly urbanized regions with severe ecological footprints.

- **Adaptive mechanisms to Global Change as a great challenge and opportunity**

Green infrastructure and land use planning

- GI and its provision of ecosystem goods and services is linked to land take issues.
- It contributes to minimising natural disaster risks, surface water run-off to reduce the risk of flooding, preventing soil erosion, connecting habitats, mitigating urban heat island effects, etc.

- Land take / spatial planning - key role in facilitating and delivering GI.

➤ **Economic instruments for land use planning**

- **Legal framework, land taxation systems, cadastral systems, territorial planning, etc. in place**
- **Taxation, fees & charges imposed on undesired land-use practices**
- **Tradable permit systems - option for land consumption targets**
- **Env. motivated subsidies – for specified land use**
- **Payments for ecosystem services**
- **Open space & green field developments through taxation**

- **Using tradable planning permits to reduce land consumption in urban areas**
 - Investigated options for tradable planning permits to reduce land consumption⁸ Example: German research project (RAFINA)
 - Municipalities entitled to buy or sell their share of land consumption rights Rationale: Municipalities in need of larger development areas would acquire rights from other communities equivalent to refunds from revenues gained from development activity.
 - This would assure that plans for land development are based on cost-effectiveness – permits not traded on a one-to-one basis – but at a level where effects on env. quality, etc. are involved.
 - Prerequisite: Only for communities that have urban land use plans that follow best practice to prevent a wild flurry of urban development.

⁸ Example German research project RAFINA

5.3. Role of government system, planning policy and government in public decisions regulating land-use change

In EU there are different spatial planning cultures, governance structures and system which has been analysed by many studies. The most remarkable ones being the classification based on the concept of families of nations developed by Newman and Thornley (1996), the traditions of spatial planning described in the European Compendium of Spatial Planning Systems and Policies (1997), the macro-regional perspectives on European Spatial Planning, analysed by Rivolín and Faludi (2005), the four-dimensional “hypercube” of territorial approach, developed by J. Farinós and described in ESPON 3.1 project ⁹, and the classification suggested by ESPON 2.3.2¹⁰ based on devolution of spatial planning powers.

In each country the system of territorial government has their peculiarities with regard to the size of the different units (local municipalities, supra-local entities such as countries, regions), the basic functions they perform, the planning competences ascribed to each NUTS level. However, it is possible to identify some common characteristics among countries.

The key question is to identify which level or levels play the key role in land use changes. Generally speaking the local municipalities have a strong weight in decision-making, although the balance between the power of local and supra-local levels might differ among countries.

EU-LUPA is considering the governance structures and planning systems in place in each territorial reality in order to define the most appropriate level of implementation of each of the suggested policy messages and recommendations.

One of the most recent and remarkable analysis of planning policies and governance across EU countries is being undertaken by the PLUREL project which provides a category of countries through a joint evaluation system, bringing the government and planning aspects together¹¹.

Two dimensions are analysed: the functioning of the government system (fragmented/ consolidated) and the planning policy system (strong/ weak control through regional/ national level)

The level of fragmentation of the administrative government system regarding land use changes is expressed as the function of the size of the local and supra-local level which has a role to control such decisions. The strength of the spatial planning policy by the assessment of how strong influence the supra-local levels have on land-use

⁹ ESPON Project 3.1 Integrated tools for European Spatial Development

¹⁰ ESPON Project 2.3.2 Governance of territorial and urban policies

¹¹ Deliverable report 2.2.1 National spatial planning policies and governance typology Ivan Tosics, Hanna Szemzo, Dora Illes, Antal Gertheis (Metropolitan Research Institute, Hungary) Konstantinos Lalenis, Dimitris Kalergis (University of Thessaly, Greece)

changes (e.g by means of spatial planning on this level, importance of local plans or veto power on local decisions). The type of regional/ spatial planning policy can be: weak level control, medium level control and strong and controlled spatial policies.

Control mechanisms from supra-local levels of the planning system	Most important supra-local level (from land-use change perspective)	Local level	Countries	Value
c) Strong, controlled spatial policies	Large (>1M)	any		7
	Medium-sized (0,5-1M)	any	Portugal	6
	Small (<0,5M)	any	Cyprus, Greece, Lithuania	5
B) Medium level of control	Large (>1M)	Large (>30)	Denmark, The Netherlands, United Kingdom	6
		Medium-sized (10-30)	Belgium, France, Germany	5
		Small (<10)	Italy, Spain	4
	Medium-sized (0,5-1M)	Large (>30)	Ireland	5
		Medium-sized (10-30)		4
		Small (<10)	Austria	3
	Large	Large (>30)	Sweden	4
		Medium-sized (10-30)	Finland	3
		Small (<10)	Estonia, Latvia, Luxembourg, Malta	2
A) Weak level of control	Any	Large (>30)	Bulgaria	3
		Medium-sized (10-30)	Poland, Slovenia	2
			Czech Republic, Hungary, Romania, Slovakia	1
		Small (<10)		1

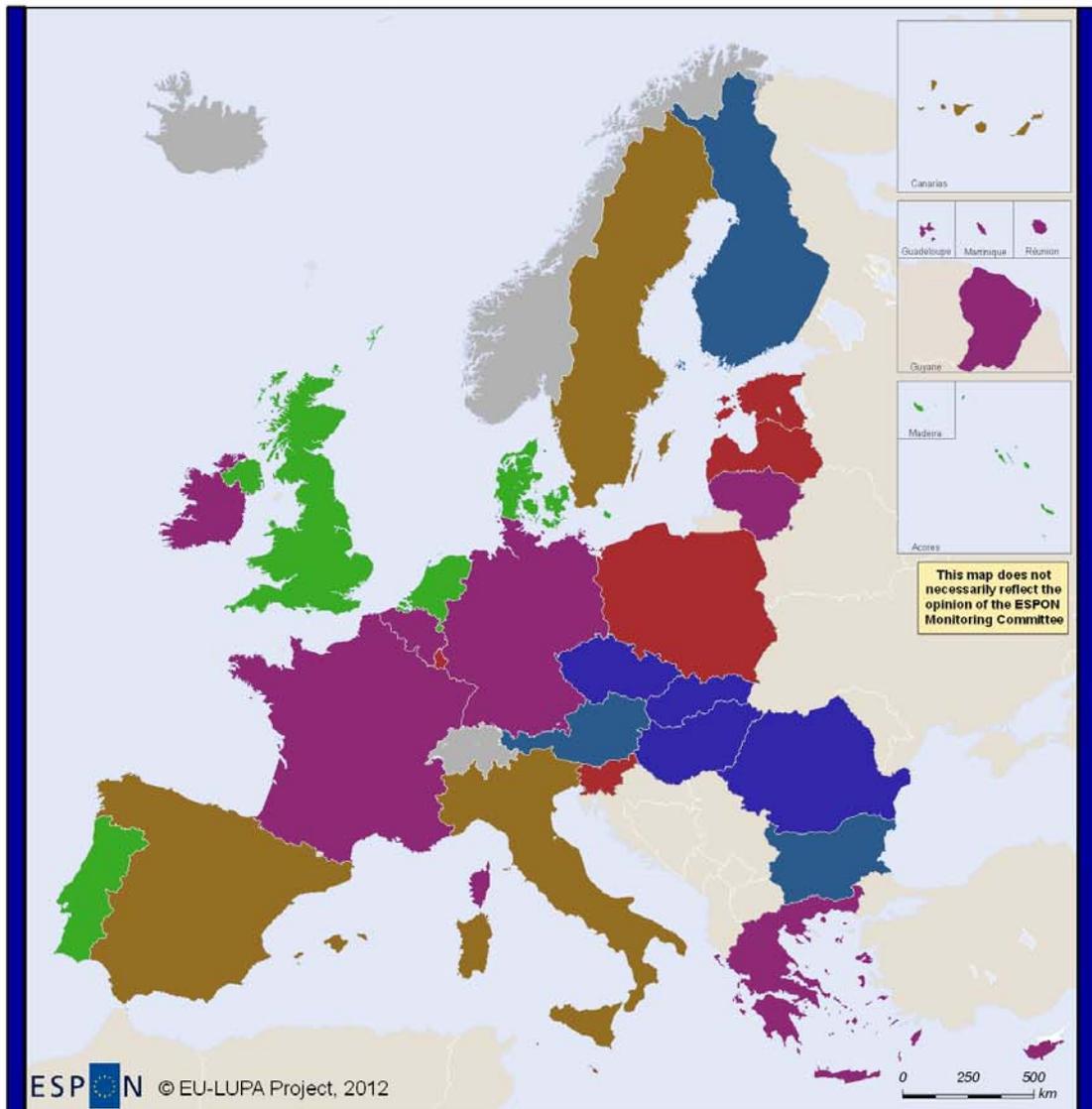
Table 6 Potential control resulting from the national government and planning systems

The results show a high diversity of government and planning systems in the EU countries from the perspective of land-use change. Regarding the potential control resulting from the national government and planning systems, Northern European countries (e.g. Denmark, the UK and the Netherlands) show higher levels mostly because of their consolidated local government systems, while Southern European countries showing a higher potential (such as Cyprus, Greece or Portugal) have more fragmented local government systems, but stronger control by supra-local levels. Most new member states show a weak control potential, with the notable exemptions of Lithuania (where the tradition of strong planning is based on the presence of the former Western Soviet planning institutions) and Bulgaria (with a consolidated local government system).

The results show different values regarding the potential control resulting from the national government and planning systems. However, these values don't show the real strength of the public control over land-use change, as in practice these powers can be effectuated in different ways. Because of this, these values should be seen as a potential resulting from the government and planning systems. A weak potential control is hard to overcome even if the willingness is given, while a high potential may or may not be used entirely, depending on the intentions of the public bodies in power.

Studies on other factors influencing the strength of the public control can be found in deliverables D2.2.2 and D3.3.10, studying the interests of public sector and its further instruments influencing land use change (E.g financial incentives) and the role of governance respectively

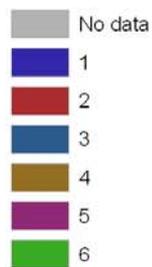
Potential strength of public regulation over land use change in EU countries



EUROPEAN UNION
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INVESTING IN YOUR FUTURE

Regional level: NUTS 0
Source: Own elaboration, 2012
Origin of data: PLUREL Deliverable report 2.2.1
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Legend



Map 2 Potential strength of public regulation over land use change in EU countries, based on level of fragmentation of the administrative government system and the type of the regional/ spatial planning policy. PLUREL integrated project, Deliverable 2.2.1, 2010.

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ISBN

EU-LUPA

European Land Use Patterns

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CHAPTER 4

Case Study Methodology and Case Studies Reports

Draft Final Report Part C Scientific report
| Version 00/June/2012



This report presents the draft final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

Information on the ESPON Programme and projects can be found on www.espon.eu

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8. Case Studies Summary

1. Introduction

There are a large variety of European regions that represent the different land use management with different drivers of land use patterns. They represent variety of types located in geographical space. Land use has also a different regional dynamics due to social, economic and environmental development changes.

According to the EEA2 the type of land use change varies among different types of regions. *“Urban areas and related infrastructure are the fastest growing land consumers, mainly at the expense of productive agricultural land. Rural landscapes are changing due to agriculture intensification, land abandonment and forest exploitation. Coastal and mountain areas are undergoing profound spatial reorganizations to accommodate intensive tourism and leisure activities.”*

The rationale behind using case studies as a one of the scientific method is to identify, conceptualise and theorise drivers and dynamic processes which are stimulated by specific land use changes on the macro and micro level. The cases shall differ in its features of e.g. endogenous potential of region (physical, human and social capital), its environmental, socio-economic and geographical assets.

The case studies are seen as essential elements to provide a better insight and confirm some of the main findings of task 2.2 and 2.3 taking the advantage of additional expertise with good local/regional knowledge.

Finally the major objective of the case studies are:

- verify and confirm proposed typology and identified processes and challenges;
- identify land use functions and undertake a “multifunctionality” assessment;
- identify factors and drivers (natural and socio-economic) of land use changes and land use dynamics in details in different types of areas;
- give answer about mechanisms and trends (processes) of land use changes in local scale;
- identify challenges in those areas and defining policy recommendations to cope with those challenges on the basis of stakeholders opinion;

The pre-selection of the case studies was made based on the ESPON typologies with regard to represent specific and different geographical regions. The proper selection reduced the number of case studies on the base of worked out typology (task 2.2) and data availability.

2. Methodology

Four consistent steps could be distinguished in task Case Studies:

1. *Selection of the regions analyzed*
2. *Statistical survey and characterization of selected case regions*
3. *Identification of the drivers and dynamics of land use changes*
4. *Verification of the proposed typologies*

2.1. Selection of the regions analyzed

A two steps approach followed in order to identify the regions for the case studies. At the first step of case study selection – pre-selection – there were identified six areas (regions) as a potential cases for analysis from each partner perspective, interesting in relation to the topic of land use but also bearing to mind the availability of data and accessibility.

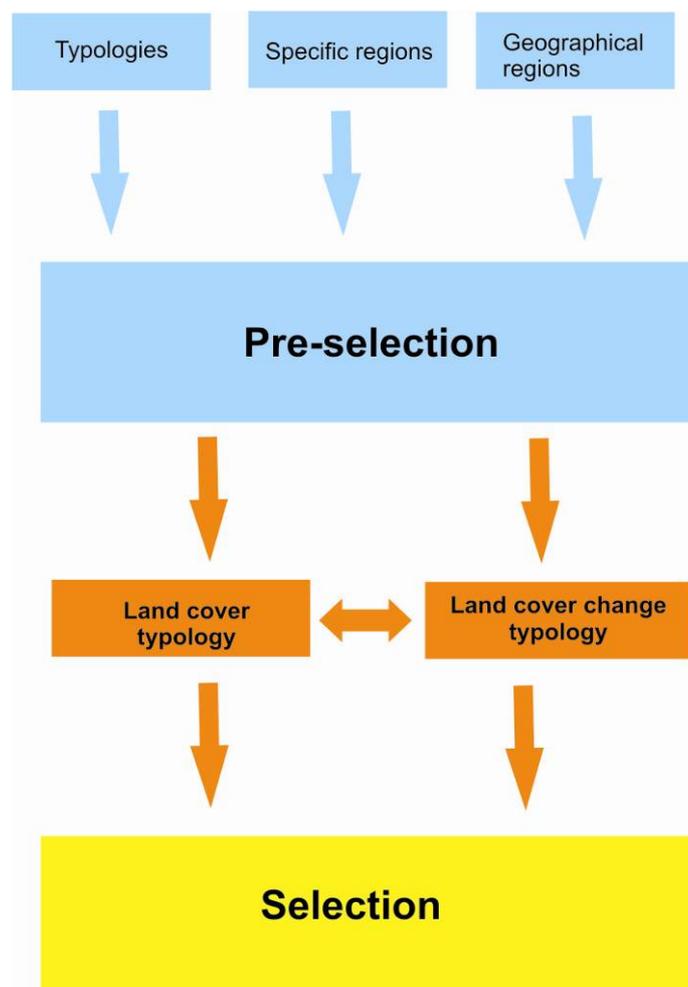


Fig. Model of case studies units selection

The pre-selection was based on partner expert knowledge, ESPON documents (eg. ESPON projects, ESPON Atlas, ESPON previous typologies) and Corine Land Cover Dynamic Regional Clusters (draft) worked out as an

element of Land Cover Typology study. Two main criteria for pre-selecting the case study regions were taken into account:

- the specific types of territories; it is intended to cover various types of regions (cross border regions, mountain areas, outermost regions, highly populated multifunctional areas),
- the geographical patterns: The pre-selected territories should represent various geographical regions (Western Europe, Mediterranean Europe, East-Central Europe, Nordic countries).

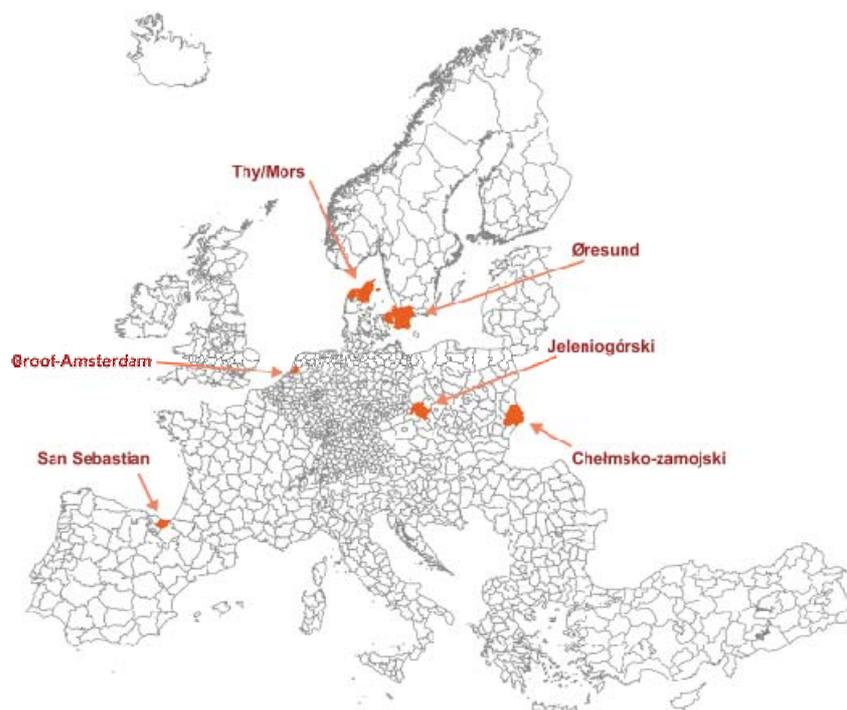


Fig. Pre-selected case studies (regions NUTS 3)

Tab. Pre-selected case studies according to basic types of regions

Case studies NUTS 3	Cross border	Mountain area	Highly populated	Peripheral	Urban-rural open space	Costal
Øresund (Sweden/Denmark)						
Thy/Mors (Denmark)						
Jeleniogórski (Poland)						
Chelmsko-Zamojski (Poland)						
Amsterdam (The Netherlands)						
San Sebastian (Spain)						

The pre-selected regions represent the different land use management with different drivers of land use patterns. They represent variety of types (cross-border, mountain areas, highly populated, coastal, peripheral, etc.) located in different geographical space (West, East, South and North Europe). Pre-selected regional land use has also a different dynamics due to social, economic and environmental development changes.

To each chosen regions were worked out a statistical profile with the identification of the land use changes direction and the main current socio-

economic processes and actors with possible impact to land management and land cover change (see all of the profiles in appendix 1).

The second step - the proper selection reduced the number of case studies to four regions on the base of the typologies worked out in task 2.2.

- 1) Land Cover Typology; the selected regions should represent various types of territories in the case of land use structure (urban area, arable land, woodland) and functions (from mono to multifunctional);
- 2) Land Cover Change Typology; the regions should represent the areas characterized by different dynamics and level of land cover changes (from less to high number of changed clusters).

Those selected diversified regions give possibility to find a more trends and processes in land use and land cover changes and will facilitate the verification of proposed typology.

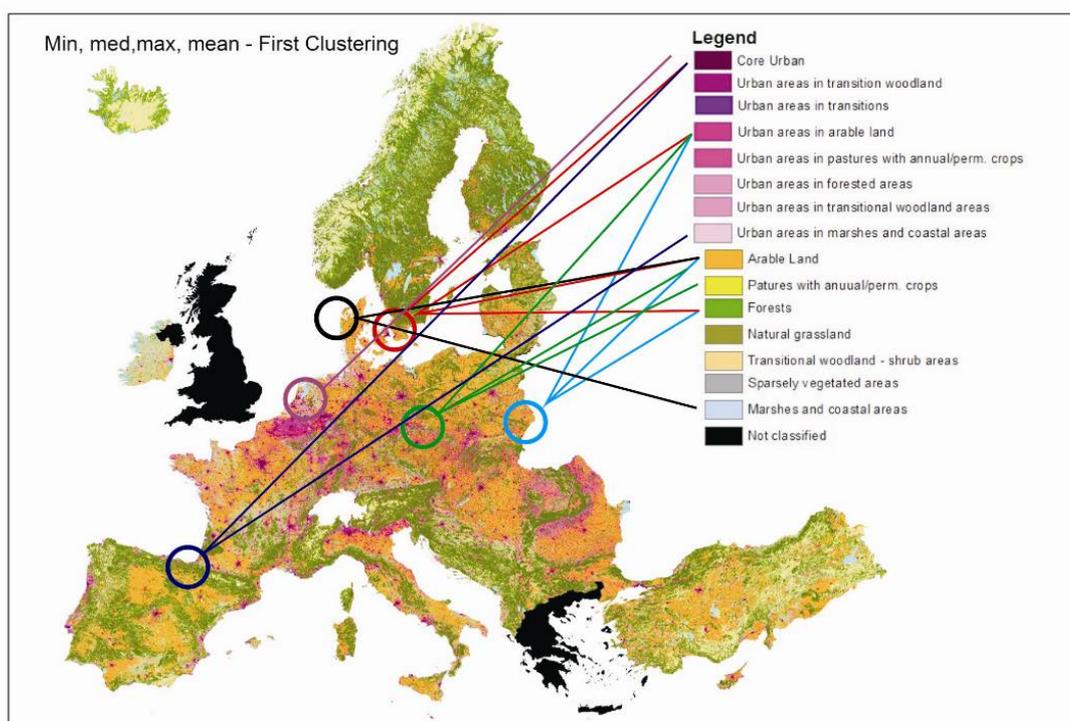


Fig. Major type of land use according to Land Cover Typology

Tab. Qualitative evaluation of land use and land cover change in pre-selected regions (L- low, M – medium, H – high)

Case studies NUTS 3	Major type of land	Level of land use differentiation	Level of multifunction ality	Level of land use changes (nb. of clusters)
Öresund	urban/arable	H	H	M
Thy/Mors	arable	L	L	L
Jeleniogórski	arable/forest	M	M	M
Chełmsko-Zamojski	arable	L	L	L
Amsterdam	urban	H	H	M
Bayonne- San Sebastián	urban/semi-urban	M	H	H

Finally proposed regions to case studies are:

- 1) Öresund – as cross-border region with highly differentiated land use structure (from urban core, semi-urban to arable), high multifunctionality and several clusters of land cover changes in the period 2000-2006;
- 2) Eurocity Basque Bayonne- San Sebastián - as cross-border region, with high share of urban areas and relatively high number of changed clusters in the period 2000-2006 (mainly agricultural), multifunctional;
- 3) Chelmsko-Zamojski – located on periphery (EU border), mostly agricultural, monofunctional, with low number of changed clusters;
- 4) Jeleniogórski – located on the Poland-Germany-Czech Republic borderland, multifunctional, in economic transition.

2.2. Statistical survey and characterization of selected case regions

At the first step the case study area was focused on the statistical profile of each region with the identification of the main current socio-economic processes and actors with possible impact to land management and land cover change.

Secondly the changes of the land use and land cover structure and they dynamics have been characterized. In each region major effect of the land use change (deforestation, desertification, soil degradation, biodiversity changes, urban sprawl, floods etc.) and dynamics of these changes identified.

There were analyzed regional development strategies and others regional and state documents according to land use policies and influences to land use changes. Other sources with influences to land use changes surveyed too, including interviews with local authorities and other important player.

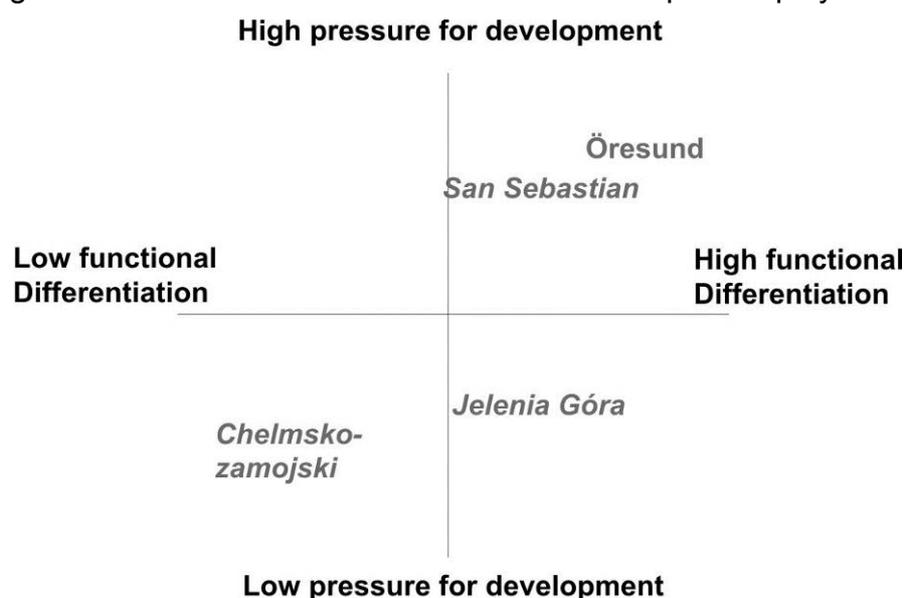


Fig. Characterization of case studies regions

2.3. Identification of the drivers and dynamics of land use changes

This subtask synthesizes the findings in the case study regions in order to mirror them to land use changes and its dynamics. One of the most important results are detailed identification and evaluation of the drivers of land use and land cover changes. They make possibility the answer about mechanism and trends of land use changes as well as interrelation between different functions and factors in those changes.

2.4. Verification of the proposed typologies

Finally on the basis of mentioned analysis there were possible to validate proposed typologies and formulate chosen policy recommendations (on the basis of stakeholder's opinion).

In order to ensure the comparability of the investigated results in the selected regions a common design for all studies was formulated. The following aspects was take to account:

- a description for the relevant statistical data to be analysed. The statistical survey combines the statistical profile and added relevant data outlining the overall situation of the region. A questionnaire will be elaborated collecting standardised data.
- a potential stakeholders interview guide with the criteria of interviewees selection. In order to get information about the mechanism and tends of land use and land cover change and formulate recommendations, interviews with regional key player will be conducted. Criteria will be set up for the selection of them and a template for the case study report.

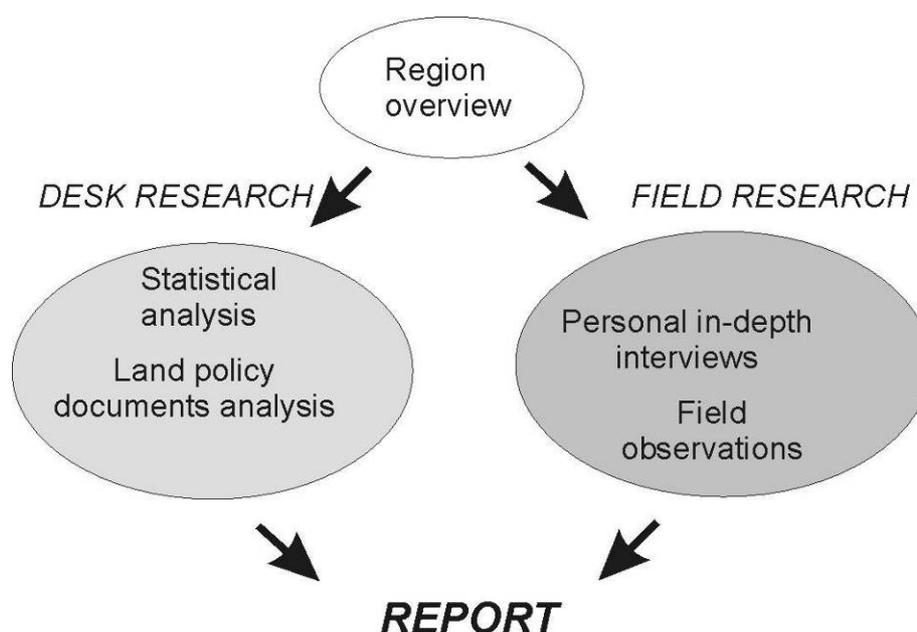


Fig. Basic scheme of case study research

2.5. Technical description of the case studies research

There are five major elements in the case studies research:

Region's general overview (on the basis of literature, regional expertise, documents and other sources).

Collection of statistical data and statistical deep analysis of regions.

Collection and analysis of main policy documents, especially those related to spatial planning (law related to spatial planning, regional plans of spatial organization, regional socio-economic and investment plans); planning system assessment.

Field study

1. Personal in-depth interviews (3 regional experts + 1 members of TPG). The preferred stakeholders are: (1) representative of regional authority, (2) representative of "practice" – eg. farmers, tourism, business association (depending on the main economic function of the region, influencing significantly land use changes), (3) representative of regional research organizations (university, research institutes, etc.) dealing with regional development issues. See final version of interview questions in appendix 2.
2. Field observation of current condition of land use (character of settlements, structure of agricultural land, industrial areas, tourism zones, natural areas, multifunctional land use etc.).

Reports (see appendix 3)

3. APPENDIX

App. 1

Pre-selected regions characteristic

Region Öresund					
Location within Europe		Nordic	Western	East-Central	Mediterranean
		X			
Type of location		Core	Transitional	Peripherall	
		X			
		Cross-border	Coastal	Mountain	
		X	X		
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)	
	3.600.000	170	21.203	increase	
Qualitative description	<p>Cross-border region with important impact on land use of the bridge between Sweden and Denmark. The focus would be on the Swedish side where most changes have been registered.</p> <p>The Öresund region is very interesting in the aspect of land use typologies with urban sprawl interaction, and consequently also with multifunctional activities as the following are taking place:</p> <ul style="list-style-type: none"> - Protected areas both on islands in the region, and on the Swedish mainland - Agriculture, with South Sweden being the most intensive producing areas in Sweden - A large number of renewable energy producers both individual and park based windmills, on both land and sea. - In addition a high production of biomass for biogas, power and district heating generation. Especially on the Swedish side there are interactions and conflicts between agriculture and biomass production. - High mobility between the Swedish and the Danish side, and with the bridge being the most important commuting tool, especially from the Swedish side - Coastal communities where tourism and second homes from both sides are playing an important role <p>The region is an excellent illustration of the urban sprawl problem and since the bridge was erected the implications of urbanization from one country (the Danish side) on the land use patterns in another country (on the Swedish side) is obvious.</p>				
Land use structure (%)	Artificial surface	Agricultural land	Forested land	Water bodies	
		38% (2009 – NUTS2)	22% (2009 – NUTS2)		
Major tendency in structure of land use in period 2000-2006 (2000=100%)	Artificial surface	Agricultural land	Forested land	Water bodies	
Increase (A – above country level, B – below country level)		-	-		
Decrease (A – above country level, B – below country level)		-	-		
Stable		-	-		
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)	Developed land area has increased at the expense of agricultural land				

Description of land use changes (other important information)	1) increase of built-up area 2) change land on wetland areas and forests					
Socio-economic level	GDP per head	Index of unemployment	Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)		
	49.000 Euro	3 % (2009)	30%	densely		
Regional functions (2 – highly represented; 1 – represented; 0 – lack)	Agriculture	Forestry	Tourism and recreation	Settlement (Build up)	Industry	Others (administrative, education, etc.)
	2	1	1	2	2	1
Other qualitative description of region	<p>This region is already part of Nordregio's research agenda, so accessing data, interviews etc. would be quite easy.</p> <p>In relation to the aims of the case studies, this region will contribute by:</p> <ul style="list-style-type: none"> - Verify and confirm proposed typology and identified processes and challenges. - Identify land use functions and undertake a "multifunctionality" assessment - Identify factors and drivers (natural and socio-economic) of land use changes and land use dynamics in detail in different types of areas; - Give answer about mechanisms and trends (processes) of land use changes at local scale; <p>Identify challenges in those areas and defining policy recommendations to cope with those challenges on the basis of stakeholders opinion.</p>					
Major local and regional plan documents	<p>Programme Summary of the Oresund Region INTERREG IIIA PROGRAMME [http://event.interact-eu.net/download/application/pdf/1007227]</p> <p>The Øresund Science Region: A cross-border partnership between Denmark and Sweden [http://www.oecd.org/dataoecd/55/50/37006070.pdf]</p>					

Localization on the map



Fig. Region Öresund

Region Thy/Mors							
Location within Europe		Nordic		Western	East-Central	Mediterranean	
		X					
Type of location		Core		Transitional	Peripherall		
		Cross-border		Coastal	Mountain		
				X			
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)			
	65.000	2.5	3000				
Qualitative description	<p>A local population of 65.000 but the region visited by a large number of second home owners and tourists Klitmøller being among the important windsurfing sites in Europe) triples or quadruples the population in summer.</p> <p>The Thy/Mors region is interesting in the aspect of multifunctional landscapes as the following activities are taking place:</p> <ul style="list-style-type: none"> - Including the first Danish national park = protection of species as well as of pristine - landscapes - Agriculture, with Mors as one of the most intensive producing areas in Denmark - A large number of renewable energy producers – both individual and park based windmills, a high production of biomass for power and district heating generation. One of the few geothermal sites in Denmark - The establishing of a Windmill testing site - Both large scale and small scale fisheries - Forestry - Tourism - Second homes <p>Even the region is rural, the interaction with major cities not only in Denmark but also in Germany is obvious due to this region being among the most attractive places during summer.</p>						
Land use structure (%)	Artificial surface		Agricultural land	Forested land	Water bodies		
			55% (2009)	10% (2009)			
Major tendency in structure of land use in period 2000-2006 (2000=100%)		Artificial surface	Agricultural land	Forested land	Water bodies		
Increase (A – above country level, B – below country level)			-	-			
Decrease (A – above country level, B – below country level)			-	-			
Stable			-	-			
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)		agricultural land has decreased , while urban land use has increased					
Description of land use changes (other important information)		<ul style="list-style-type: none"> • region promotes itself as a rural • more intensive agriculture than in other regions • many small lakes and watercourses have disappeared from the landscape as a result of draining 					
Socio-economic level		GDP per head	Index of unemployment	Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)		
		37.000 Euro	4,4% (2009)	29,6 % (2010)	thinly		
Regional functions (2 – highly represented; 1 – represented; 0 – lack)		Agriculture	Forestry	Tourism and recreation	Settlement (Build up)	Industry	Others (administrative, education, etc.)
		2	0	2	0	0	2

<p>Other qualitative description of region</p>	<p>This region is already part of Nordregio's research agenda, so accessing data, interviews etc. would be quite easy.</p> <p>In relation to the aims of the case studies, this region will contribute by:</p> <ul style="list-style-type: none"> - Verify and confirm proposed typology and identified processes and challenges. - Identify land use functions and undertake a "multifunctionality" assessment - Identify factors and drivers (natural and socio-economic) of land use changes and land use dynamics in detail in different types of areas; - Give answer about mechanisms and trends (processes) of land use changes at local scale; <p>Identify challenges in those areas and defining policy recommendations to cope with those challenges on the basis of stakeholdes opinion;</p>
<p>Major local and regional plan documents</p>	<p>Regional Development Plan 2007 [http://www.rn.dk/NR/rdonlyres/46389D16-8094-4195-8C4E-1FB826318AA4/0/NorthDenmarkRegion_RegionalDevelopmentPlan2007.pdf]</p> <p>Business Development Strategy 2007-2010 [http://www.rn.dk/NR/rdonlyres/37A7FD8A-7C17-4E18-A89B-B4B78E3C6A74/0/NorthDenmarkRegion_BusinessDevelopmentStrategy20072010.pdf]</p>

Localization on the map



<http://nationalparker.skovognatur.dk/Thy/Kort/NationalparkThyKort.htm>

Fig. Region Thy/Mors

Region Jeleniogórski					
Location within Europe		Nordic	Western	East-Central	Mediterranean
				X	
Type of location		Core	Transitional	Peripherall	
				X	
		Cross-border	Coastal	Mountain	
				X	
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)	
	576 145	103,4	5 571 km2	Average -3,3 ‰ per year	
Qualitative description	<p>Regions relatively rare inhabited (average in Poland 122,1 inhabitants per km²) and with decreasing number of inhabitants, in region in 2009 domestic migration rate -1,7 ‰, natural movement rate -1,6 ‰). Urban rate relatively high in comparison to Polish conditions (jeleniogórskie 62,5 %, Poland 61%), without big cities but with many small towns. The biggest is Jelenia Góra (84,5 thous. inhab.). Share of inhabitants in postproductive age relatively low (jeleniogórski 16,2%, Poland 16,5 %). High share of unemployment (jeleniogórski 17,5 %, Poland 11,9 %). High share of forests in land use structure (jeleniogórski 39,3 %, Poland 29,3 %), and low share of arable lands (jeleniogórski 32,5 %, Poland 44,3 %). GDP per capita relatively low, poorest region in dolnoslaskie voivodeship, only 71,5 % of the average value in voivodeship, 77,7 % of Polish average..</p> <ul style="list-style-type: none"> • High level of forest • Very diverse landscape • Valuable natural features and significant geo- and biodiversity • Dense, well-developed settlement network, many small towns • Development of service, residential and commercial functions • High spatial mobility of population • Relatively high number of post-socialist factories • Multifunctionality of most rural areas • Agritourism upland/mountain areas • Concentration of commerce and services around certain border crossings • Dense road system • Outstanding natural and cultural features plus attractive landscape as foundation for further development of tourism • Special conditions for health and spa-based tourism • Increased interest in buying land and second homes <p>Functional diversification of borderland area</p>				
Land use structure (%)	Artificial surface	Agricultural land	Forested land	Water bodies	
		25% (2009 – NUTS2)	51% (2009 – NUTS2)		
Major tendency in structure of land use in period 2000-2006 (2000=100%)	Artificial surface	Agricultural land	Forested land	Water bodies	
Increase (A – above country level, B – below country level)		-	A (103%)		
Decrease (A – above country level, B – below country level)		A (89%) NUTS2	-		
Stable		-	-		
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)	transformations associated with the takeover of land used for agriculture to industry, urbanization, and forestry forms of land use				
Description of land use changes (other important information)	<ul style="list-style-type: none"> • increased area fallow and idle land • high forest cover 				
Socio-economic level	GDP per head	Index of unemployment	Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)	
	5 952 €	13,7% (2009)	18,4 % (NUTS 2)	thinly	

Regional functions (2 – highly represented; 1 – represented; 0 – lack)	Agriculture	Forestry	Tourism and recreation	Settlement (Build up)	Industry	Others (administrative, education, etc.)
	2	2	1	0	1	0
Other qualitative description of region	Multifunctional region, well recognized by us, we have some research experience from this region.					
Major local and regional plan documents	The 2000-2020 Development Strategy for the Slaskie Voivodship [http://bip.slaskie.pl/STRATEGIA/strategia_07_05.pdf]; Spatial Development Plan the Silesian Voivodeship [http://slaskie.pl/planzagospodarowania/] The 2006-2010 program of renewal rural area of the Silesian Voivodeship [<a href="http://www.slaskie.pl/strona_n.php?jezyk=pl&grupa=3&dzi=1248440598&id_men
u=160">http://www.slaskie.pl/strona_n.php?jezyk=pl&grupa=3&dzi=1248440598&id_men u=160]					

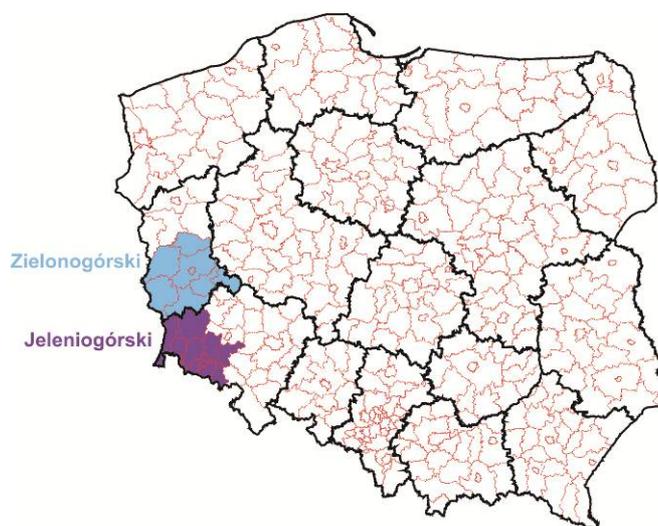


Fig. Region Jeleniogórski

Region Chelm-Zamosc							
Location within Europe		Nordic		Western	East-Central	Mediterranean	
					x		
Type of location		Core		Transitional		Peripherall	
						x	
		Cross-border		Coastal		Mountain	
		x					
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)			
	644 007 (2010) 649318 (Eurostat)	69.3 (2006) 70.0 (Eurostat)	9 291 9290 (Eurostat)	decrease			
Qualitative description							
Land use structure (%)		Artificial surface	Agricultural land	Forested land	Water bodies		
		3,17	72,38	23,55	0,32 (+0,58 wet)		
Major tendency in structure of land use in period 2000-2006 (2000=100%)		Artificial surface	Agricultural land	Forested land	Water bodies		
Increase (A – above country level, B – below country level)		A (124,6)		A (103,6)	A (114,9)		
Decrease (A – above country level, B – below country level)			B (98,0)				
Stable							
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)		Conversion from agricultural land cover to artificial and forested land					
Description of land use changes (other important information)		1) stable increase of forested land 2) increase of artificial surface 3) domination of arable land in agricultural land 4) Diversified plant cultivation					
Socio-economic level		GDP per head	Index of unemployment	Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)		
		5700 €	13.8 (2009)	-	thinly		
Regional functions (2 – highly represented; 1 – represented; 0 – lack)		Agriculture	Forestry	Tourism and recreation	Settlement (Build up)	Industry	Others (administrative, education, etc.)
		2	2	2	0	0	1
Other qualitative description of region		1) poorly developed industry 2) low income households dependent on agriculture 3) untapped tourism potential 4) negative migration balance 5) unfavorable age and sex structure of population					
Major local and regional plan documents		<i>Social Policy Strategy of Lubelskie Voivodship</i> [http://www.lubelskie.pl/index.php?pid=196]; <i>The 2020 Development Strategy for the Lublin Voivodship</i> [http://www.lubelskie.pl/index.php?pid=1093]; <i>The 2008-2015 Development Strategy for Chelm District</i> [http://www.powiat.chelm.pl/articles.php?lng=pl&pg=466] <i>The 2008-2015 Development Strategy for Zamosc District</i> [http://www.bip.starostwo.zamosc.pl/page/776/84/strategia-rozwoju-powiatu-zamojskiego-na-lata-20.html]					

Localization on the map

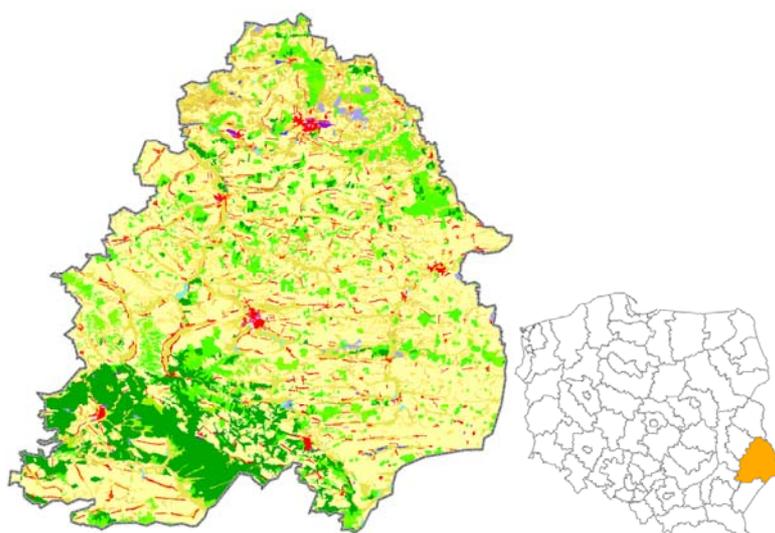


Fig. Region Chelmsko-zamojski

Region Groot Amsterdam

Location within Europe	Nordic	Western	East-Central	Mediterranen
		X		
Type of location	Core		Transitional	Peripherral
	X			
	Cross-border		Coastal	Mountain
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)
	1,235,514	1563 hab/km2	790.32km2	1990-2009: 161,167

Qualitative description

The case study area "Groot Amsterdam" (NUTS3) is 790 km² and located in the province of Noord-Holland. The NUTS3 region (NL326) consists of 15 municipalities. The centre is Amsterdam the capital of the Netherlands. In the southwest the international airport Schiphol is located with cities like Amstelveen, Hoofddorp and Nieuw-Vennep. In between these cities you find arable land. The northwestern part consist mainly of pastures with some places like Purmerend and Edam-Volendam.

Twenty nine different types of land use exist in the national detailed land use map of 2008 (LGN6). The main land uses in the NUTS3 region "Groot Amsterdam" are presented in the Table.

In between 2004 and 2008 in the NUTS region only 5.9km² of land use changed between these main classes.

Some socio-economic indicators for the NUTS3 region:

GDP per capita 52,857 Euro (2007), labour input of employed persons (1000 full time eq. jobs) 696.4, housing stock in absolute figures for dwellings, recreation houses, capacity recreational buildings are respectively 592,711; 290 and 16,012. And the following table presents the regional accounts

SIC '93	Periods	Output (basic prices) mln euro	Intern Consu m. mln euro	Gross value added mln euro	Compens of employees mln euro	Taxes, not product-related	Subsidies, not product-related	Gross operating surplus	Labour input of employed persons 1000 fte's
						mln euro			
Total economic activities	2007	123669	66513	57156	33679	642	437	23273	696.4
A+B Agriculture hunting forestry fishing	2007	779	377	402	140	8	8	262	6.2
C-F Industry	2007	19941	13802	6139	3127	39	79	3051	70.8
G-K Commercial services	2007	85522	45455	40067	22639	507	212	17133	437.7
L-P Public administration, social work	2007	17427	6879	10548	7772	87	138	2826	181.7

Main Land use	Area
agriculture	360.4
greenhouses	8.2
orchards	1.6
forest	13.2
water	84.4
urban	256.2
infrastructure	34.9
nature	31.4
total	790.3

At least per municipality information is available on population, education, housing, income-social security, infrastructure and mobility, criminality

Land use structure (%)	Artificial surface		Agricultural land	Forested land	Water bodies	
			17 % (2009 –NUTS2)	4 % (2009 – NUTS2)		
Major tendency in structure of land use in period 2000-2006 (2000=100%)	Artificial surface		Agricultural land	Forested land	Water bodies	
Increase (A – above country level, B – below country level)			A (104%) NUTS2	A (119%) NUTS2		
Decrease (A – above country level, B – below country level)			-	-		
Stable			-	-		
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)	Urbanization, multifunctional land use; urban agriculture on the under-used land.					
Description of land use changes (other important information)	Revitalization of the structure of land use in region,					
Socio-economic level	GDP per head		Index of unemployment	Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)	
	GDP /capita EU27 = 100 : 190 GDP /capita country = 100: 143 €		3,8 % (2009)	38,7 % (2010 NUTS 2)	densely	
Regional functions (2 – highly represented; 1 – represented; 0 – lack)	Agriculture	Forestry	Tourism and recreation	Settlement (Build up)	Industry	Others (administrative, education, etc.)
	0	0	1	2	1	2
Other qualitative description of region	<ul style="list-style-type: none"> • detailed spatial land cover/use information available at 25*25m grid level • national statistics at municipality level from national office of statistics (CBS) • geographical information on agricultural farms (GIAB) • farmland prices 					
Major local and regional plan documents	<i>Amsterdam City Comprehensive Plan</i> [http://www.scribd.com/doc/59941257/Amsterdam-City-Comprehensive-Plan]					

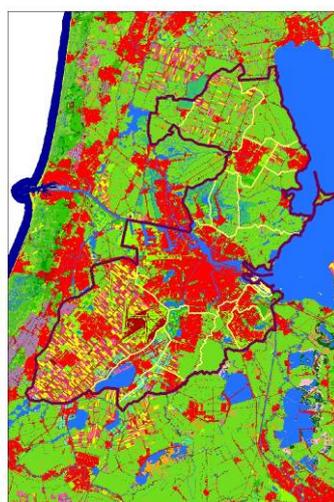


Fig. Region Groot Amsterdam

Eurocity Basque Bayonne- San Sebastián						
Location within Europe		Nordic		Western		East-Central
						X
Type of location		Core		Transitional		Peripherral
		Cross-border		Coastal		Mountain
		X		X		
Size	Inhabitants (nb.)	Density (nb./ km ²)	Surface (km ²)	Pop. growth rate, 1990-2010 (increase/decrease/stabile)		
	650.000	about 140/km ²	800 km ²	unknown		
Qualitative description	<p>The Basque Eurocity of Bayonne-San Sebastián is located on both sides of the dividing line that was historically formed by the Bidasoa River.</p> <p>"The Bayonne-San Sebastián Basque Eurocity" straddles the French-Spanish border on the Atlantic side of the Pyrenees, extending along the 50 km urban corridor that separates Bayonne and San Sebastián. It is the natural access route between the Iberian Penninsula and Western and Central Europe..."</p> <ul style="list-style-type: none"> - At the heart of the Atlantic Arc between Bilbao and Bordeaux. - At the western end of the French- Spanish border. - On the Atlantic façade of the Pyrenees. <p>Both territories share a common Basque cultural heritage and throughout history have lived together through periods governed by mutual goodwill and the desire to promote reciprocal needs and interests, and, as has occurred in other border areas, also through periods of confrontation and estrangement. In effect, the special circumstances of the twentieth century made the Franco-Spanish border very strong.</p>					
Land use structure (%)	Artificial surface		Agricultural land		Forested land	Water bodies
			23% (2006-NUTS2)		41 % (2006 – NUTS2)	
Major tendency in structure of land use in period 2000-2006 (2000=100%)	Artificial surface		Agricultural land		Forested land	Water bodies
Increase (A – above country level, B – below country level)					B(100,2%)	
Decrease (A – above country level, B – below country level)			A (98%)		-	
Stable					-	
Dominant land use changes 1990-2006 (see Nordregio said nb. 23)	green area devoted to agriculture, with little rural villages (French side) and Spain's industrial north					
Description of land use changes (other important information)	<ul style="list-style-type: none"> • visible pressure on land use change by the infrastructure 					
Socio-economic level	GDP per head		Index of unemployment		Share of high educated inhab.	Degree of urbanization (densely/intermed./thinly)
	25.000		10,7% (2009)		36,8 % (2009 – NUTS 2)	intermed
Regional functions (2 – highly represented; 1 – represented; 0 – lack)	Agriculture	Forestry	Tourism and recreation		Settlement (Build up)	Industry
	2	1	2(France)		1	2(Spain)
						Others (administrative, education, etc.)
						0
Other qualitative description of region	<p>The desire to live without frontiers and to co-operate across borders, means that sharing differences and diversity produces a new metropolitan reality that adds a new element to the features defining the identity that each of us already has. New squares, avenues, universities, beaches, promenades... will spring up out of the sum of those that already exist. Here are just two examples: the Eurocity will have a large square, the Main Square of the Eurocity, which will be the sum of the squares that</p>					

	<p>already exist in our cities today. Our University won't have a single campus, but the university campus of the Eurocity will be the sum of the campuses that we already have. The same will happen with the beach, the coast, culture...</p>
<p>Major local and regional plan documents</p>	<p>THE BASQUE EUROCITY BAYONNE-SAN SEBASTIÁN THE STRATEGY : OBJECTIVE AND ACTIONS [http://www.eurocite.org/page.asp?IDPAGE=244]</p>



Fig. Region Eurocity Basque Bayonne- San Sebastián

Field study – interview questionnaire

Region

Place

Person interviewed

Interviewer

Date

Introduction to the interview

Please inform the interviewed person about a major EU-LUPA Espon project aims and expected results of case studies (i.e. to understand and obtain a clear view on land use dynamics, land use changes and current land use patterns in the European territory, Identify main challenges in different types of territories, regions and cities by means of their territorial efficiency and define the policy options and recommendations to cope with these challenges).

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

.....

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

.....

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

.....

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

.....

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

.....

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

.....

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

.....
.....

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

.....
.....

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

.....
.....

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

.....
.....

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

.....
.....

2. Multifunctional land use - which of the functions in your region co-exist?

.....
.....

3. Which of the functions are the most important in the context of land use?

.....
.....

4. Is the number of functions of land use increasing or decreasing?

.....
.....

5. To which extent is the land in your region used in multifunctional way?

.....
.....

6. What kind of functions co-existence is:

- a) the most effective?

.....
.....

- b) the most desirable?

.....
.....

- c) the most common?

.....
.....

- d) the most difficult?

-
.....
7. Which of the functions of land use are the most important for the future regional development?
-
.....

IV. Spatial conflicts

1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).
2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?
3. Which of the actors are the most dynamic and successful in obtaining new land?
4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?
.....
.....
2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).
.....
.....
3. Is there any monitoring of land cover changes in the region? (Please describe briefly).
.....
.....

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?
.....
.....
2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?
.....
.....

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.
.....
.....
2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.

.....

.....

Exemplar Region Report Structure

INTRODUCTION TO THE REGION

(Administrative and geographical location: area, number of inhabitants, other basic data. Reasons which decided to choose the region for the study.)

1. CHARACTERIZATION OF LAND USE AND LAND COVER

1.1. Definitions of land use

1.2. Surface and structure of land use

(Basic data on land use in the region. A brief description on how the land is used and what the related economic activities – based on the data, regional documents, literature).

1.3. Land cover specific

(Land cover reflects the biophysical state of land. The specific land covers patterns, structures, characteristic and peculiar for the region).

1.4. Protected areas (from environment, military, etc. points of view)

(Protected areas generate different limitations of human activities and thus they influence significantly land use and the related processes. There are different forms and extent of nature and landscape protection. Areas protected from other point of view should be also identified and described in the region (areas of limited use around airports, landfill sites, sewage plants; military areas etc.).

1.5. Technical management of the land use (infrastructure, drainage systems, etc.)

(The main elements of technical infrastructure: roads, railways, power network, drainage systems).

1.6. Major trends in historical context

(The processes and major trends concerning land use and land cover structure on the basis of statistical data, literature and interviews with regional experts. The impact of economic and demographic processes and phenomena on land cover in historical context. The past trends and tendencies are, on the one hand, a background for contemporary processes, and on the other hand they can help with foreseeing the future processes).

2. NARRATIVE OF CHANGE IN RELATION TO LAND USE

2.1. Socio-economic (demography, employment, ... etc.)

(The main demographic processes and phenomena influence land use changes significantly. The economic situation and dynamics, which is connected with socio-demographic issues, is also very important as regards land use and land management. Description of the processes of agriculture, industry, tourism development and employment, with a focus on its impact on the land use. Statistical data, regional documents and interviews results should be used).

2.2. Environment (Landscape, soils, climate change... etc.)

(Description of the environmental changes, changes in the spatial extent and condition of protected areas over the last decades, as well as main threats to natural areas. Relations between socio-economic processes and environmental conditions, and its impact on land use).

2.3. Government and planning system

(The analysis of administrative and legal system related to spatial planning and management. The effective and efficient institutions, coherent and effective law and state policy play an important role in land management and land use. Description of the planning system.)

2.4. Localization (accessibility, core-periphery, urban-rural continuum)

(The location of the region in economic space is very often a key factor of land use processes. The location in European and national scale, as well as the internal spatial differentiation of the region in terms of accessibility, core-periphery relations).

2.5. Conclusions in the context of land use

(The above mentioned issues and processes related to localization, demography, economy, environment, administration and governance will be summarized and assessed from the point of view of land use, its contemporary and future changes).

3. ANALYSIS OF LAND USE CHANGES

3.1. Dynamics and directions of land use and land cover changes

(Dynamics of land use and land cover should be presented graphically (charts, maps) on the basis of regional databases. The period of analysis should depend on availability of data. Interview results will provide detailed information for description, understanding and explanation of the dynamics and directions of land use).

3.2. Trends, actors and drivers of the changes (micro and macro scale)

(On the basis of interviews results, regional, local documents and literature main drivers of land use change will be identified and described on the local/regional scale. Drivers can be related to demographic processes, economy, employment, agriculture, environment, governance, transport. The major actors (for example: entrepreneurs, new inhabitants, farmers, tourists) who determine land use changes will be identified. An important point will be also a holistic analysis of drivers and actors who create a complex and interrelated system).

3.3. Contemporary and potential conflicts

(As space is limited different actors compete to obtain the possibly largest area or their needs. Spatial conflicts reflect how strong is the competition for land and who are the most important actors, what are the main drivers. Interviews with local experts will provide information on contemporary and potential future spatial conflicts).

3.4. Scenarios

(The possible scenarios of future land use and land cover changes will be presented on the basis of statistical data and the other information collected during the study. The scenarios will reflect low, moderate and fast economic development).

5. MULTI-FUNCTIONALITY OF LAND USE

5.1. Functional differentiations

(Functional profile of the chosen region will be presented and analysis of the local differentiations of economic functions).

5.2. Current multiple uses of land

(Identification of co-exists functions of the land use in the region. Inter-actions between the multiple uses of land and their temporal and spatial changes. Evaluation of the most effective, desirable, common and difficult functions in the context of land use multi-functionality).

5.3. Potentiality of multiple uses of land

(Identification of the potential other land activities. Possible conflicts between functions).

6. POLICY CONTEXT OF LAND MANAGEMENT

6.1. Land use in the regional/local documents

(Local and regional strategies, plans and programs related to land use, spatial planning and management, socio-economic development and environment will be reviewed and assessed).

6.2. Influences of regional/local planning

(Programs and plans of spatial development contain the future directions of land use, which are planned and expected by local/regional authorities. The review of regional and local plans and programs will help with foreseeing future land use changes).

7. CHALLENGES AND POLICY RECOMMENDATIONS (2020 perspective)

8. CONCLUSION

(Drivers and dynamics of land use will be summarized and assessed. An important part of conclusions will be identification of major effects of land use changes).

LITERATURE

APPENDIXES

www.espon.eu

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ISBN

EU-LUPA European Land Use Patterns

The Øresund Region Case Study Report Appendix 4

Applied Research 2013/1/8

Mariola Ferenc, Marcin Mazur

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1. INTRODUCTION TO THE REGION

The Øresund region is located on two strands of the Strait of Sund - both in Denmark and Sweden. The boundaries of the Øresund region changed in the recent years. With administrative changes, in Denmark as well as in Sweden, the area of the region increased. From 1 January 2007 the administrative division of Denmark applies to 5 regions, which replaced the division of 13 provinces (*Amts*). As part of administrative reform, the number of municipalities was reduced from 270 to 98. In Sweden, in 1997, counties of Kristianstad and Malmöhus merged to Skåne county (*Scania*). Through changes in the Øresund, region expanded its area more than twofold. It currently covers the region of Skåne on the Swedish side of the strait, the capital region of Denmark and Zealand region (islands *Sjælland*, *Lolland*, *Falster*, *Møn* and *Bornholm*) on the Danish side. The region has a total area of 21 203 km², of which 11 369 km² is on the Swedish side and 9 834 km² belongs to Denmark. With 3.7 million inhabitants the Øresund region is the largest and most densely populated metropolitan region of the Nordic countries.

The Øresund's Bridge linking Copenhagen and Malmö since 2000, is a comprehensive motorway network that connects the North of Scandinavia with Denmark and Western Europe.

This bridge also extends the regional railroad that formalizes a loop between the Danish and Swedish coasts. On the other hand, the various waterways that facilitate communication among numerous cities of the Bay extend to the Baltic Sea and the Atlantic Ocean via the North Sea, thus expanding the possibilities with the coastal countries concerned (Figure 3). The most obvious and on-going process in this area is the urban sprawl.



Figure 1 – Old regionalization of Øresund region.

Source: <http://www2.dmu.dk/rescoman/groundobs/maps/oresund.htm>



Figure 2 – The area of Øresund region

<http://www.tendensoresund.org/en/key-map>



Figure 3 - Key traffic nodes for international passenger traffic in the Øresund region.

Source: http://www.tendensoresund.org/en/accessibility-from-a-european-perspective/Picture6.jpg/image_xlarge

The Øresund region is very interesting in the aspect of land use typologies with urban sprawl interaction, and consequently also with multifunctional activities as the following are taking place:

- Protected areas both on islands of the region, and on the Swedish mainland
- Agriculture, with Southern Sweden being the most intensive producing area of that country
- A large number of renewable energy producers both individual as well as park based windmills, on both land and sea.
- In addition, a high production of biomass for biogas, power and district heating generation. Especially on the Swedish side there are interactions and conflicts between agriculture and biomass production.
- High mobility between the Swedish and Danish sides, and with the bridge being the most important commuting tool, especially from the Swedish side. In 2010 approximately 20 000 people a day commuted across the Sund – six times more cross-border commuters compared to the year 2000.
- Coastal communities where tourism and second homes from both sides are playing a significant role.

The region is an excellent illustration of the urban sprawl problem and since the bridge was erected the implications of urbanization from one country (the Danish side) on the land use patterns in another country (the Swedish side) occur.

2. CHARACTERIZATION OF LAND USE AND LAND COVER

2.1. Definitions of land use

The terms "land cover" and "land use" are often confusing.

Land use was defined by de Bie (2000) as "a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources ". He described land resources as all aspects of land that enable, support, constrain or influence present as well as potential land use. FAO defined land use as "the total of arrangements, activities, and inputs that people undertake in a certain land cover type", the same organization in contrast defined **land cover** as "the observed physical and biological cover of the earth's land, as vegetation or man-made features." (FAO, 1997a; FAO/UNEP, 1999).

Good example, which illustrates the above definitions is "grassland" for cover term, while "rangeland" or "tennis court" refer to the use of a grass cover.

T.M. Burley suggests, that land use means to combine a land cover and land utilization. He used the concept of land cover to refer to the setting in which action (employment) takes place, i.e. the vegetation and artificial constructions covering the land surface. Second concept, land utilization, was used for the activities i.e. the employment of the land surface through the medium of land cover.¹

The most important transformation in land use is a combination of many interactions including:

- Socio-economic and historical changes
 - Land ownership and tenure changes
 - Population growth
 - Urbanization
 - Industrialization
 - Development of technology
 - The establishment of transportation and communication networks
- Political decisions:
 - Subsidies and taxes for using the land
- Environmental conditions:
 - Climatic factors
 - Soil quality²

¹ Jankowski W., 1975, Land Use map ping development and the methods, Geographical Studies, Publisher PAN, Wroclaw, Warszawa, Krakow, Gdansk, No.111.

² Brouwer F.M., Chadwick M.J , Future land use patterns in Europe, [in]: Brouwer F.M., Thomas A.J., Chadwick M.J., 1991, Land use changes in Europe : processes of change, environmental transformations, and future patterns, Kluwer Academic Publishers, Dordrecht, Boston, London, p. 49.

2.2. Surface and structure of land use

The region has a total area of 21 203 km², of which 11 369 km² is on the Swedish side and 9 834 km² is on the Danish side. It is very diversified: a high population density region of Copenhagen and Malmö, forest area in the North and East of Scania, agriculture land in Southern Scania and Zealand. Additionally all region has a highly developed coastline, along which evolved the residential area, touristic and recreation zone, small business centre, and windmill farms producing renewable energy.

Kostrowicki J. observed that, the Northern region is mostly characterized by market-oriented agriculture with livestock breeding, which progressively declines with the distance from settlement of traditional agriculture.³

Agriculture has a large impact on the specificity of land use in Denmark. Land under arable use accounts for 90% of the utilized agricultural area in Denmark⁴. On the Danish side of Øresund region agriculture is the most significant form of land use. In the past traditional agriculture dominated, but nowadays the organic agriculture becomes more popular. A new trend is also to convert agricultural land into industrial area with highly developed transport infrastructure (like in Købe area).

Merging information about land use in Denmark and Sweden is difficult due to the different approach to the leading statistics. Structure of land use in the Øresund region is decidedly different than in Denmark or Sweden (Figure 4). In whole Denmark there are more utilized agricultural lands (58%) and less forest areas (11%). In Sweden the situation is reversed: more than 58% of land is covered by wooded area and just 7% is used as agricultural land. The Øresund region consists of three different sub-regions: Hovestaden (the capital region of Denmark), Sjælland (Zealand) and Scania region (in Eurostat statistics the most similar region in terms of area is Sydsverige). Each of the three regions is completely different: the Copenhagen area has the highest rate of "Other" area, which is mainly urbanized land. In two remaining regions, this indicator is at the level of 1/4 of land. The Zealand region has 63% of utilized agricultural area and merely 1/10 of this region is covered by forest. The region of Scania has the highest share of wooded land (42% of area) and a high rate of agriculture land.

The region is a combination of mono-centric development (Copenhagen, Malmö) with some multicentre elements (Roskilde, Købe, Søro).

In the 21st century the land use changes were not as significant in case of the urban area of Great Copenhagen. Most changes occurred on rural areas, which transitioned into urban ones. The changes in urban areas weren't observed in the recent years, as they mostly took place in 1970s and 1980s. Nowadays only the area of fifth zone is still developing. Vast majority of urban land was established on former agricultural land. Between 2000 and 2006 the urban land-take was much higher than between 1990 and 2000, about 340 ha per year in second period

³ Lee J., Land resources, land use and projected land availability for alternative uses in the EC [in:] Brouwer F.M., Thomas A.J., Chadwick M.J., op.cit., p.40.

⁴ Kostrowicki J., Trends in the transformation of European agriculture [in:] Brouwer F.M., Thomas A.J., Chadwick M.J., op.cit., p.2.

compared to the previous 50 ha per year⁵. Almost no urban land is transferred back to other uses. Once the land becomes urban – it remains urban.

In 1972 the zoning system in Denmark divided the land to urban, rural and recreation zones. This fragmentation was in use till the turn of the century. It protected rural areas exclusively for agriculture production, apart from one compromise being the development of communication networks.

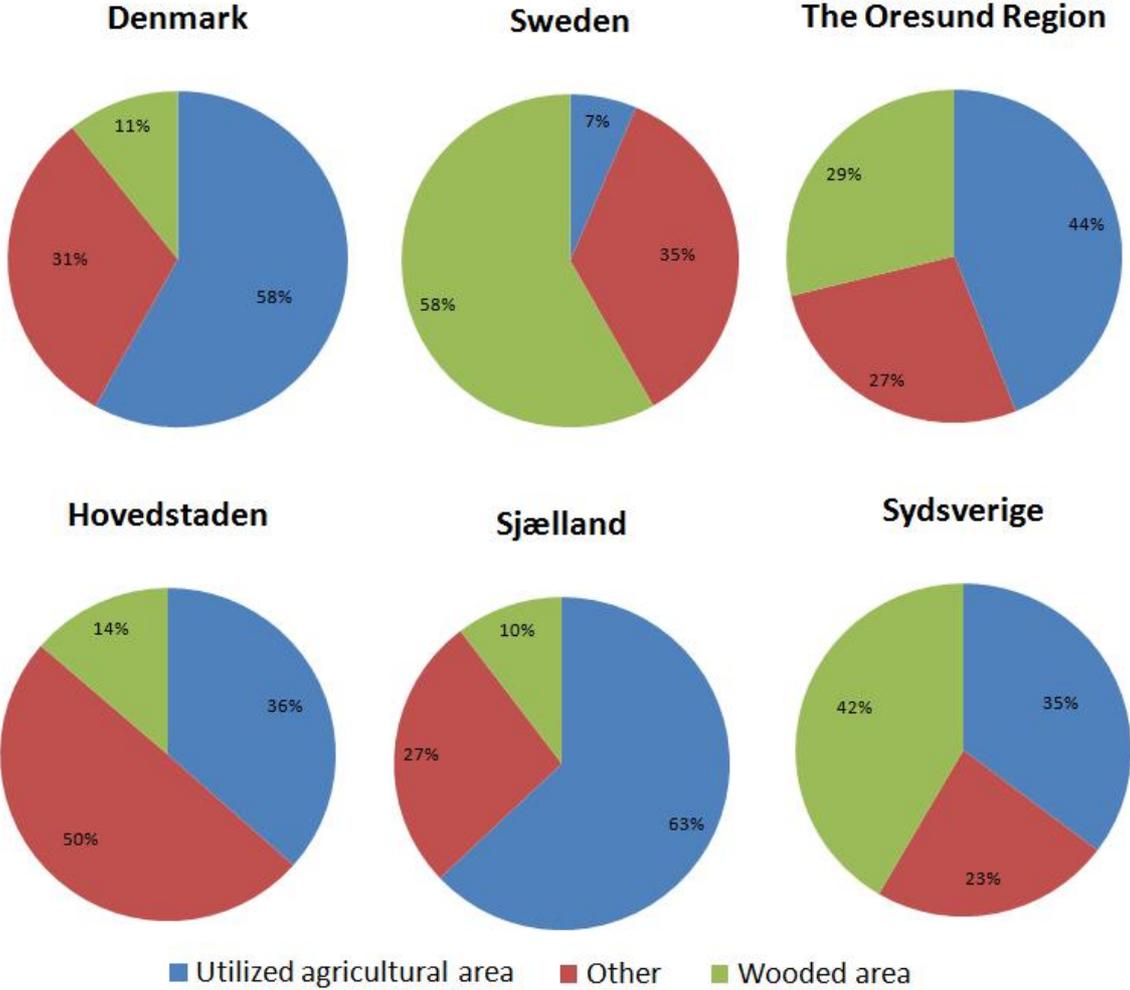


Figure 4 – Structure of land use in 2009

Source: Eurostat

Every year the number of visitors to Danish and Swedish countryside is increasing. Nordic people are highly aware of healthy and safe style of living, and they perceive contact with nature as a medicine for “lifestyle illnesses”. For this reason, preservation of natural environment values is so essential for Nordic inhabitants.

It was not simple to reconcile aspirations of both, residents and investors, but the Nordic people managed to achieve it. Most overwhelming was the rigid adherence to

⁵ Zasada I , Fertner C , Piorr A, Nielsen TAS . Peri-urbanisation and multifunctional adaptation of agriculture around Copenhagen . Geografisk Tidsskrift . 2011; 111(1):59-72.

the rules concerning planning and thinking about the future, not the current time and potential benefits.

It was noted that the city of Copenhagen evolves on a circular plan: first round of infrastructure and consequently the “gaps” in between are managed. When formulated "Finger Plan" as a basis to fill the emerging space, both in the city and the outskirts the green space was use. Small areas, located in or near the city were mainly used by residents for short trips, while large surfaces of green areas on the outskirts were visited during the longer vacation. When organizing the undeveloped space, a conflict between natural and urbanized areas was visible: the pressure put on recreational and agricultural area was intensified.

By analyzing Figure 5 (with old administrative division) it can be deduced that between 1985 and 2004 agriculture in Denmark was highly modified. Agricultural land area decreased or was stable in almost all Danish side of Øresund .

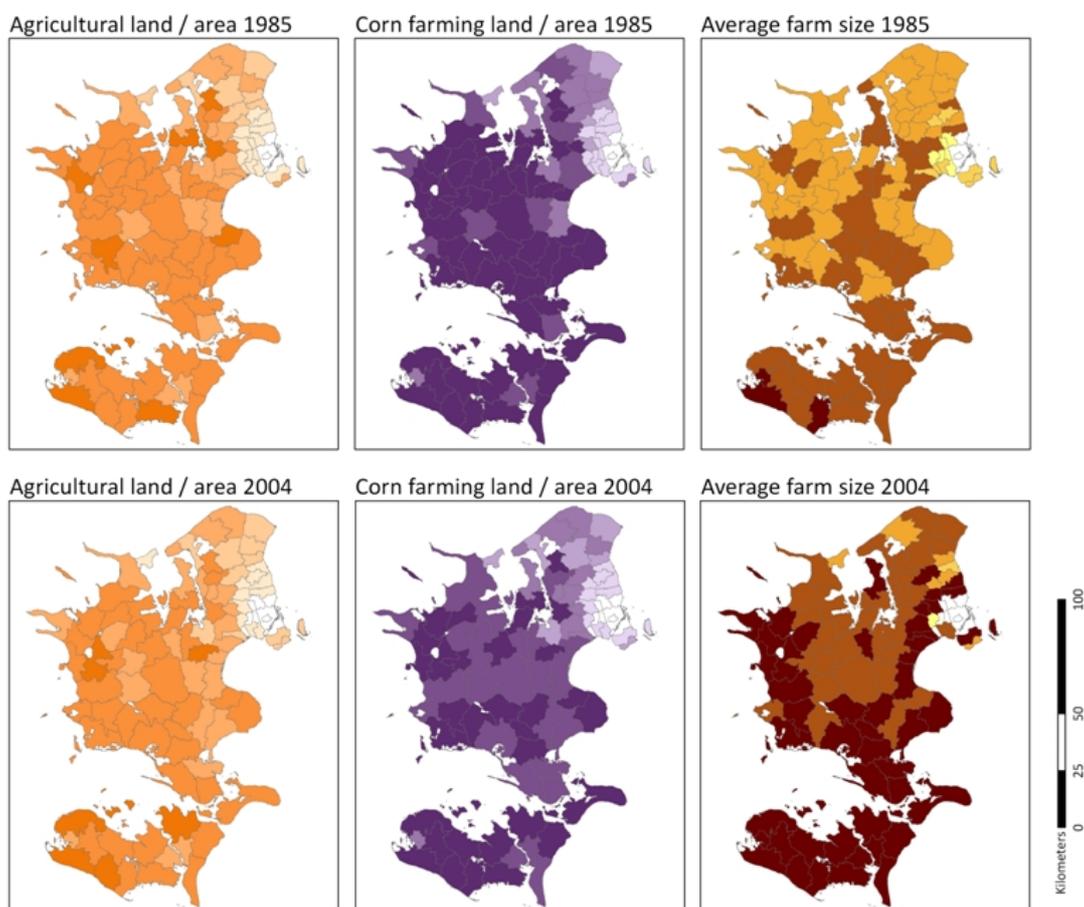


Figure 5 – Agricultural data for the Copenhagen and Zealand regions. Data for municipalities. Changes between 1985-2004

The darker the color the higher the rate

Source: http://landblend.files.wordpress.com/2010/03/overview_kom_data_s.jpg

Greatest changes are to be noticed in corn farming land areas: in 1985 this type of agriculture was critical, because of high number of animal's farm. Together with an increased number of EU Member States, these farms were moving out to less developed countries, like for instance Poland. Corn farming land hence decreased. EU policy supports big farms, thus the average farm size still increases in almost all

of Denmark. Only in a few municipalities remain farms of insignificant size. This situation exists exclusively in the neighborhood of Copenhagen and in the North of the Copenhagen region, because of a specific lifestyle and recreational farming.

2.3. Land cover specificity

Land cover is the physical material at the surface of the earth.

According to Jesper Brandt, Denmark is a very urbanized country, so there are not a lot of natural, environmental elements. Researchers from Roskilde University focused on small elements of environment, like small lakes, groups of trees, rivers. They realized that these small elements are also important for landscape and for perception of space as a whole.

Researchers focused on development of small biotypes, which are shown in Figure 1 (fragmentation on general linear and area biotypes). They discovered that in 1950s and 1960s negative changes occurred. In the next decades the adverse trend was still observable. In early 1990s the situation altered to positive. But nowadays it is negative again. The most important reason is that the agriculture sector has a rather strong political support. Researchers didn't find correlation between distance from urban centre to the area where measurements were made, because Denmark is a relatively small country with a significant pressure from urban population on the countryside. People have different interest for rural area.

% of change	1954-1968	1968-1980	1981-1986	1986-1991	1991-1996
Linear biotypes	- 0.6	- 2.3	- 1.3	- 1.3	0.9
Area biotypes	- 0.5	- 0.8	- 0.8	- 0.8	0.3

Figure 6- Development of small biotypes. Changes per year.

Source: interview with Jespar Brandt, Esbern Holmes

Corine Land Cover for Øresund region reflects the biophysical state of land. In this region main role plays the urban area, forest and arable land. Detailed land use in the region is shown in Figure 8. The core of the region is the Copenhagen area, which is the most urbanized area of Nordic countries.

The lands occupied by industry, commercial and transport are closely associated with urban areas. The highest percentage of them are located in the immediate vicinity of Copenhagen. In figure 7 there is a noticeable green ring around the city approximately 15 km from the center. Most arable lands are situated within 20-30 km from the city, in a further distance value is fixed at more than 50% of the area. With the distance from the center of Copenhagen, forest area is gradually increasing. About 70km from Copenhagen forests cover exceeds 40% of the area. It is mainly associated with dense forestation of Skåne.

Land cover in the Øresund Region in 2000

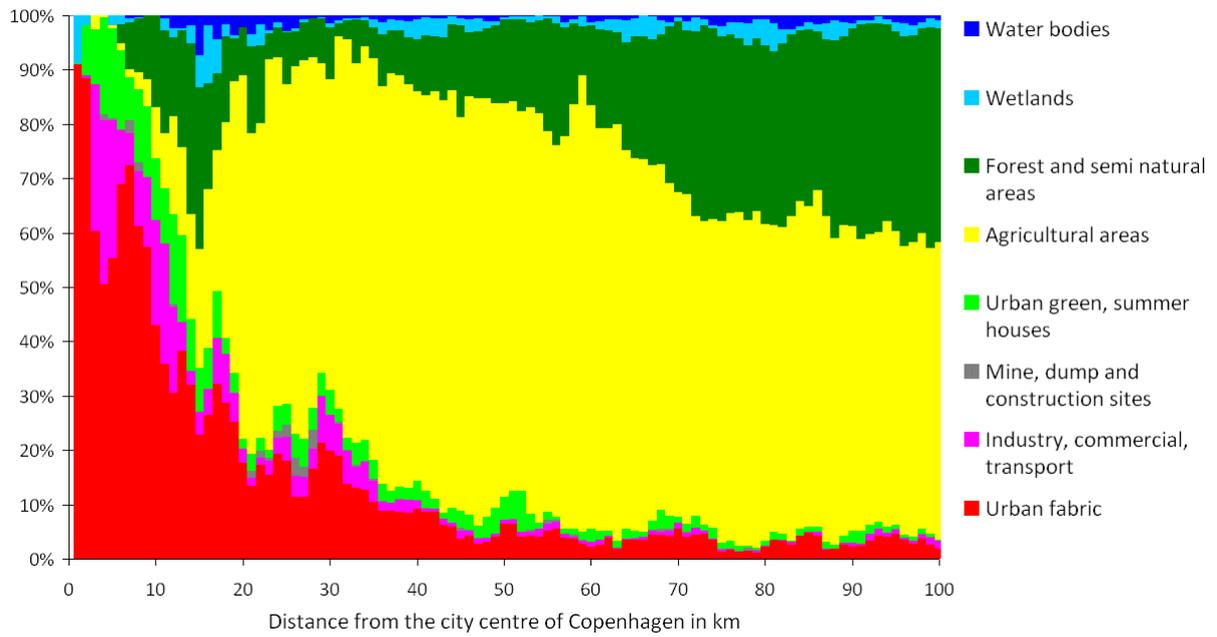
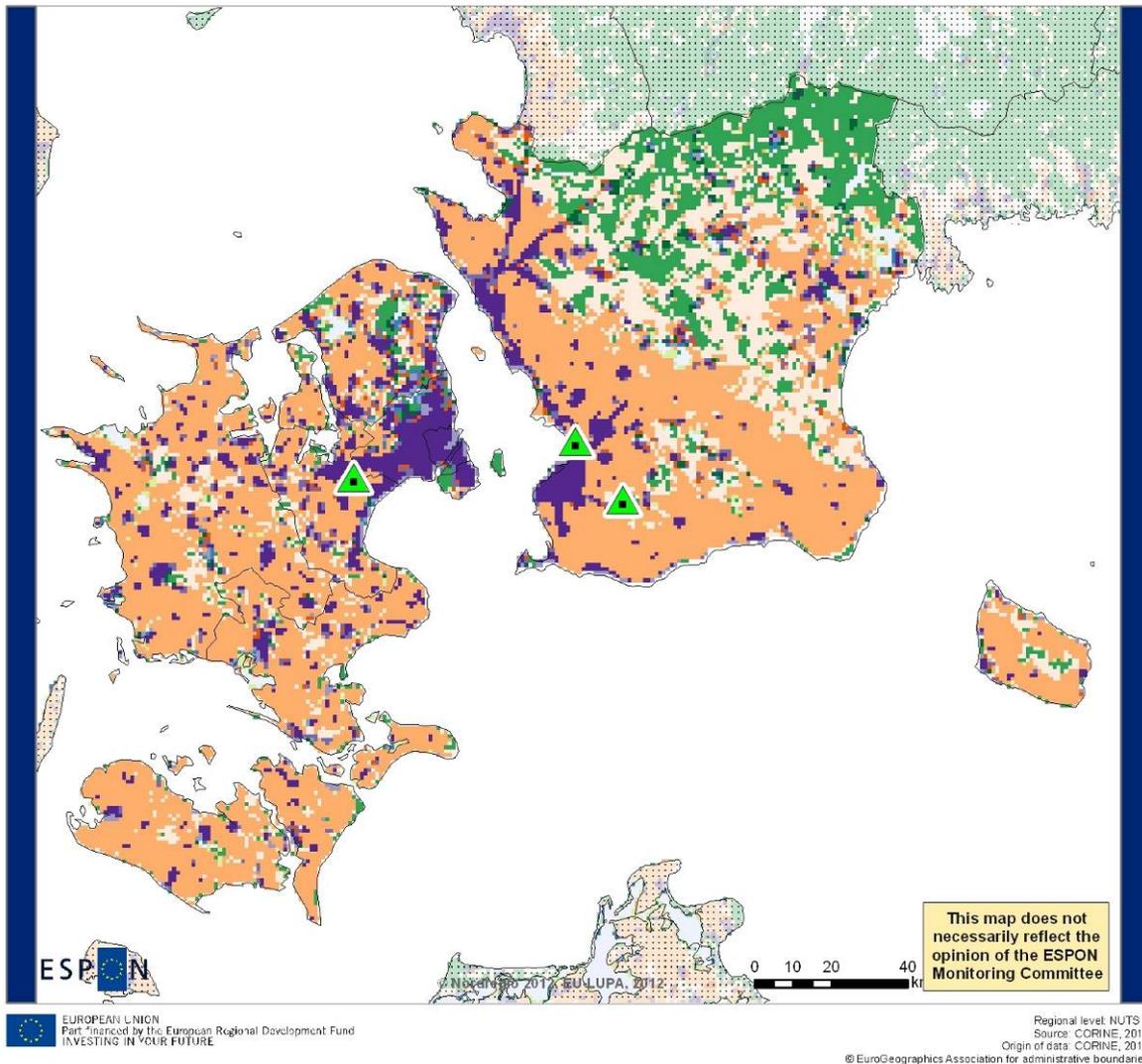


Figure 7 – Land cover in the Øresund region in 2000

Source: http://landblend.files.wordpress.com/2010/05/Øresund_lc_20001.gif

Stable Elements of Land Cover 1990 - 2006 Øresund Region



Stable Land Types

- Urban cores and metropolitan areas
 - Suburban residential and economic areas
 - Special urban areas with relation relationships to the marine environment
 - Arable land in predominantly rural areas
 - Pastures and agricultural mosaics in peri-urban or rural community areas
 - Forested areas and agricultural mosaics in peri-urban areas
 - Rural forest
 - Pastures, agricultural mosaics and mixed forest in predominantly rural areas
 - Transitional woodland or sparsely vegetated areas
 - Lands primarily associated with water courses
 - Sparse vegetation, wetlands, water bodies and snow or arctic conditions
- Points of investigation
 Areas outside the case study region

Figure 8 – Stable elements of Land Cover 1990-2006

Source: Nordregio based on Corine Land Cover

2.4. Protected areas (from environment, military, etc. points of view)

First National Park in Denmark was established in August 2008. Parks preserve the most unique and valuable natural areas and landscapes; by protecting habitats and species to offer a unique experience for visitors and contribute to sustain the natural heritage.

In Øresund region the national park of Kongernes Nordsjælland (the Kings' Northern Zealand) is located. It consists of beaches, woods, lakes and streams and is only 30 minutes away from Copenhagen. In many places, the landscape bears traces of the time when the area was the hunting grounds of the Danish kings.

Danish legislation protects especially vulnerable natural areas such as moors, marshes, lakes, meadows and sand dunes, as well as many plants, animals and their living and breeding habitats. The EU Natura 2000 programme, which protects especially valuable ecosystems of flora and fauna, is a critical element in the process of protection and preservation. Denmark is in possession of 246 Natura 2000 identified sites. Altogether, these cover 8% of the Danish countryside and about 12% of its sea area. Protected countryside covers an area six times the size of Bornholm.

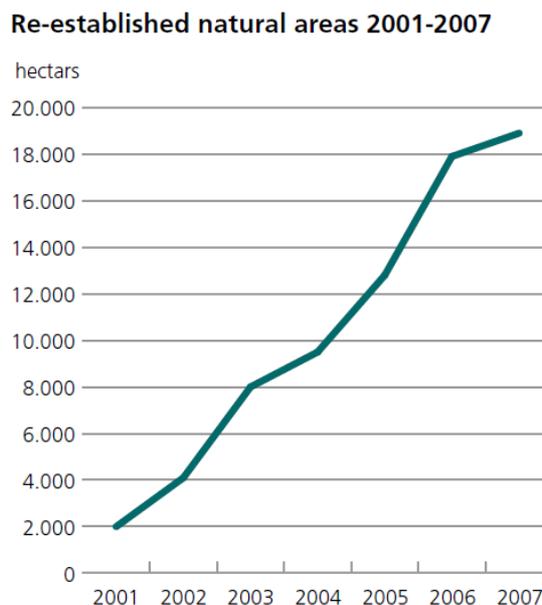


Figure 9 - The graph shows the total rise in natural areas from 2001 to 2007. This rise is a result of state re-forestation, private re-forestation and rehabilitation of natural and wetland areas in Denmark.

Source: Forest and Nature Agency 2008

On the other side of Øresund, in Scania more protected areas can be found. There are three national parks:

- *Dalby Söderskog* is a small national park situated in the municipality of Lund, near Dalby. It has an area of 0.36 km² and consists of broadleaf forest. It was established in 1918, when it was thought to be a unique remnant of primeval forest. In fact, the area has previously been used for pasture. Due to high concentration of limestone and chalk in the soil, specific conditions were provided for unique flora colonisation.

- *Stenshuvud* National Park is located on East coast of Scania with its total area of 386 hectares, including the hill Stenshuvud, which is 97 meters high. The shape of the hill is a characteristic point on the horizon, and for centuries it was a reference point for sailors on the surrounding waters. Park faces the Baltic Sea and is covered by broadleaf forest, especially hornbeam, heaths, meadows and swamps. Natural park protects various animal species like hazel dormouse, golden oriole, European tree frog. There are about 600 plant species present.
- *Parc nacional de Söderåsen* - the park features an especially contoured landscape with up to 90 m (300 ft) deep ravines. The valleys are covered with broadleaf forest, mostly beech.

2.5. Technical management of the land use (infrastructure, drainage systems, etc.)

The infrastructure of the Øresund region contributed to transforming of the area into a competitive business centre and it provides efficient transport accessibility, for residents, tourists and investors. The deciding factor for this was the availability of multimodal transport options (motorway, railway, airport, harbour). The Øresund region has the largest logistic hubs in Scandinavia.

a. Roads, motorways

The most important connection for the Øresund region with rest of Europe is the Great Belt Bridge, which links Zealand with the mainland. Along with the motorway E20 it connects the region with other Scandinavian countries. Southern part of Zealand is combined with the North by motorways E47 and E55. Skåne is crossed by roads E22 and E65. Trips by car comprised 62% of all to the rest of the country, Norway, Finland and the remaining regions of Denmark, but only 25% of all trips to and from the rest of Europe⁶.

b. Railways

Railway connection of the greatest significance in the region is the so-called "necklace of pearls". There are located some older and newer towns, which are connected by this railway, making this region more accessible. Second important connection is between Copenhagen and Malmö. Railways of the region could be compared to road transport, as they present similar efficiency. In Sweden railways are more important than in Denmark, because of longer travelling time and more dense truck traffic.

In the past, there were slow connections with limited capacity, and as a result, Copenhagen and Malmö tended to develop rather independently.

⁶ www.tendensoresund.org

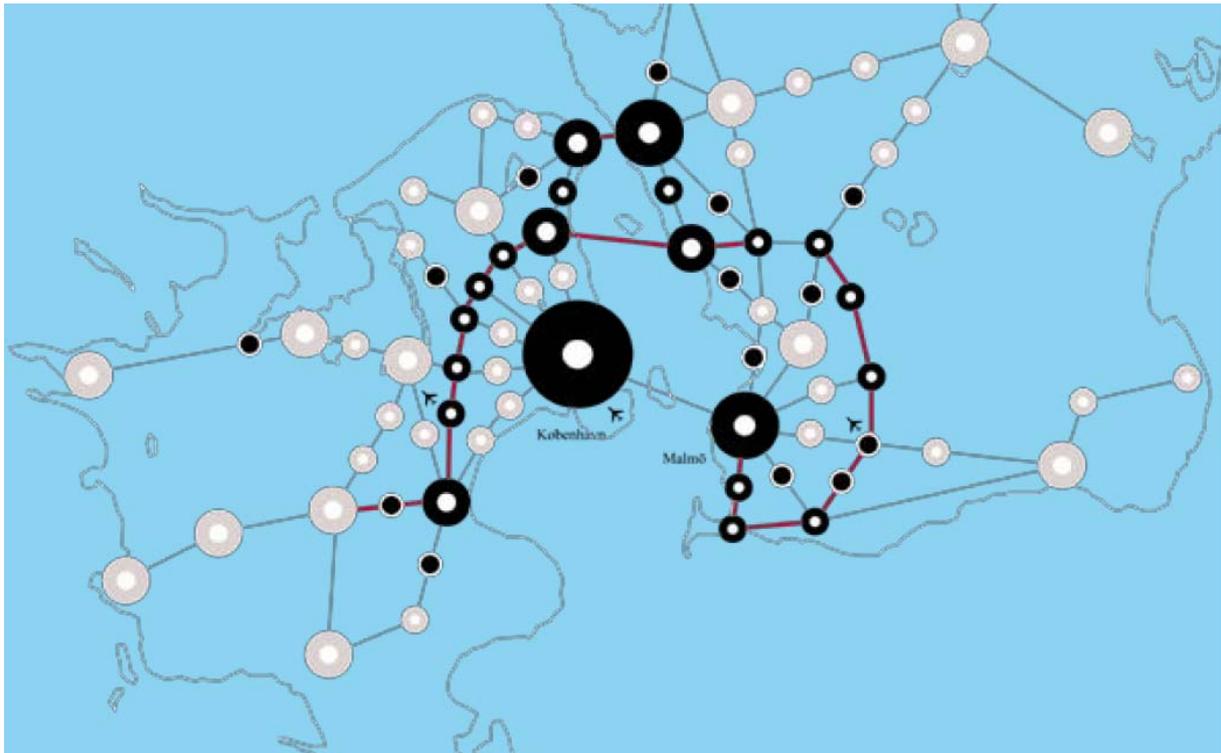


Figure 10 - New ring railroads merge the existing (station-) urban networks together across the Finger Plan and the Swedish train lines.

Source: Byplan, Nr. 4 december 2008/60. <http://www.bypplanlab.dk/sites/default/files/byplan0408.pdf>

c. The Øresund Bridge

The Øresund Bridge was opened on 1st July 2000. 182 million people have crossed the Øresund Bridge either since then, of which 111 million by car and 71 million by train. This is comparable to all of Denmark's and Sweden's populations taking the trip across the bridge as many as thirteen times during the first nine years. The 111 million car travellers can be broken down into 48 million vehicles during the period 2000-2009.⁷ The economic crisis affected Denmark and Sweden as well, and resulted in a slowdown of traffic intensity on the bridge.

Nowadays the car traffic is very dense every day: about 19 500 vehicles per 24 hours, which is a 141% increase comparing to the period 2001 – 2009.

All kinds of purposes to travel with passenger car over the Øresund Bridge increased, but the structure of travelling is changing as well. More and more people travel over the bridge for commuting purposes. During 8 years, between 2001 and 2009 this kind of travelling increased from 5% to 42%. Other kind of purposes lost on their importance (Figure 12).

⁷ www.tendensoresund.org

Daily traffic across the Øresund Bridge

Category	2001	2005	2007	2008	2009	Growth 2001 - 2009
Passenger cars	7,290	12,328	16,831	17,767	17,986	147%
Motorcycles	67	82	106	96	93	39%
Vans and caravans	204	300	465	441	449	120%
Lorries	421	737	927	932	817	94%
Coaches	103	155	153	131	117	13%
Total traffic	8,085	13,602	18,482	19,367	19,462	141%

Number of individual journeys						
Category	2001	2005	2007	2008	2009	Growth
Cars	21,900	32,000	40,600	41,000	41,300	89%
Trains	13,500	18,100	26,600	29,400	30,400	125%
Total	35,400	50,100	67,200	70,400	71,700	103%

Figure 11 – Daily traffic across the Øresund Bridge.

Source: Ten years, the Øresund bridge and its region <http://uk.oresundsbron.com/page/34>

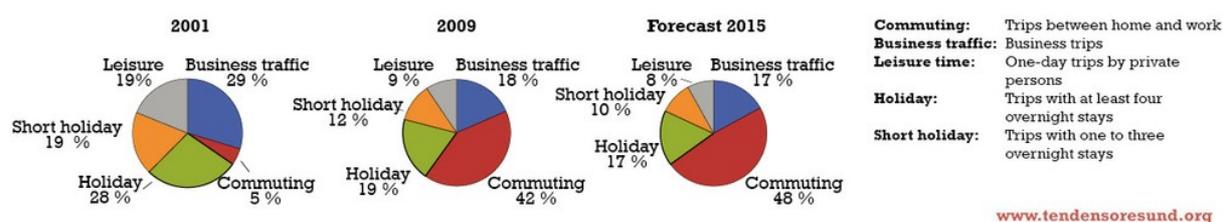


Figure 12- Purpose of travel with passenger car over the Øresund Bridge

Source: Ten years, the Øresund bridge and its region <http://uk.oresundsbron.com/page/34>

d. Copenhagen – Malmö Port (CMP)

This provides an excellent example of how two harbours, located on the opposite coasts and in two different countries, can create synergy effects and new cross-border cooperation involving four million consumers.

Each year the company offers efficient transport and logistics services to nearly 8000 ships. Thanks to its strategic location in the Øresund region, CMP's facilities also serve as hubs for the whole Baltic Sea region and its roughly 100 million consumers and hundreds of thousands of businesses. At its ports in Copenhagen and Malmö CMP handles a wide variety of freight, including consumer goods, transit of oil, grain, scrap metal, building materials, industrial inputs and new cars. The company also handles significant cruise and passenger traffic between different destinations in Northern Europe. In recent years CMP has also established a car distribution operation, which has become a centre for car transports to the Nordic and Baltic states and Russia. CMP's facilities are full-service ports, which offer transport and

logistics services in cruise, ferry, *RoRo* (Roll-on/roll-off) and container traffic, car imports, combi traffic, and oil and dry bulk terminals. Thanks to its specialisation in the form of different business segments, CMP is able to provide professional services, combining the right technology, infrastructure and professional expertise to meet each customer’s specific requirements. This ensures high-quality execution.

e. Copenhagen Airport (Kastrup)

The Copenhagen Airport is the largest airport in Scandinavia. It is located in the Southern outskirts of Copenhagen. Having a good connection with Sweden by Øresund Bridge, it hence becomes an international port for Southern part of this country.

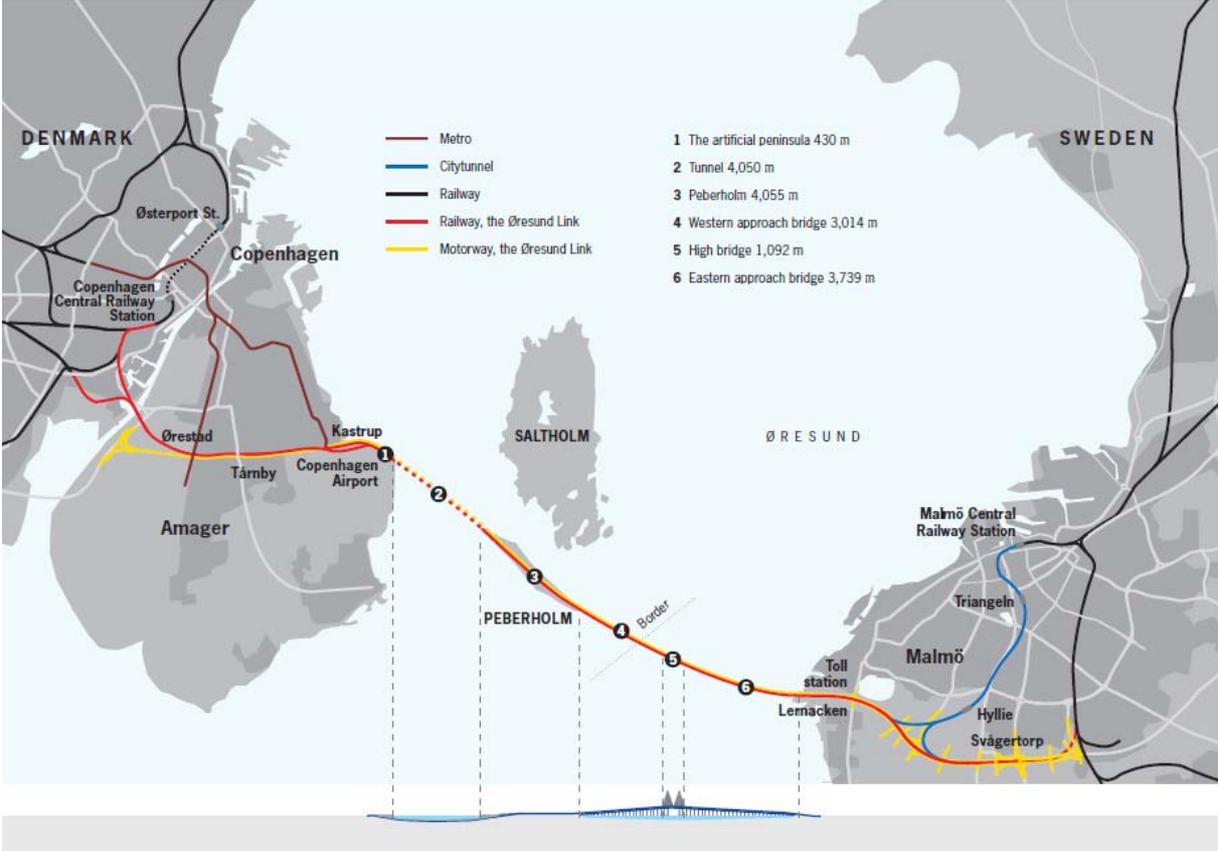


Figure 13 – The Øresund Bridge and the accompanying infrastructure

Source: Ten years, the Øresund bridge and its region <http://uk.oresundsbron.com/page/34>

2.6. Major trends in historical context

In the years 1960 - 1990 all over Europe, arable land decreased by about 6 million hectares. Never before the changes in land use were as significant. It should be noted that population showed flexibility in adopting to the new situation. People had to learn to manage the land.

Till 1658 Scania belong to Denmark. In that year, in Roskilde the treaty was signed, by virtue of which all Danish lands East of Øresund were ceded to the Swedish

Crown. But the historical events in administration didn't change the mentality of Øresund people. They still feel connected with Denmark.

In the historical context we shouldn't extend beyond the last century, because the sense of research might be lost.

After the Second World War, in 1947, the Danish architects and urban planners Peter Bredsdorff and Sten Eiler Rasmussen presented the Finger Plan (Figure 14). This was a development plan for Copenhagen city and its suburbs. The main core was the city and the skeletal 'fingers' pointed the future development along existing transportation infrastructure. Finger plan protected green wedges between "fingers", facilitating the access to nature, woodland and pastoral landscape. It wasn't a legislative plan, but city growth was directed in this way. In 2007 the plan was incorporated into Denmark's Planning Act. Appliance of spatial planning to the Finger Plan contributed to avoid traffic overload commonly found in other big cities.

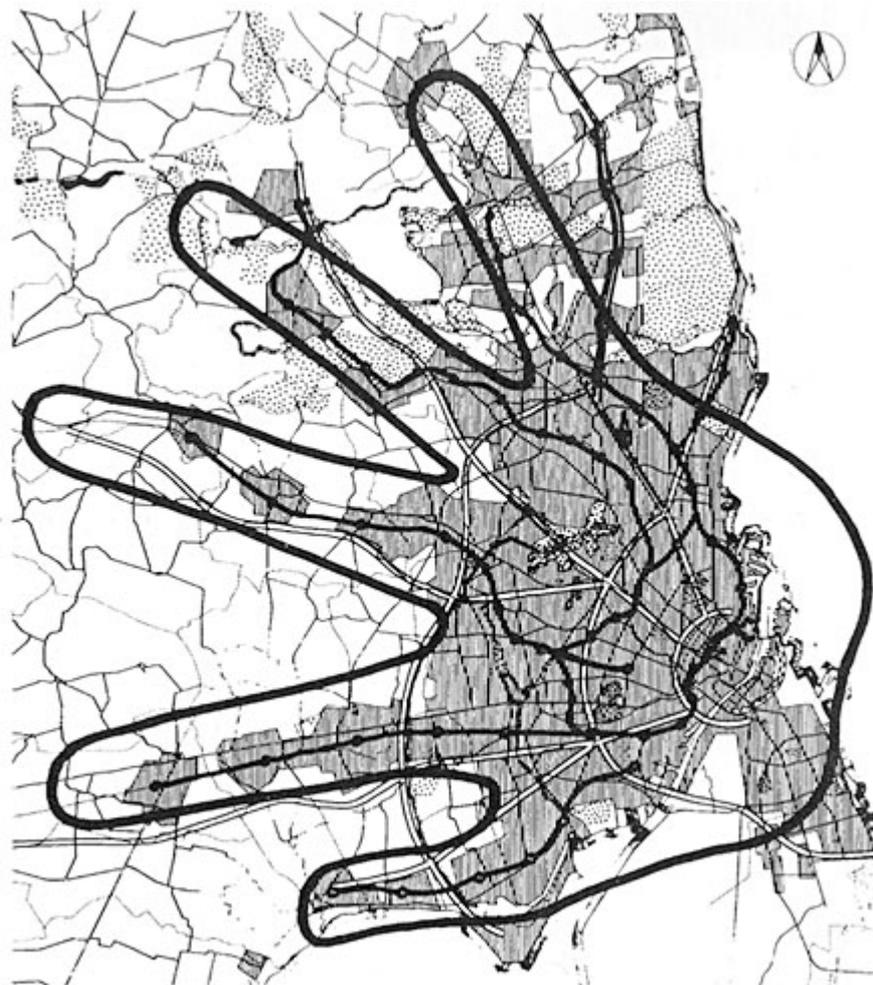


Figure 14 – Finger plan from 1947

Source: <http://www.oresundstid.dk/billeder/1945-2000/16-02.jpg>

There were a lot of ideas for spatial planning in Øresund region. In late 1950s there were suggestions about a great lake, which could be formed by building two bridges: on the North and on the South of the strait. Coast was to be an urbanized area, while the interior of the region was to be used for agriculture and forestry. Only the

Southern bridge was built (The Øresund Bridge), but there are still plans for another one towards the North (nowadays there is a ferry connection only).

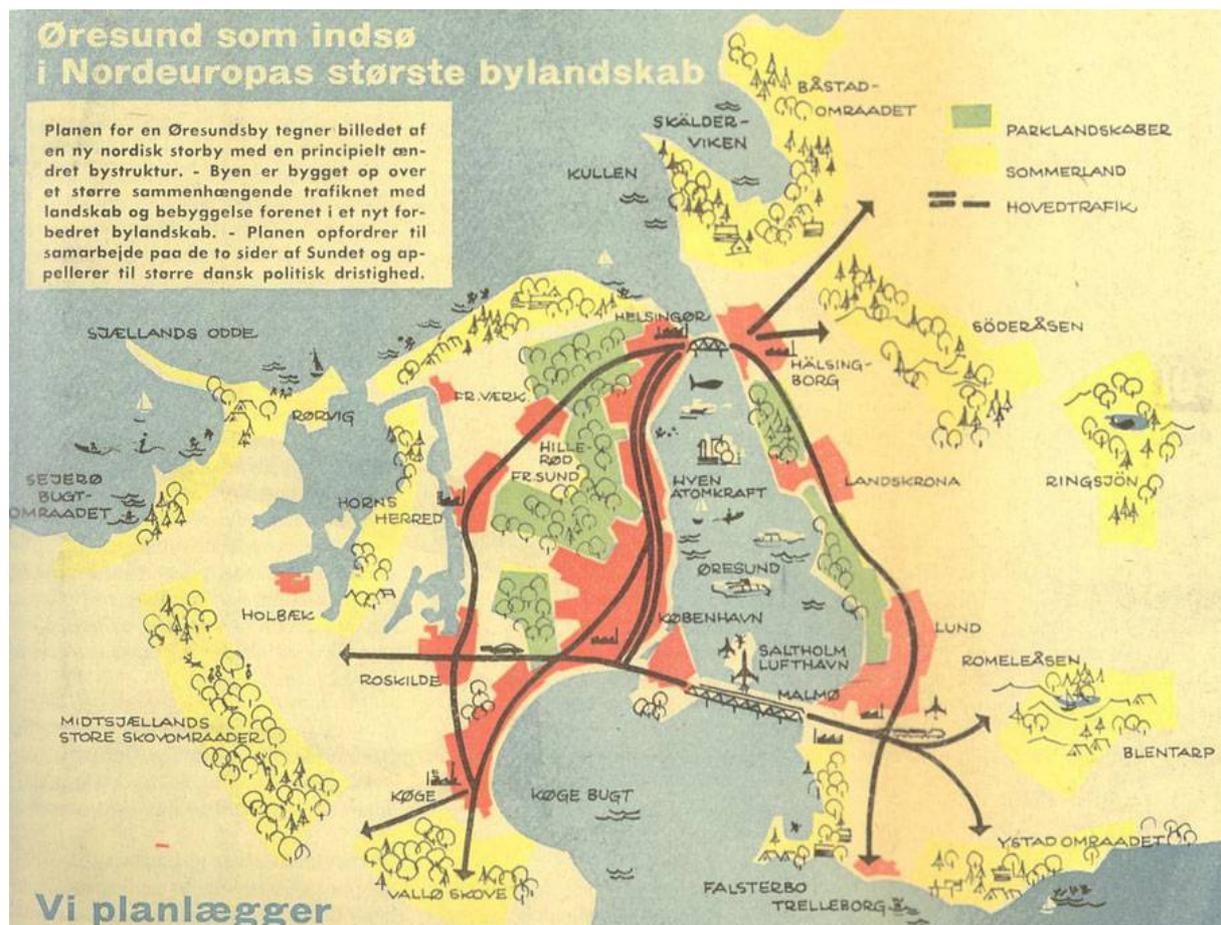


Figure 15 – The Øresund region in map from 1959 as a great lake in Nordic countries landscape.

Source: Arne Gaardmand : Dansk Byplanlægning 1938-1992, Arkitektens Forlag 1993

During the 1980s and 1990s the country's industrial base changed. In agriculture the processes of merging, mechanization and industrialization went hand in hand with a strategy that aimed at the large quantities of inexpensive devices (pork, chicken, dairy products, etc.). The industry underwent changes that resulted in increased investment in service industries, renewable energy, electronics and medical products.

In the 1990s Sweden experienced a serious crisis, which resulted in a rise in unemployment reaching the level of other EU countries and USA, and the emergence of public debt, which in the late 1990s reached 50% of GDP. This crisis was associated with the global slowdown in the economy and tax cuts by the right-wing government, while maintaining social expenditures at the same level. The implementation of numerous reforms and recovery programs failed to improve productivity and increase macroeconomic indicators

From 1 January 2007 the administrative division of Denmark applies to the 5 regions, which replaced the division of 13 provinces (Amt). As part of administrative reform also reduced the number of municipalities from 270 to 98. In Sweden, in 1997, counties of Kristianstad County and Malmöhus County merged to the Skåne County (Scania).

3. NARRATIVE OF CHANGE IN RELATION TO LAND USE

3.1. Socio-economic (demography, employment, ... etc.)

The Øresund region has the highest population density in the Scandinavia region, with 3.7 million inhabitants. In the region of Scania live 1.2 million and on Danish side 2.5 million people. The population of the region is concentrated mostly on the Danish side, with the vast majority in the agglomeration of Copenhagen. Metropolitan regions and cities are characterized by a greater female share in total population, which could be associated with a greater access to jobs for women in these areas.

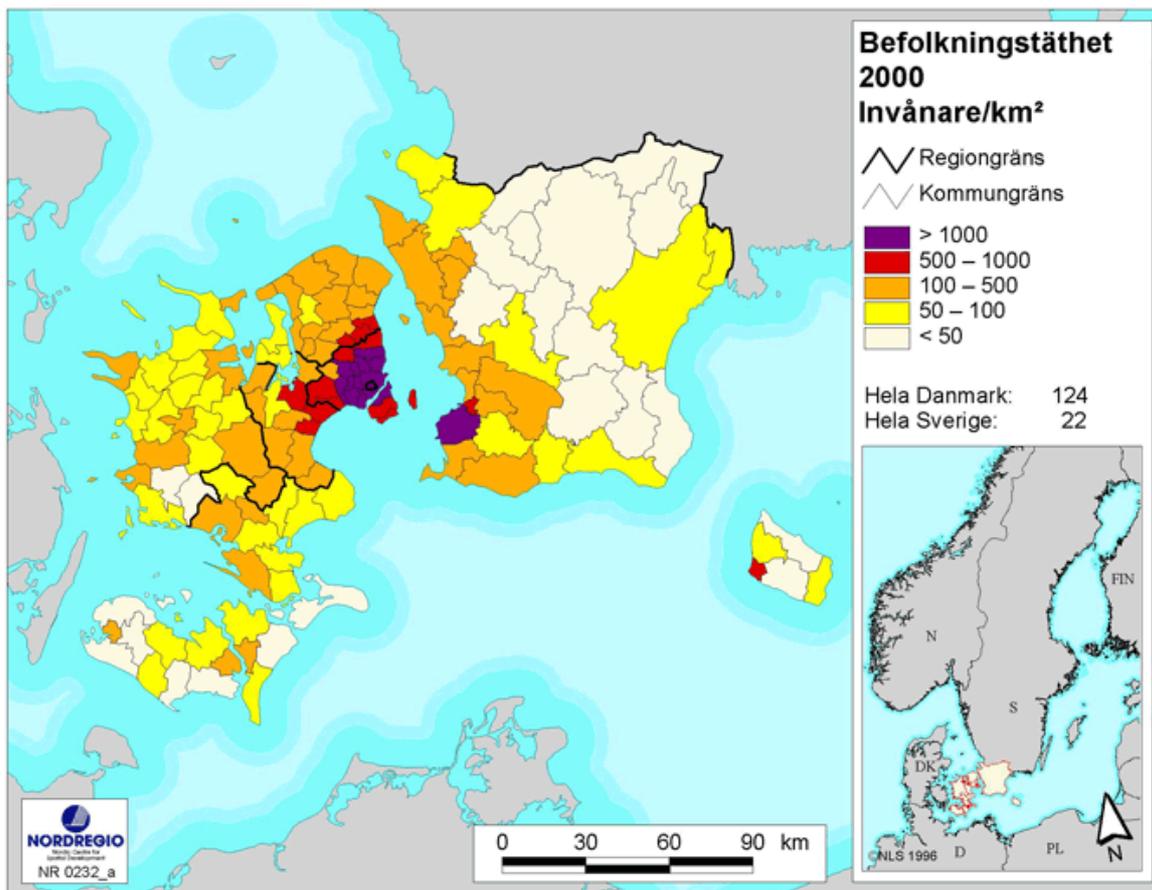


Figure 16 – The Øresund Population density in 2000

Befolkningsstäthet = population density

Kommun = municipality

Invånare/km² = Population/km²

Hela Sverige/Danmark = Whole of Sweden/Denmark

Source : <http://www.nordregio.se/>

In the period of 2000 to 2008 population increase of the region reached 180 000 people. The total growth of the region is caused by to 40 000 more births than deaths, mainly on the Danish side. The rest of this growth is due to a surplus of immigrants. A large part of the migration flow across Øresund is concentrated in the two large cities of Copenhagen and Malmö.

The age structure in Øresund region is rather adverse from the economic point of view, as it is in all Nordic area. The most common trend is that the urban areas have a greater share of younger population in comparison to rural and sparsely populated ones. Another common trend is the extended life expectancy.

In general, the most rapid population growth regions are located in the most densely populated capital and big city regions.⁸ Total fertility rate (TFR) is nowadays less than two children per woman. At the same time, low fertility is accelerating the ageing of European populations. Sweden has had a relatively high fertility in the recent decades. During the 1980s and 1990s, the annual TFR for Sweden fluctuated around the value of 1.8 children per woman.

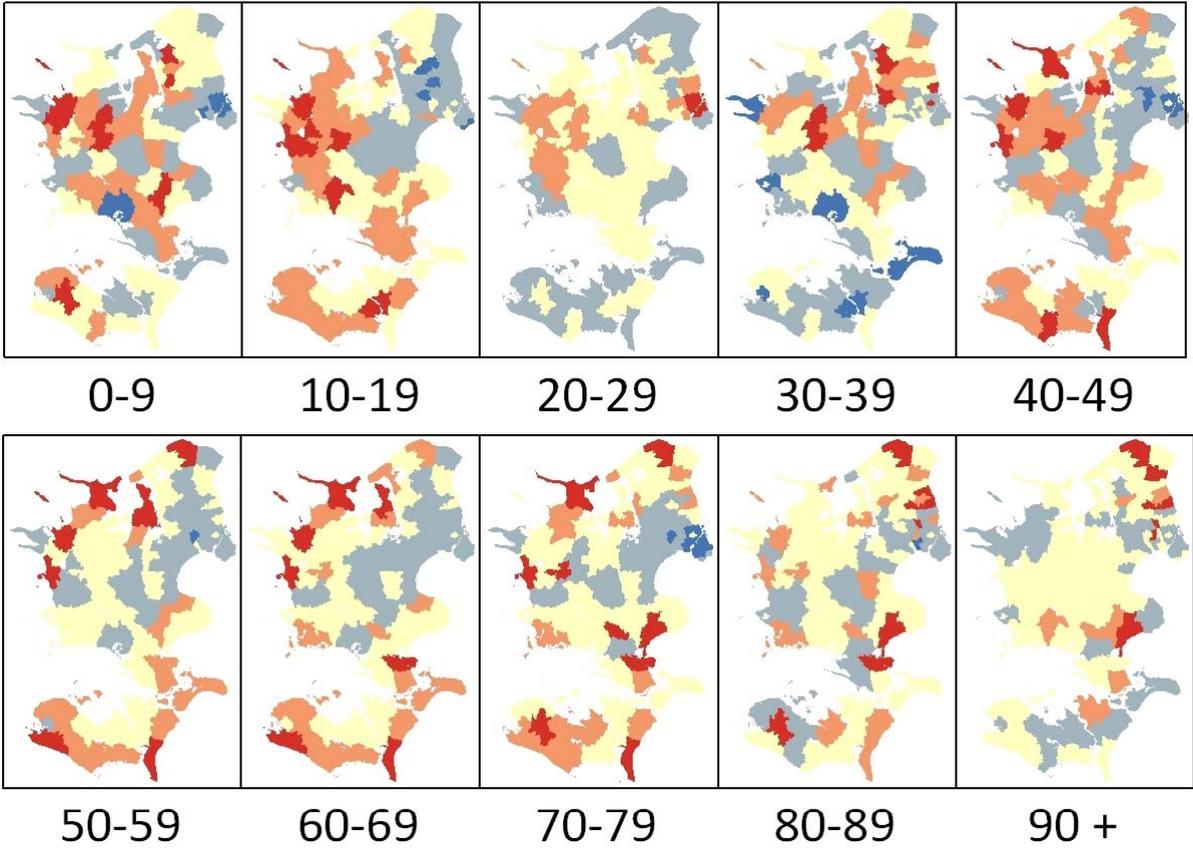


Figure 17 - In-migration by age groups in the Copenhagen region in 1996-2006

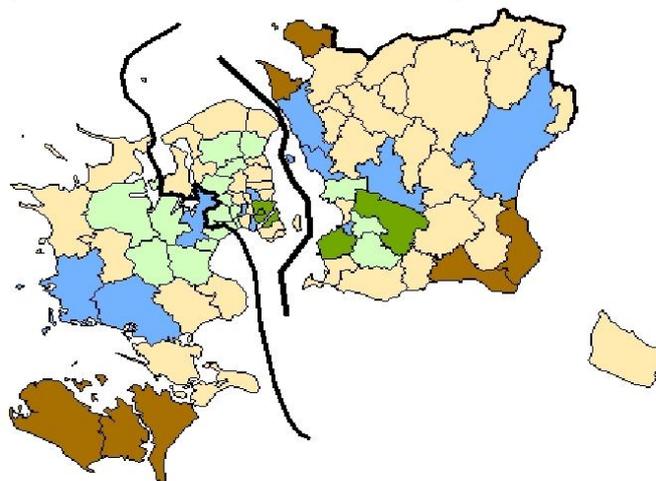
Red means high in-migration in relation to regional average,
 Blue means low in-migration in relation to regional average.
 Yellow means around regional average (-0.5 to 0.5 Standard deviation).

Source: Kupiszewski, M., Illeris, S., Durham, H., 2001, Internal Migration and Regional Population Dynamics in Europe: Denmark case study. Working Paper Working Paper 01/02, School of Geography, University of Leeds.

Figure 13 shows the sum of in-migrants in the years 1996 – 2006 by 10-year age groups. Not surprisingly most of 20-29 year group tend to move into the city, while 50 – 79 year old group to the coast, away from urban areas.

⁸ Rauhut D., Rasmussen R., Roto J., Francke P., Östberg S., 2008, The Demographic Challenge to the Nordic Countries, Nordregio, Stockholm.

Scandinavian people tend to change their place of living several times in their lifetimes. First, when they grow up and go to university or first work– they move from homes to cities, to experience what the city life has to offer. The Second shift occurs when they form a family: young people establish themselves in the blocks or on estates of detached houses in suburban areas or in the city, depending on the income level. The next stage, in adulthood, is moving to the countryside or into urban areas (block). Together with the movement, the demand for residential areas, recreational and leisure is changing. It is worth noting that the destination places in case of all movements are concentrated within one hour of access (isochrones).



Age structure 2005*

Age group over (+) or under represented (-) compared to the average Nordic age structure

0-19	20-29	30-44	45-54	55-64	65+
++++	+++	++	-	----	----
+	++	+	-	--	-
++	-	+++	+	-	---
--	++++	+	---	---	--
-	-	-	-	+	+
--	--	---	++	++	+++

* Denmark, Faroes, Greenland & Norway: 1.1.2006; Finland, Iceland & Sweden: 31.12.2005

Categories based on 'hierarchical ascending classification' analysis.

Figure 18 –Age structure in the Øresund region in 2005

Source: Rauhut D., Rasmussen R., Roto J., Francke P., Östberg S., 2008, The Demographic Challenge to the Nordic Countries, Nordregio, Stockholm.

Population of the Nordic countries is known as for the awareness of safety and healthy lifestyle. This is a reason why they excel in high life-expectancy level and low mortality.

The age structure in Øresund region is similar to structures of the both nations. On the Danish side there is a smaller share of teenagers and a greater proportion of people in age 25-44; on Swedish side there are more people aged 22-34 and a lower percentage of those in their 50. and 60. comparing to Sweden as a whole⁹. The Nordregio presents a map of age structure in 2005 in multiplies of Øresund region. The map shows age diversity in the different municipalities of the region. The most important relationship is the arrival of young people, up to the age of 44 in urban areas. In peripheral areas are dominated by people over 45 years of age. Figure 9 confirms that the majority of people aged 20-29 live in metropolitan areas and cities with Universities.

⁹ Øresund Trends 2010

Comparing the rates in the Nordic countries to the EU-27 average, these are societies with a greater share of older and younger people, but in the category "young adults" are below the EU average. In 2004 in Denmark about 15% of the population was aged over 65 years.

The population forecast predicts an increase in number of habitants of the Øresund region to about 4 million people by 2029. The population rate is expected to increase more rapidly on the Swedish side, whereas the largest percentage of elderly is expected to increase on the Danish side.

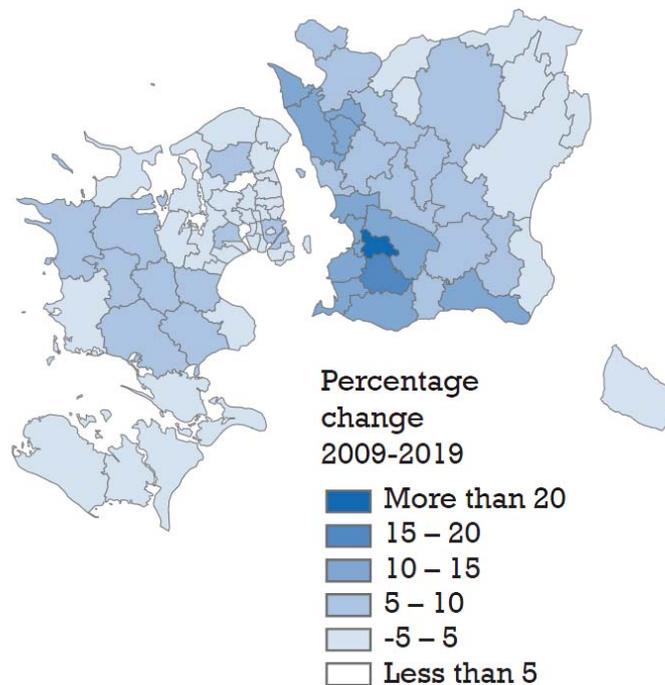


Figure 19 - Forecast of population 2009 – 2019

Source: Statistics for Denmark and Skåne region. Map: Skåne region

Most of migration is taking place inside the country: people move from the peripheral areas into the metropolitan ones. Every second person who migrates is aged between 20 and 35 years old. This situation is similar in all Nordic countries. Most of the migrants arriving in the region return to their former place of residence or come from other regions of Scandinavia. Another group are the people from neighbouring countries (e.g. Germany, Poland, Great Britain, Russia).

Net migration rate is positive for migrants from abroad, but for citizens of Denmark and Sweden it is negative. Migrants settled mainly in the metropolitan region and in large cities, additionally exacerbating the uneven population of the area.

The most important factors influencing the age structure of the region are:

- low fertility rates,
- high average life expectancy,
- the out-migration of young people.

But they do not explain the whole problem, now considered as crucial long-term changes in the economy and the social condition.

The structure of age, gender and education in the Øresund region has a huge impact on the local economy. Peripheral regions increasingly pit on the traditional manufacturing and intensive agriculture industries.

The workforce within the region is 1.8 million people, which makes it the largest recruitment base in Scandinavia. In addition, the population is highly educated and this confirms the thesis of following a strong correlation between universities, industry and public sectors.

There are 11 universities in the Øresund region with approximately 165 000 students, 6 500 Ph.D. level research students and 10 000 researches. In addition, there are around 4 000 visiting students from about 800 other universities with which the region's educational institutions cooperate.

In this region 1/3 of residents between the age of 25 and 64 has some form of post-secondary education.

However, there are strong regional differences: the capital region of Denmark has the highest percentage of people with higher education, subsequently the Region Skåne . While in the region of Zealand, this ratio is the lowest. This region has the highest percentage of population with compulsory education. The statistics do not include the population that continues learning at that level. Analysing the regions, there is a wide variation among their municipalities: from 17.5% of people with higher education in the South of Zealand and in Northern Skåne to over 40% in urban areas.

There is a tendency to increase the population with higher education and increase the number of students. In 1998 in the region 135 396 persons studied, and 10 years later, about 20 000 more. In 1998, the Øresund region had 23.4% of people with higher education, while a decade later, in 2007 that figure was already 32.6%. The highest increase in this time-frame was noted in the capital region of Denmark: 37.1% in 2007, is an increase of 13% compared to 1998.

The Øresund region has two world-class universities and three top European schools: first two are University of Copenhagen, with 43rd position in the global ranking and the Lund University.

There are over 130,000 students in the region, and more than 40% of them are in the biomedical sciences faculty, which is connected with Medicon Valley, cluster organized on both sides of Øresund .

It is worth noting that some regions, despite of offering the universities, do not record higher proportion of young people than expected. In case of Roskilde, a city that has one of the largest universities in the region, most of young people with the beginning of a higher level of education are not moving to this city, but remain living in Copenhagen, which offers more attractions for the youth. High-speed trains, public transport, determine University of Roskilde accessibility for people living in Copenhagen as it is located within the area covered by isochrones of 60 minutes.

With the opening of the Øresund Bridge the possibility for residence on one side of the Sund increased and hence the opportunity to study, work and leisure. With the opening of the bridge in 2000, the number of students increased on the opposite side of the bridge, especially in case of young Danes studying in Sweden, with an increase of over 600 in 2000 to 1400 a year later. Changes among Swedish students were not that significant, but they are considered to be long-lasting. Within 10 years, from 1998, the number of students increased from 900 to almost 1600.

Despite the economic crisis, the Øresund region recorded a growth in employment in the last decade. In 2007 in the region were employed 1.83 million people, including 18 400 commuters through the strait. Most of them lived and worked in Sweden, Denmark (17 800), in the opposite direction traveled only 600 people. Opening of the bridge intensified migration between Denmark and Sweden. In 2003, 72.7% of the region's population aged 16-64 was employed. Six years later this rate grew up to 74.9%. The employment rate differs on the sides of the strait. In the Danish part of the region in 2007, it was 77.7%, and 68.9% in Sweden. Above all, the employment rate is much higher among younger age groups in the Danish part compared to the Swedish part of the Øresund region.

In the third quarter of 2009 over 68 thousand inhabitants of the region were unemployed (3.0% of the population aged 16-64 years). In the period 2004-2009 in the Danish side of the region the unemployment rate fell from 4.2 to 2.3%, while the in Sweden from 5.2 to 4.3%. Between 2002 and 2007, the unemployment decrease reached 32%. The Danish economy helps young people to embark at the beginning of a career, thus resulting in less unemployment among youth in Denmark than in Sweden. This explains lower unemployment rate on the Danish side of the strait. Impact on the structure of employment was also determined by the "efterlønssystem" which gives older people the chance to retire at a younger age.

The governments of Denmark and Sweden signed a bilateral agreement to avoid double taxation - as many Swedes choose to pay tax in Denmark, where these are lower. The agreement also refers to compensations for the other side, because of its lost tax revenue.

Unfortunately, the economic crisis put its impact upon the region which resulted in a decline in employment and overall decline of economy.

An increasing number of people are employed in private business sector, while the share of employment in agriculture and manufacture industry continues to decrease. The manufacturing industry (including construction) accounted for roughly 15 percent of total employment in the capital region of Denmark, which can be compared to Zealand and Skåne regions where the manufacturing industry accounted for 22% and 23% of employment respectively.

GDP per capita in the Zealand and capital region is 105 507 € and in Scania 31 560 €

Value added (a company's or an industry's production minus the value of input goods) is a contribution to the Gross Domestic Product (GDP) or at the regional level, the Gross Regional Product (GRP). Regarding economic growth measured as a change in value added for an industry, three sectors particularly increased in significance in period 1993-2007 in the capital region of Denmark: transport and telecommunications, finance and the chemical and plastics industry. In Zealand and Skåne regions, the manufacturing industry still plays an important role in the economy. The most apparent disparities occur between the structure of industry in different regions: the largest concentration of business services, real estate and financial operation, transportation, travel, post and telecommunications is in the capital region, because this type of activity usually concentrates in the capital city.

Industry	Capital	Capital	Region	Region	Region	Region
	Region of Denmark	Region of Denmark	Zealand	Zealand	Skåne	Skåne
	1993	2007	1993	2007	1993	2007
Agriculture, forestry, hunting, fishery	0.5%	0.3%	3.5%	2.5%	2.8%	1.5%
Mining and quarrying	0.1%	0.0%	0.2%	0.1%	0.3%	0.1%
Food and tobacco industry	1.7%	1.0%	3.8%	2.8%	4.4%	3.1%
Textiles, clothing and leather industry	0.1%	0.1%	0.3%	0.1%	0.2%	0.1%
Wood, paper and graphic industry	2.4%	1.7%	2.0%	1.4%	3.7%	2.6%
Chemical industry, rubber and plastics	2.5%	3.8%	1.7%	3.8%	2.7%	3.6%
Industry for other non-metallic mineral products	0.3%	0.2%	0.9%	1.0%	1.0%	0.9%
Iron, metal and other manufacturing industries	4.2%	3.9%	5.9%	6.4%	7.1%	8.6%
Electricity, gas, heating and hot water supply	2.2%	1.4%	2.9%	1.3%	3.0%	3.2%
Construction	3.4%	3.6%	7.2%	7.6%	5.3%	5.5%
Wholesale and retail trade	15.0%	13.2%	9.8%	13.2%	11.2%	12.7%
Hotel and restaurant industry	2.0%	1.5%	1.6%	1.2%	1.1%	1.3%
Transport, travel, post and telecommunications	7.1%	12.7%	7.7%	5.6%	8.1%	6.9%
Financial operations	7.5%	11.1%	2.6%	3.8%	3.9%	2.1%
Real estate, business services, R&D	21.4%	21.3%	17.3%	18.4%	17.4%	23.2%
Public administration	7.2%	6.3%	8.4%	7.1%	6.6%	4.2%
Education	4.7%	4.5%	7.0%	6.7%	6.3%	5.9%
Health and medical care	11.4%	8.5%	12.3%	13.4%	11.6%	10.8%
Culture, leisure and recreation	6.4%	4.9%	4.9%	3.7%	3.2%	3.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total value added	318.2	453.3	103.0	129.7	173.0	278.0

www.tendensoresund.org

Figure 20 – Industry in the Øresund region

Source: www.tendensoresund.org

The Øresund region has 99 629 people employed in the high tech service sector, which makes 5.4% of total employment of the region. This is 10th place in EU-15 if the number of employees is considered. The Eurostat Statistic show, that Øresund region has a very high specialisation Index of high tech services, one of the highest in Europe.

The Öresund region focused in pharmaceutical production and some computer-related forms of service production. Skåne has a prominent position in the manufacturing industries and in natural science as well as technological research and development. The capital region of Denmark is specialised in pharmaceutical industry, other advanced technological manufacturing and several computer industries. Zealand region has specialisation in pharmaceuticals and the production of medical equipment. The region is an economic powerhouse that accounts for 26% of the aggregate of the gross national products of Sweden and Denmark. The region invests 3.9% of its gross regional product in research and development. It is a consistent pattern that most of R&D investments take place in metropolitan areas. About ¾ of Danish expenditures on R & D derive from business sector for Øresund region: 71% for the capital region of Copenhagen, 3.1% for Zealand region. In Sweden 18% of industry's R&D investments are made in Skania region.

Example of Platforms vs. Clusters

- Platform: "Öresund Science Region": Promotes knowledge-based economic development in Öresund region (Zealand/Copenhagen and Southern Sweden/Malmö).
- Acts as a cluster facilitator and is owned by Öresund University. Focuses on the strong sectors in the region: ICT, Logistics, Food, and Environment
- Financed by memberships and by public funding
- Clusters: Pharma and medico-cluster in Öresund region

- A market driven, geographically based cluster. Consist of about 300 companies, public institutions (ex. hospitals and universities). Medicon Valley Alliance – the platform, that stimulates the cluster
- Formerly a part of Öresund Science Region.

The region focused on Medicon Valley, which was modeled on the American Silicon Valley. The idea was created during the early 1990s and was supported (administratively and financially) by the European Union Interreg II Programme. The researches performed at local Universities (in Copenhagen and Lund) were the beginning of medical activities in the Øresund. There were numerous medical researchers, which brought several Nobel Prize winners and fueled the development of Medicon Valley. Nowadays, the cluster consists of universities, hospitals and companies, which take part in science market, biotech, med-tech and pharmacy researches. In 2003 Medicon Valley accounted for more than 20% of the total GDP of Denmark and Sweden combined¹⁰



Figure 21 – Companies, universities and hospitals of the Medicon Valley in the Øresund region

Source: http://www.mva.org/media%2815,1033%29/Region_Medicon_Valley.jpg

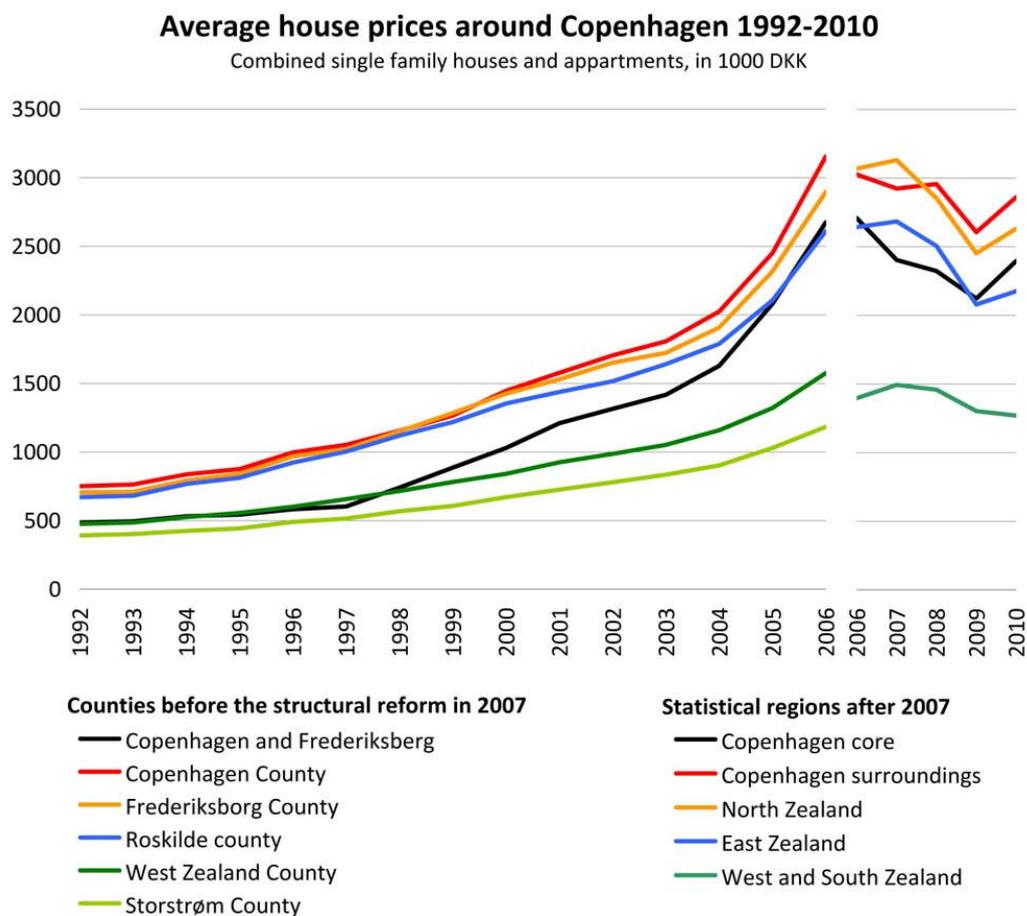
Top R&D companies in Medicon Valley:

- Novo Nordisk (diabetes)
- H. Lundbeck (neurosciences)

¹⁰http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2310/the_medicon_valley_region_academia_and_industry_join_forces_in_research_and_training

- Coloplast (medical devices)
- AstraZeneca (inflammation)
- Genmab (cancer)
- ActiveBiotech (cancer)
- NeuroSearch (neurosciences)
- TopoTarget (cancer)

The average house prices in Denmark were the highest in Copenhagen county and Frederiksborg County till 2007 (before the administrative reform), and the highest level was reached in 2006. The administrative reform in Denmark coincided with the time of global crisis and it was had impact of inhibition growth of prices in the whole region.



Source: Statistics Denmark 2011 | Christian Fertner, August 2011

Figure 22 – Average house prices around Copenhagen

Source: http://landblend.files.wordpress.com/2011/08/house_prices.jpg

3.2. Environment (Landscape, soils, climate change... etc.)

The landscape of the Øresund region is very diversified. There are open spaces in countryside, large forest area in Skania and highly urbanised area in cities. The Øresund region is surrounded by the sea, with attractive coastline offering soothing landscape. The region attracts tourists and people for their second houses and

business. There is a temperate climate, which allows to spend time outdoors most of the year. In Øresund, golf and horseback riding are very popular forms of spending leisure time. The Danish and Swedish people care about quality of their lives but also the quality of natural environment. They support the use of renewable energy sources, of which wind is the most efficient (due to open spaces as well as frequent and strong winds from the sea). There are many wind mills in the Sund, but some inhabitants claim that they contribute to landscape deterioration.

There are policies in Denmark concerning expansions within forest areas, which means that as much land as possible will be converted into forest areas. The forested lands in Denmark occupy 10-15% of total territory and the intentions are to increase their share within the period 5 to 10 years. The forest areas are expanding, one of the aims to be achieved is to obtain a combination of managed forest areas, not only the monoculture of pine forest. Some of them are open to public access, others are very old forests under strict supervision.

There are two types of forests in Denmark: national forest, managed by state accessible for the citizens and private forests. Private forest owners complain for strict regulations. People can own the forest, but it will be still open for public access. The restriction concerns what be done in the forest, many of the forest areas are kept for hunting purposes. Permits for hunting are deliberately expensive in order to discourage potential hunters. According to Rasmus Ole Rasmussen due to environmental regulations Denmark back from 1960s. the amount of pollution given out is known. There are strict regulations on filters, land management and water surplices protection. The most significant threat is the agriculture, because farmers due to a widespread use of chemical fertilizers. There are in Denmark numerous organic farms, thus there is no necessity to use chemicals. Farmers however are aimed at production with less human labor involved which brings more profit. Many of these farms are moving to less developed countries, because it's cheaper to buy large areas and start this non-environmentally friendly and unhealthy production. Intensive agriculture moved from Øresund region to Jutland, for instance. It's interesting what happened to Denmark's agriculture in the last 30 years, because when Denmark joined the EU, people from Holland moved to Denmark and started their production. When Poland joined the EU, some farmers from Denmark moved there. This trend is because the land is cheaper and law regulations are less demanding in less developed countries.

The aim is to limit the amount of pollution from wood burning stoves. The Danish Ministry of the Environment has set up a grant scheme of more than DKK 7 million for the development, testing and demonstrating the technologies that can contribute to reducing pollution from wood burning stoves in private homes.

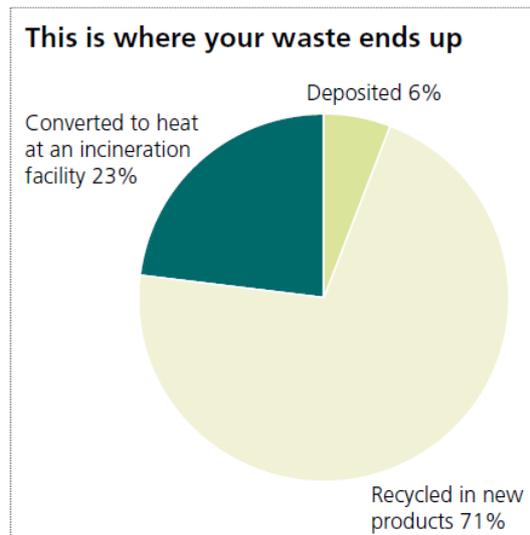


Figure 23 - Danes produce over 15 million tonnes of waste per year.

Source: The Environmental Protection Agency, ISIAG, Waste Statistics 2006

CO₂ budget for Øresundsregionen (g CO₂/m²/år)

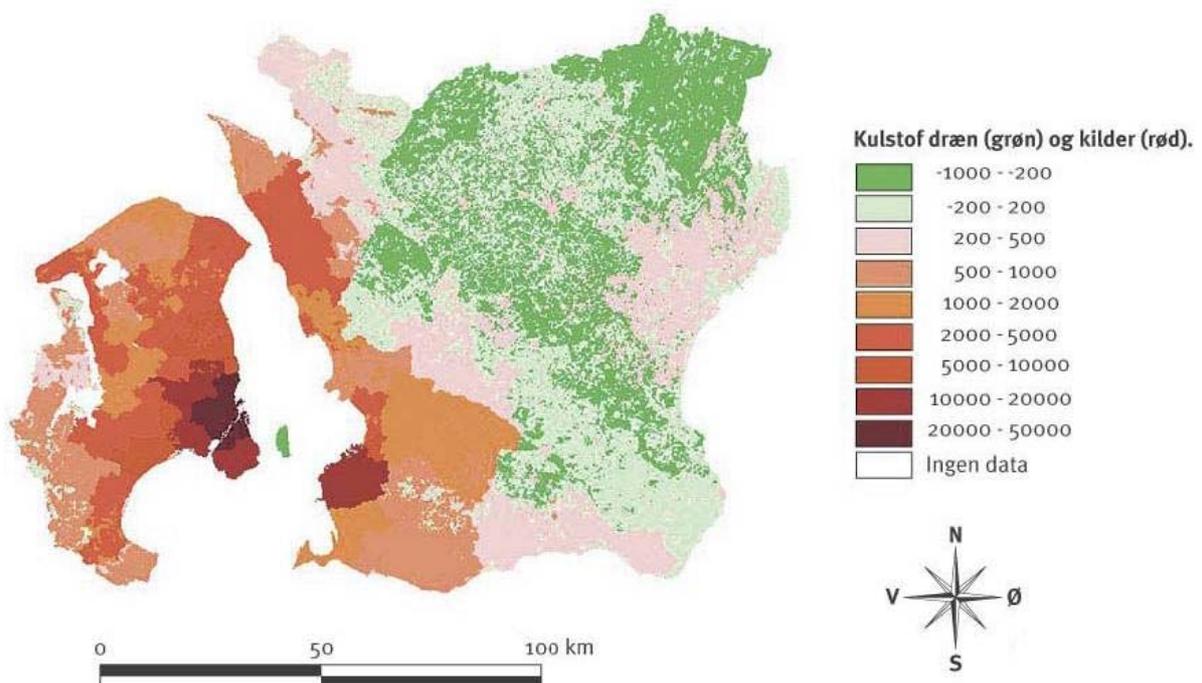


Figure 24 - The geographical distribution of CO₂ accounts in the Øresund region.

Source: Henrik Sogaard, Department of Geography. <http://www.klimadebat.dk/co2-budget-for-oeresundsregionen-geoviden-nr-2-2006-r17.php>

3.3. Government and policy

To maintain a high level of cooperation on both sides of the strait, Øresund Committee has formulated the Regional Development Strategy. According this document, the Øresund region is in 2020 expected to be:

- “a front-runner in environmentally friendly transport and a laboratory for green technology;
- a centre for clean-tech solutions and sustainable urban development so that we can host an Öresund region EXPO in 2022;
- a single, attractive, obstacle-free labor market where individuals with a variety of educational backgrounds and skills have unrestricted access to all of the region’s workplaces, irrespective of whether their skills have been acquired in Sweden, Denmark or elsewhere;
- a model for how to make the best possible use of the resources that workers with a non-Scandinavian background can bring to the labor market;
- a place where opportunities, regulations and frameworks are communicated through *Öresund Direkt*;
- a model region in terms of digital integration through the use of high quality broadband;
- a region with a diverse cultural offering that meets high criteria in terms of quality;
- a region that invests in cultural activities produced for, with and by children and young people;
- a host for international events and a popular tourist destination;
- a cohesive, competitive educational market that trains the best candidates and attracts students and researchers from other countries;
- a hub of innovation, with entrepreneurs and synergies between educational institutions and trade and industry;
- a region whose residents are able both to make use of all that the region offers and to explore its potential”.

The Øresund region is situated at the contact area of two countries. Regional planning law was changed in Denmark with the administrative reform in 2007. There were 13 *Amts* and 271 municipalities before. Now administrative units are enlarged and merged into 5 regions and 98 municipalities. Most of them has over 20 thousand inhabitants nowadays. In Skåne region, 15 out of 33 municipalities have over 20 thousand inhabitants and 31 over 10 thousand inhabitants.

3.4. Localization (accessibility, core-periphery, urban-rural continuum)

Conclusions concerning scenarios of urbanisation in Europe, developed in the EU-FP6 project PLUREL¹¹ show that peri-urban areas (area between urban settlement areas and their rural hinterland) – opposite to urban or rural areas – will experience the highest growth rates of urbanization. These areas are under a high development pressure of urbanization, which can e.g. lead to the degradation of natural

¹¹ Peri-urbanization in Europe. Towards a European Policy to Sustain Urban-Rural Futures. PLUREL Synthesis Report. 2011

landscapes nearby cities. While most urban areas are now growing at a slower rate (at 0.5-0.6% per year), housing development in peri-urban areas is growing at four times this rate.

In the case of Øresund it can be expected that regions around Copenhagen and Malmö will have the fastest increase in artificial surface of peri-urban areas compared to urban or rural areas. The highest pressure on peri-urban areas is around big cities, which will certainly be a challenge for regional green structure plans like the Fingerplan. On the other hand, e.g. in Western Jutland the highest urbanization is expected in urban or rural areas, not in peri-urban areas.

3.5. Conclusions in the context of land use

In Malmö some patterns similar to the Copenhagen region evolved; in particular with infrastructure connecting smaller towns in the region with built-up areas developed along the roads and railways. However, the establishment of the bridge between Denmark and Sweden from Copenhagen to Malmö negated the relative isolation and the Øresund region was established

As only limited land resources were available in the core urban areas most of the changes and the intensifications took place in second-tier urban areas; typically in places situated within 30 to 60 kilometres from the Copenhagen and Malmö centers. The intensifications is a result of farmland to artificial surface conversion.

Similar patterns are found on the Swedish side, but intensification is also a significant component in some of the older towns due to expansion of economic activities between the two countries, which has been directly facilitated through the development of the bridge. This has led to internal changes in the urban category, typically through construction of new dwellings to accommodate the increasing number of Danish citizens now residing on the Swedish side of the border. Finally, the forest internal conversions on the Swedish side are indications of changes from commercial forestry towards the use of forest areas in connection with leisure activities and future expansion of the urban structure.

A striking feature – and a quality of the typology in relation to the example – is the subdivision of the urban/artificial category in different components characterized by the land cover associations, which clearly show intensity and direction of urban sprawl. The direction of the sprawl is shown by urban categories associated with different land use activities such as agriculture (in Denmark and Sweden) and forestry (in Sweden) connecting a “string of pearls” of former smaller urban areas into growing centers and new nodes in the network.

Exploring the collaboration among the key players in the "functional foods" industry a based in Skåne, a province known as “the breadbasket” of Sweden. The functional foods business is a new Scandinavian field of cooperation that combines biotechnology with the traditional food industry, and it has grown up from a great collaborative spirit involving government, industry and academia. This tripartite cooperation extends far beyond functional food, and has created some unique programs and educational opportunities across the life sciences.

4. ANALYSIS OF LAND USE CHANGES

4.1. Dynamics and directions of land use and land cover changes

The Øresund region is strongly diversified in terms of land use structure. Three regions can be distinguished. These are:

- a) transformed terrains of Copenhagen and Malmö surroundings, with importance of services, industry, housing and transport land use functions. This zone is extended along main traffic routes and along coastal lines, in accordance with the famous 5 fingers plan of Copenhagen agglomeration;
- b) agricultural and recreational - Central, Southern and Western Zealand;
- c) most of Swedish part of Øresund region with strong importance of forestry and recreation, lesser importance of agriculture.

Trends of land use changing observed in the mentioned sub-regions can be approximately identified with trends observed in three NUTS 2 in the Øresund region: capital region, Zealand and Southern Sweden¹².

Dynamics and direction of land use changes depend mostly on the belonging to the one of these zones. Although general trends of land use changes can be also observed.

The Øresund region distinguishes permanent decrease of arable land area in each of its parts. Due to strong influence of Copenhagen and Malmö on the land prices during the last 20 years, agricultural lands are retreating further away from agglomeration. Attractiveness of terrains nearby long coastal line of the region as second houses area is an important factor of arable land decreasing as well.

Nevertheless, rural character of agricultural areas is relatively efficiently protected by the law regulations and spatial planning. Changes concern functional structure for the benefit of functions more exposed to leisure time services. These changes don't concern landscape in a significant manner. Therefore the decreasing of agricultural land in the agricultural areas is much slower. However share of arable land itself decreases relatively fast, what was usual for all Denmark. Between 2006 and 2009 the dynamics of decrease amounted average 1% yearly, while in Denmark it was 0.9% and in Sweden 0.4%. Decline in Denmark was especially severe in absolute values, because arable land counts there for 55.8% of total area and the decrease meant falling down by 1.6 p.p. General dropping of share of arable land area in the region is influenced mainly by the process observed in Danish part. During the period 2006-2009 share of arable land, in the Zealand region decreased by 1.2% per year and in the capital region even by 2.6% yearly. The dynamics in the capital region is much higher, but due to area of the regions disproportion, declining means lost of 7 400 ha in the capital region and 16 500 ha in the rest of Zealand. In Southern Sweden dynamics of decline counted by average 0.4% per year (fig. 27). Disproportion between dynamics observed in Southern Sweden and in Zealand is even more significant, when it's expressed in absolute values, because during this period share of arable land declined in Southern Sweden from 34.6% to 34.2% (by 0.4 p.p.) and in Zealand from 63.4% to 61.2% (by 2.2 p.p.). Permanent but low

¹² Sydsverige (NUTS 2) composed of 2 counties: Skåne (79% of total area) and Blekinge (21% of total area). Only Skåne belongs to Oresund Region.

dynamics of this process is observed in Southern Sweden at least during the last 20 years. The mean value of decreasing dynamics during the period 1990-2010 was still only 0.4% per year (fig. 28). An important impact on this situation can have also the national policy, which results from strategic importance of the Southern Sweden for Swedish agriculture, where utilized agricultural land takes only 7.5% (arable land 6.4%) of total area, and in Southern Sweden (3.4% of total area) there is 16.4% of total Swedish utilized agricultural land area (18.2% of total Swedish arable land area).

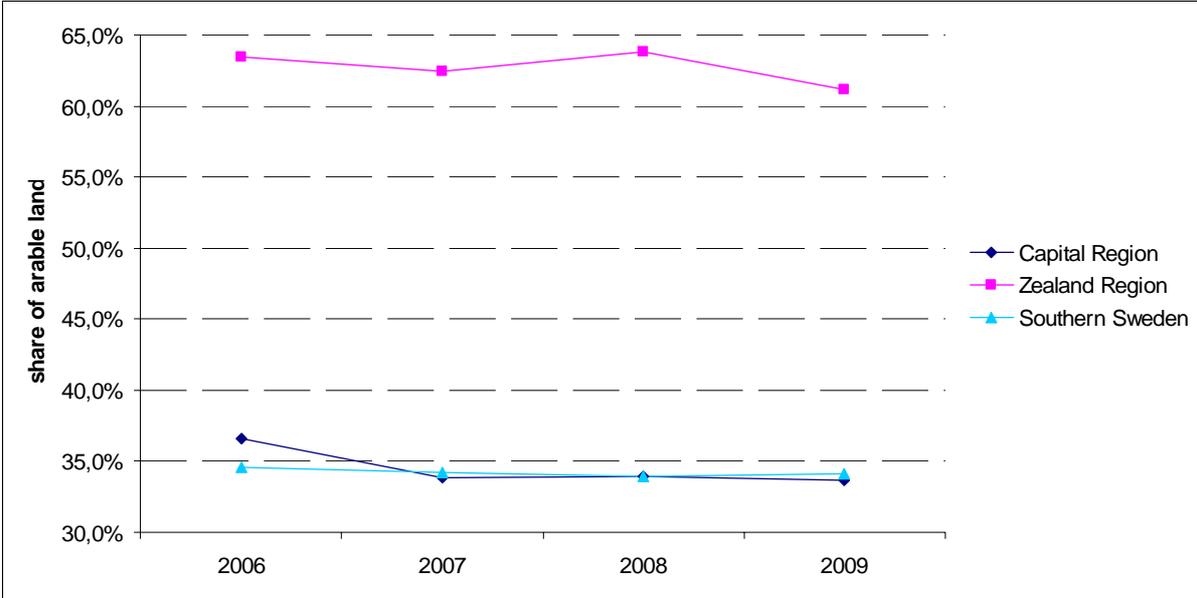


Figure 25 Share of arable land area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

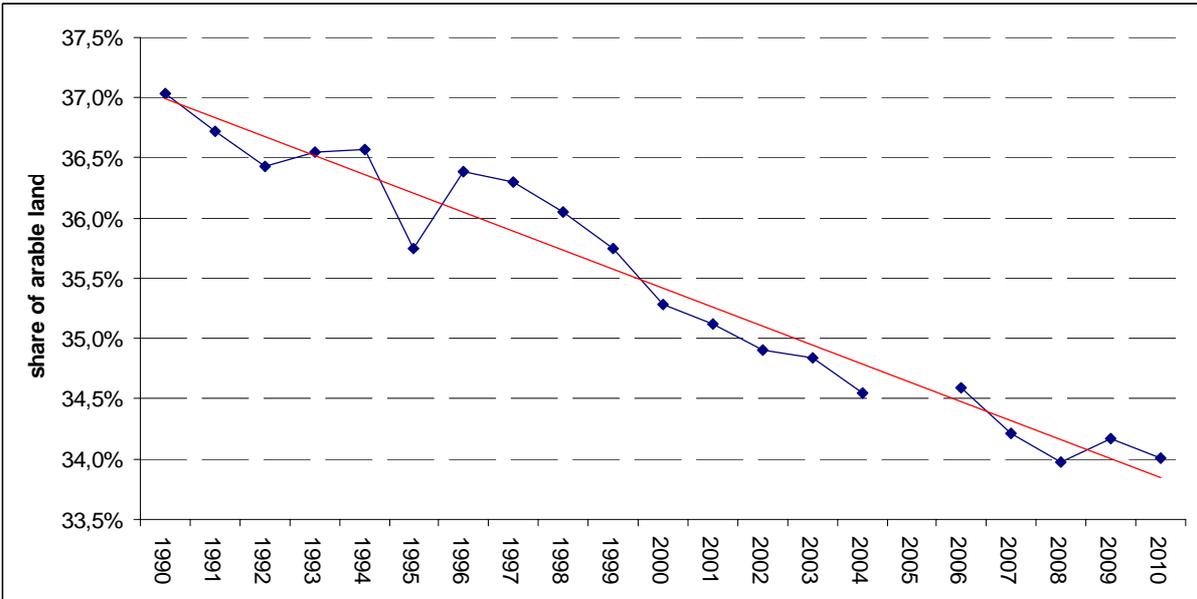


Figure 26 Share of arable land area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

Apart of the intensity of pigs breeding in Denmark, which is growing up (fig. 29), concentrating and becoming more commercial, in both countries a broad trend of animal breeding reduction is observed (fig. 30).

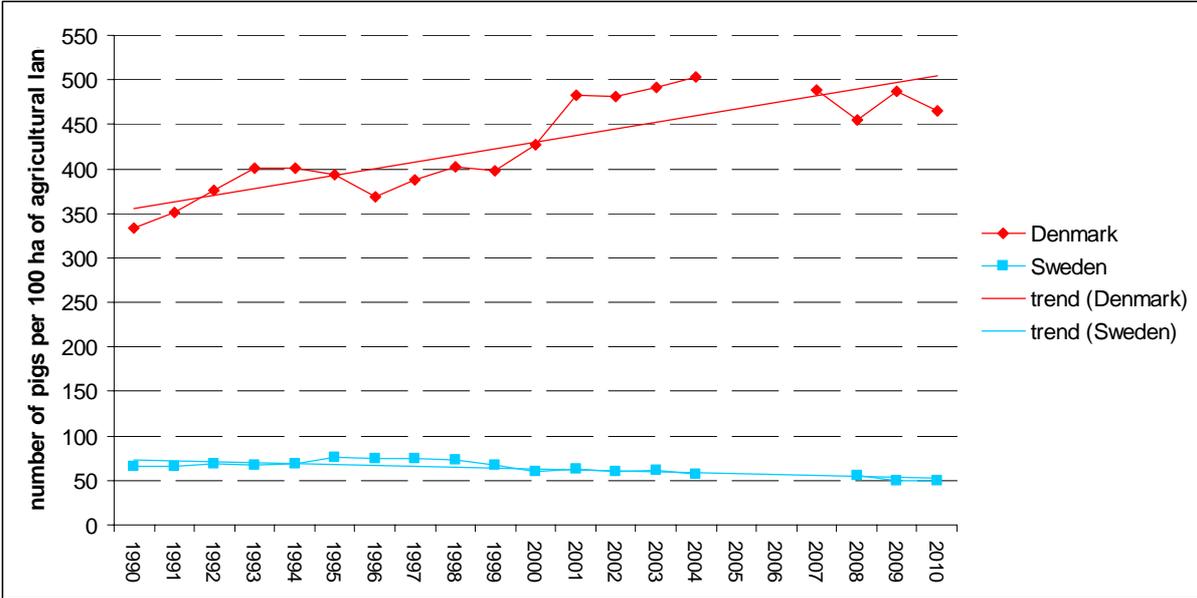


Figure 27 Number of pigs per 100 ha of agricultural land change in Denmark and Sweden

Source: own elaboration, based on Eurostat data base

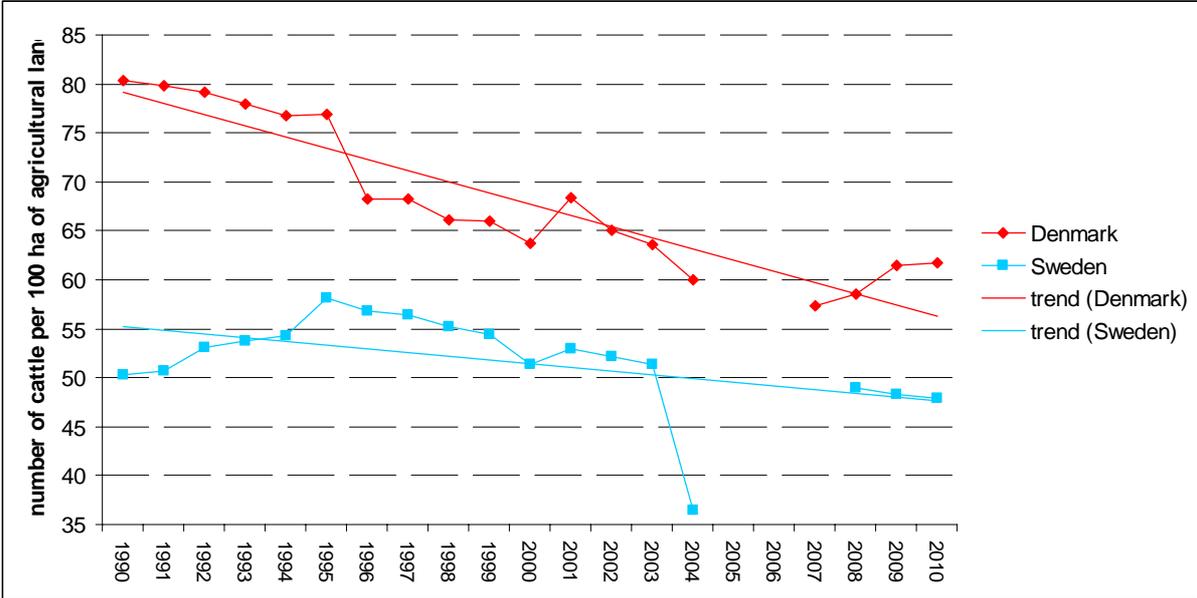


Figure 28 Number of cattle per 100 ha of agricultural land in Denmark and Sweden

Source: own elaboration, based on Eurostat data base

This negative tendency does not however influence the crops structure and the share of fodder cultivation area in the Øresund region. In Danish side there is a significant

increase of fodder cultivation area share observed in the last years. Between 2006 and 2009 the percentage of fodder cultivated land increased in the Zealand region from 3.2 to 4.3% (by 11.4% per year) and in the capital region from 5.3 to 6.4% (by 6.6% per year), where an increase was equally important in the absolute values sense (by 1.1 p.p.) due to a higher share generally. It should be stressed out that in the Swedish side the share of fodder from arable land area is even higher and there is a trend of increasing observed as well (fig. 31). Moreover, due to relatively large total area of the region and a high share of fodder cultivated land, almost the same area of it grew up in that period in Southern Sweden where increase counted 9000 ha., while in Danish side it was all together 11.7 thousand ha. This growth in a wider time perspective isn't that rapid, but the analysis of that trend since 1990 confirmed a permanent increase by 0.9% yearly (fig. 32). Permanent growth of fodder from arable land production during the period of reducing agricultural land and arable land itself is influencing the dynamic raise of fodder production significance in the land use structure since 1990.

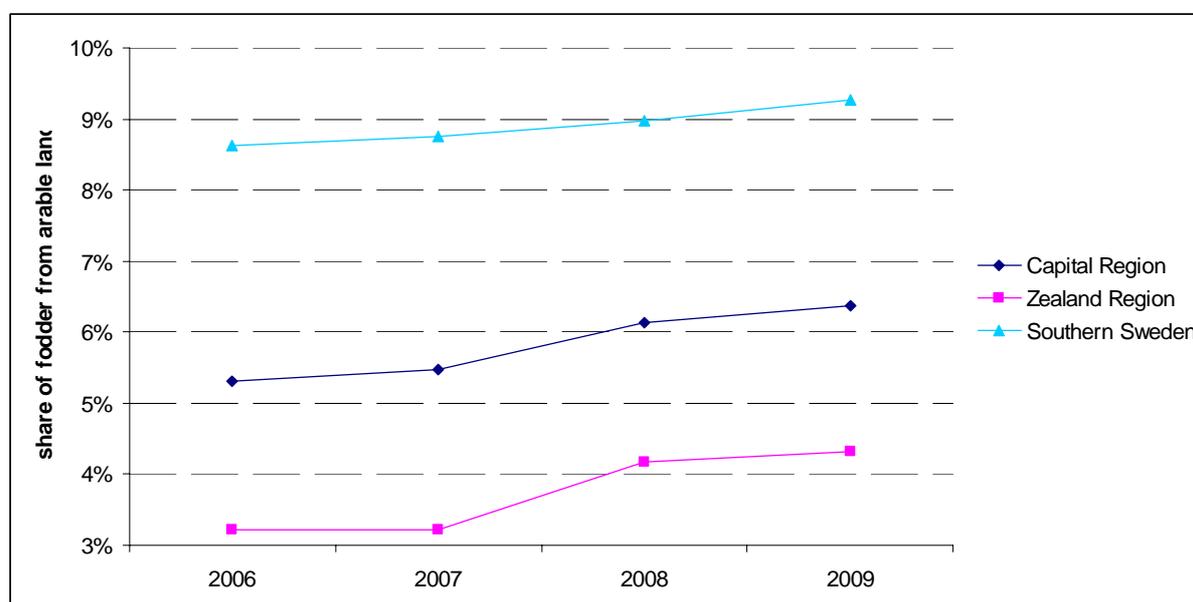


Figure 29 Share of fodder from arable land area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

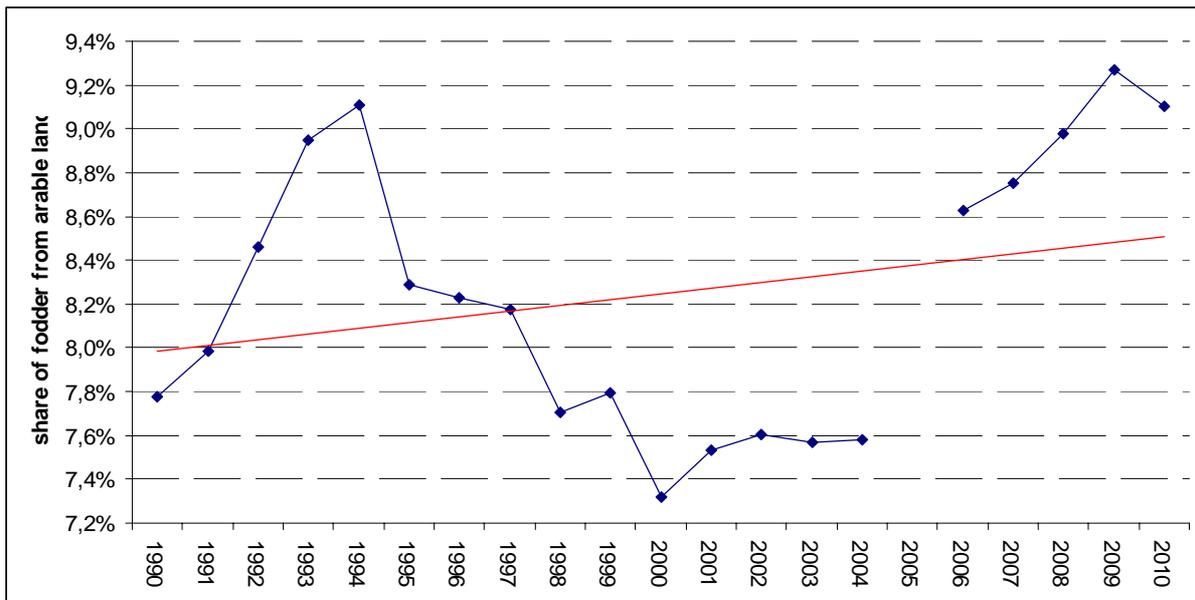


Figure 30 Share of fodder from arable land area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

In the respect of fodder from arable land production, the Øresund region has a contrary importance from Danish and Swedish points of view. Southern Sweden (3.4% of total area of Sweden) takes 11.2% of arable land cultivated for fodder purposes in Sweden. High share in this case results from important role of indigenous agriculture in general. This is caused by relatively favourable natural conditions and a high share of arable land itself. In Zealand (22.8 % of total area of Denmark) there is only 8.6% of arable land cultivated for fodder purposes in Denmark. It is strictly linked with the role of animal production in agriculture of Zealand region and the rest of Denmark. Generally, animal production, especially pork production, is a strong branch of agricultural activity in Denmark. Number of pigs per 100 ha of agricultural land is very high there, in 2009 it was 487.8 as average. Role of pork production on Zealand Island is also very significant, but a lesser extent. A number of pigs per 100 ha of agricultural land in 2009 counted 278.9 in the Zealand region and 254.3 in the capital region. In respect of cattle number per 100 ha of agricultural land regardless of high rate in Denmark (61.4), Zealand region is distinct for low values (31.7 in capital region and 18.1 in the rest of Zealand). The numbers above show, that the significance of animal production in agriculture of Denmark implies high share of fodder from arable land area there, but at the same time much lower, than in the rest of Denmark.

Simultaneously to the arable land area decrease, there is a decline of permanent grasslands area observed. In the Øresund region between 2007 and 2009 permanent grasslands area fell from 113 to 104.7 thousand ha (from 4.7 to 4.5% of total area). Area of this kind of land use decreased most dynamically in the capital region, from 2006 to 2009 from 14 to 11.4 thousand ha (from 5.5 to 4.5%), with the average decline of 6.2% per year. The main reason for that is due to occupying permanent grasslands with the lowest agricultural quality and a strong pressure of more intensive kinds of land use in this area. On the other hand, the area of permanent grasslands on the rest of Zealand increased in this period from 27.6 to

31.7 thousand ha (from 3.8 to 4.4%), average by 5% yearly. It was fully compensated with an excess lost of permanent grasslands noticed in the capital region. This resulted in agriculture extension and conversion of weaker agricultural land for multifunctional use, in most cases well adapted to sport and recreation. In Swedish part of the Øresund region a decrease of permanent grasslands of significantly low dynamics was observed in the last years. Between 2007 and 2010 the area of permanent grasslands declined from 69.4 to 68.5 thousand ha (from 5 to 4.9%), with average rate of 0.4% per year. However, this trend has changed. During the 1990s. a period of dynamic decrease was observed. Share of permanent grassland in Southern Sweden between 1990 and 1998 decreased from 6.5% to 4.2%, but in 1996 it was as low as 3.9%. In the first half of the last decade this rate slightly increased again and there is a period of relative stabilization at the level a little below 5% observed in the last years (fig. 33). The importance of permanent grasslands area of Southern Sweden for the Swedish agriculture can be expressed by the fact, that 15.3% of them is situated there.

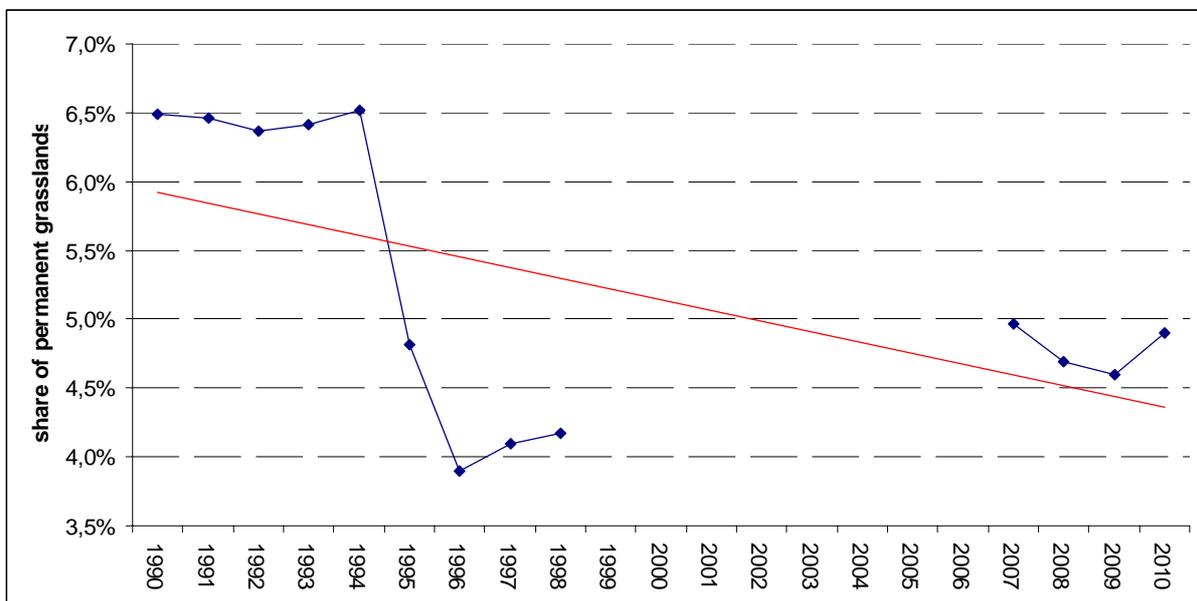


Figure 31 Share of permanent grasslands area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

In the case of permanent crops area, there is a strong decreasing trend observed in the Øresund region. Between 2007 and 2009 share of permanent crops area declined by 4.4% per year, while in Sweden the decrease was at the rate of 3.2% and in Denmark it reached a decline of 10.5% per year. This tendency in the region was mainly caused by the impact of land use changes in the capital region, where in period 2006 to 2007 the area of permanent crops fell down from 600 to 500 ha (5.6% yearly). Converting the agricultural land for other functions is observed there even in the case of such intensive form of agriculture as orchards or vegetables cultivation. This lost of 100 ha was fully compensated by an increase of permanent crops area in the rest of Zealand. But this lost noticed in the Swedish part, was almost as significant. However, such a dynamic decrease of permanent crops area did not significantly influence the general land use structure in the region, because this element takes little share due to climatic conditions. Nevertheless, such rapid

changes can contribute to disappearing of permanent crops in the land use structure of the region in longer time perspective. The stability of this trend can be examined on the example of Southern Sweden, where the area of permanent crops is permanently decreasing at least since 1990 to 2010 and declined during this period from 2.7 to 1.9 thousand ha (by 30%). It must be emphasised that the dynamics of this process was 1.5% per year, while it even grew up to 1.7% yearly in the period of 2007 to 2010. In comparison, in the capital region this dynamics is much higher and counts for 5.6% yearly. However, the impact of land use changes in the Øresund region in the Swedish case is more significant from national point of view, because due to climatic conditions 65.5% of Swedish permanent crops area concentrates in Southern Sweden.

Decreasing of utilized agricultural land area in the Øresund region is observed, what was proven by the analysis of basic elements of structure changes. This is an effect of economic importance of agriculture in the Øresund region. However, the dynamics of agriculture land area declining is slow in comparison to general trends in both, Denmark and Sweden. Between 2007 and 2009 share of utilized agricultural land fell down in the region from 45.9 to 45.3% (by 0.6% yearly), while in Denmark from 62.5 to 61.2% (by 1% yearly) and in Sweden from 7.7 to 7.5% (by 1.3% yearly). It must be noticed, that due to large disproportion in the share of agricultural land area between these two countries, a much lower dynamics observed in the Øresund region still means far greater decline in absolute values, because in Sweden the dynamics of 1.3% per year contributed to the lost of only 0.2 p.p. in the share of land use structure. Although low dynamics of utilized agricultural land share and the decreasing dynamics in most of the Øresund region was low in fact, e.g. between 2006 and 2009 in the Zealand region from 67.6 to 66% (by 0.8% yearly) or between 2007 and 2010 in Southern Sweden from 36.2 to 36% (by 0.2% yearly), in the capital region the situation was extremely opposite. From 2006 to 2009 the share of utilized agricultural land decreased there from 42 to 38.2% (by 3% yearly). Nevertheless, in the capital region between 2006 and 2009 the lost of utilized agricultural land area counted for 9600 ha and was smaller than the lost noticed in the rest of Zealand (12100 ha). On the basis of Southern Sweden case, it can be analyzed that during last years the trend of utilized agricultural area declining slowed down. Its area since 1990 was decreasing at the rate of 0.9% per year, so with definitely higher dynamics than after 2007 (fig. 34).

Permanent transformation of less valuable agricultural land into non-agricultural forms of land use in Denmark and Sweden caused a general decline of fallow lands and green manures area. In Southern Sweden, an agricultural region, it used to be a small-scale process during the last decades (by 7.2% yearly since 1999), but it is already not any longer even here (fig. 35). In the period 2006-2009 this process accelerated here to decline by 26.6% per year, but it was still not as rapid compared to the Danish part of the Øresund region. In Zealand it was slightly slower than in the capital region (by 31.2% yearly), but it's still a more significant scale than in Southern Sweden (fig. 36). Nevertheless, in much greater Swedish part of the Øresund region, where the share of fallow land was much higher, reduce of its area contributed to a more important change (by 25.9 thousand ha, while in the capital region the decrease was by 5.8 thousand ha).

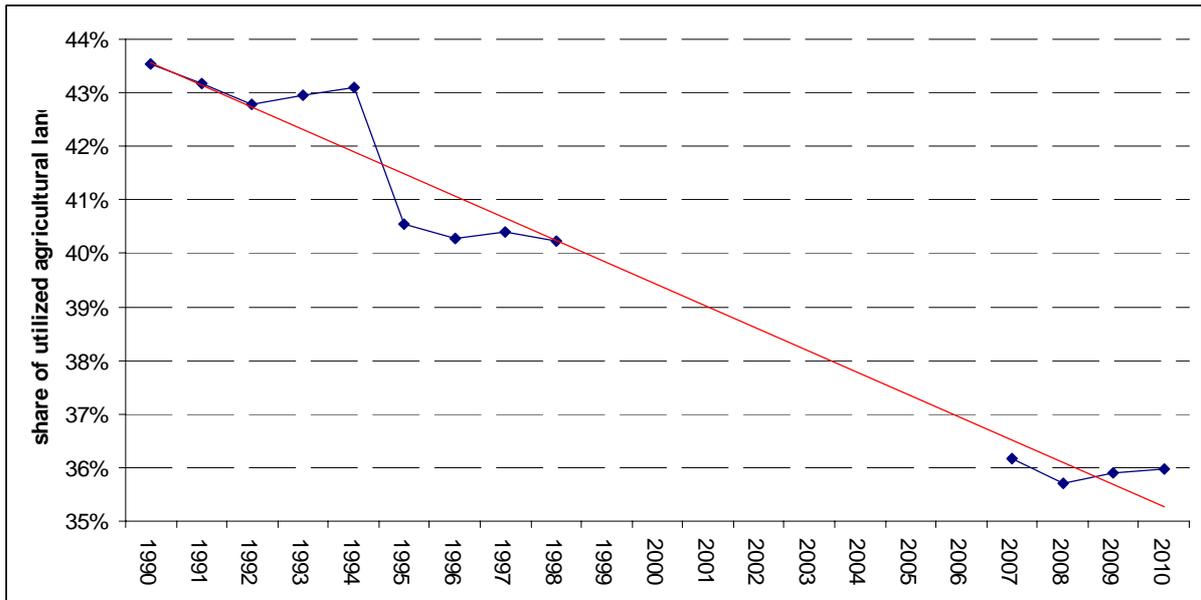


Figure 32 Share of utilized agricultural land change in Southern Sweden

Source: own elaboration, based on Eurostat data base

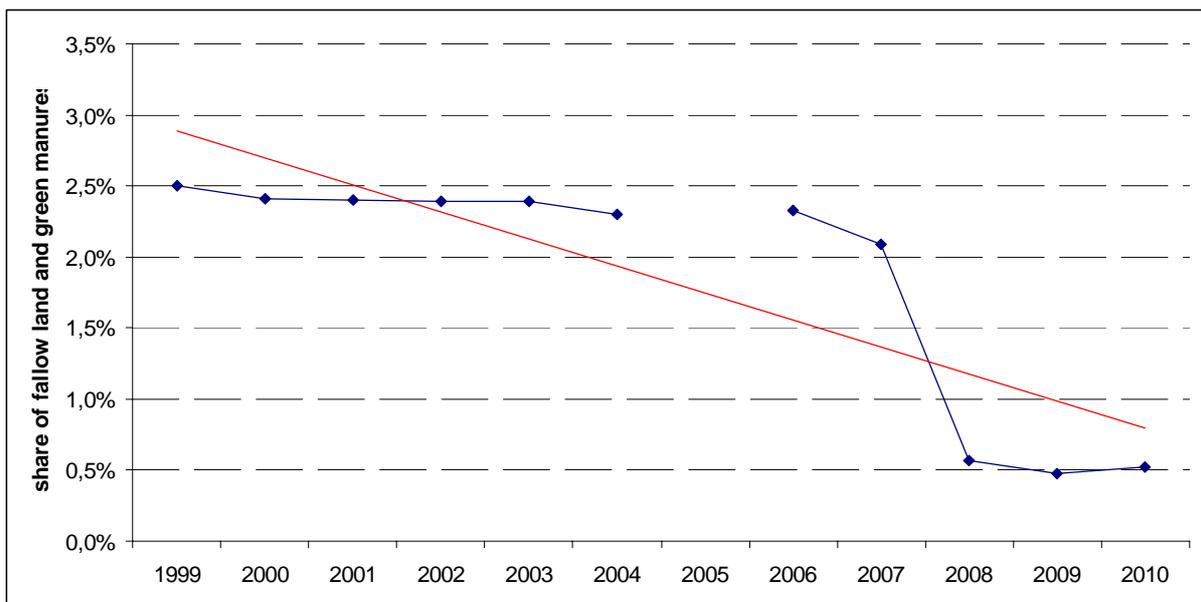


Figure 33 Share of fallow land and green manures in total area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

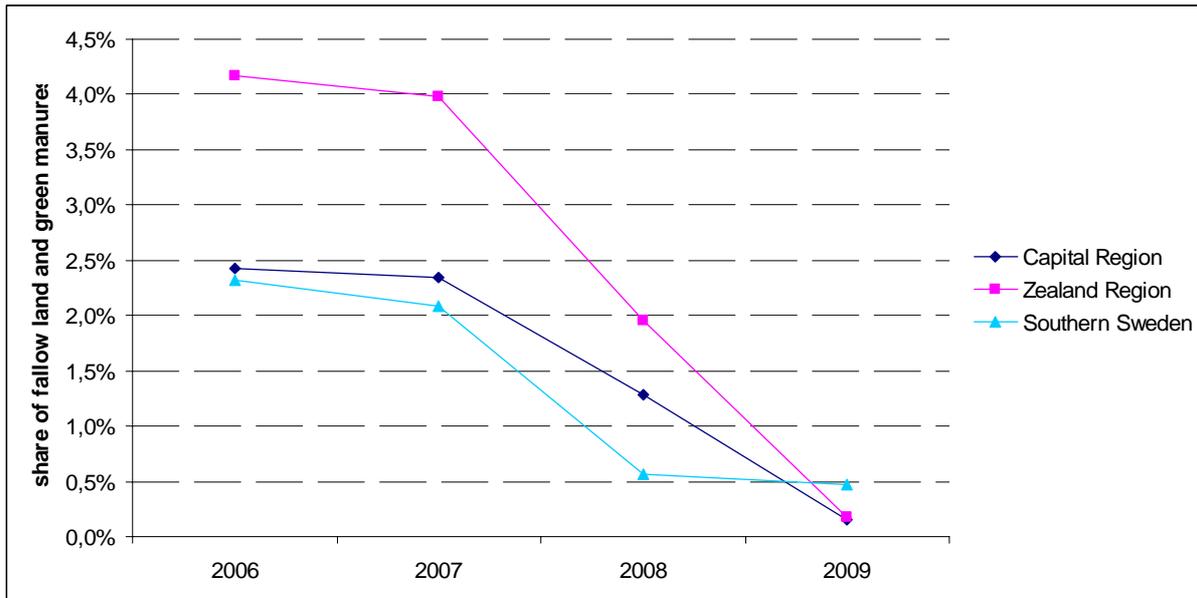
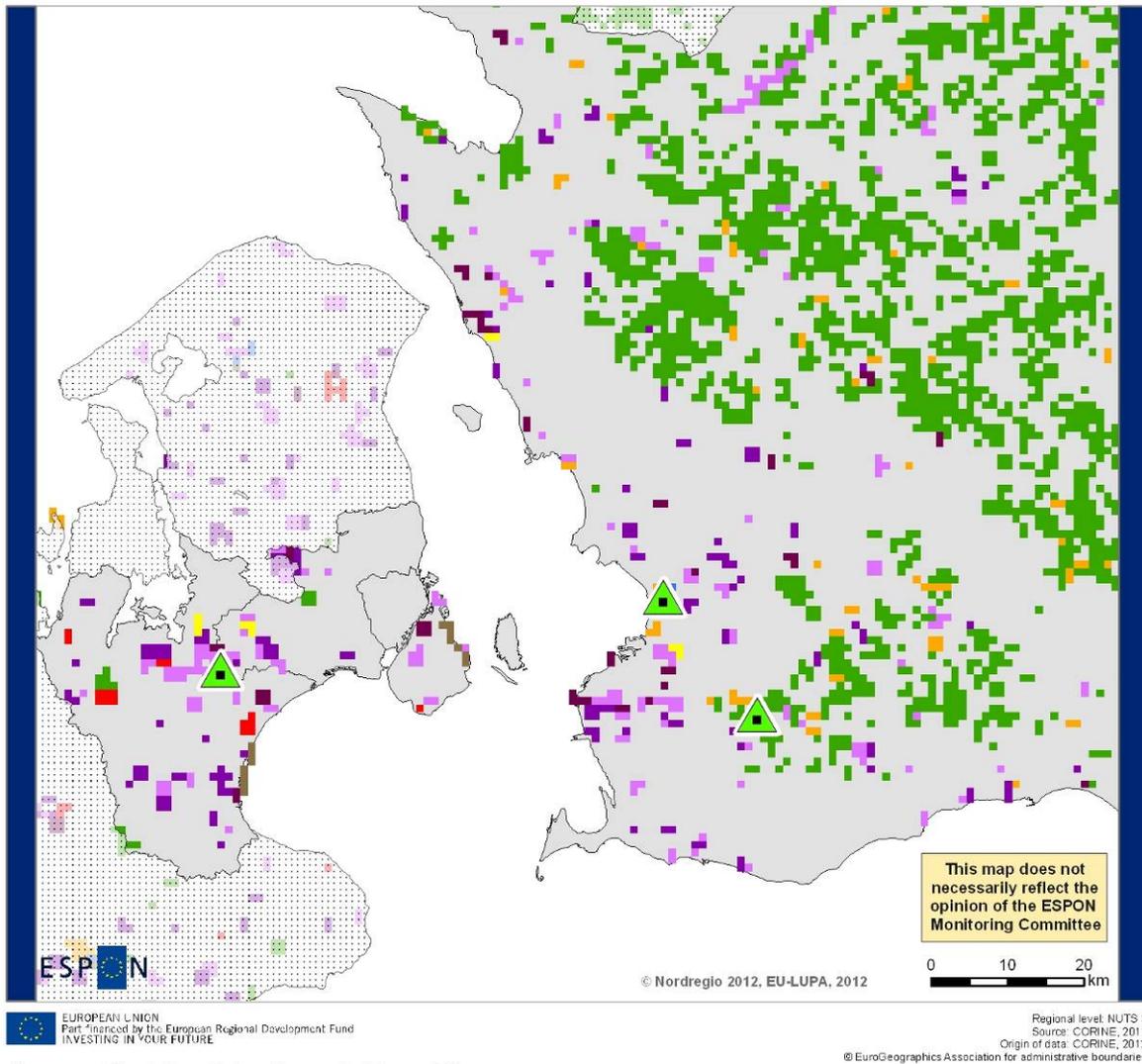


Figure 34 Share of fallow land and green manures in total area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

In the Øresund region a dynamic increase of forests area is worth to be analyzed as well. However, this process is not observed in all of Denmark. In Sweden as a whole, afforestation is not as significant compared to Skåne region. Between 2007 and 2009 in the Øresund region share of forests area increased from 27.5 to 29.7% (by 4% a year), while in Sweden from 57.3 to 58.2% (by 0.8% yearly). In fact, the only part of the region, where forests area is increasing, is the Swedish side, on which there are the territories of its definitely highest share. From 2007 to 2010 percentage of forested area increased there from 38.6 to 42.3% (by 3.3% yearly). Process of afforestation is observed in the wider time perspective as well, although somehow less intensive. In the period 1990-2010 share of forests area in Southern Sweden increased from 38.8 to 42.3% (by 0.5% yearly). This indicates, that before 2007 the trend of Swedish side afforestation wasn't so distinct. Intensity of this process is strictly related to transition of rural areas into multifunctional land use in the last years, especially for recreational purposes. This is mostly driven by the needs of developing agglomeration inhabitants. Such areas are usually multifunctional, because as they provide a wood source or residential area apart from mentioned functions.

Land Cover Flows 1990-2006 Øresund Region



Areas Subject to Land-Use Change

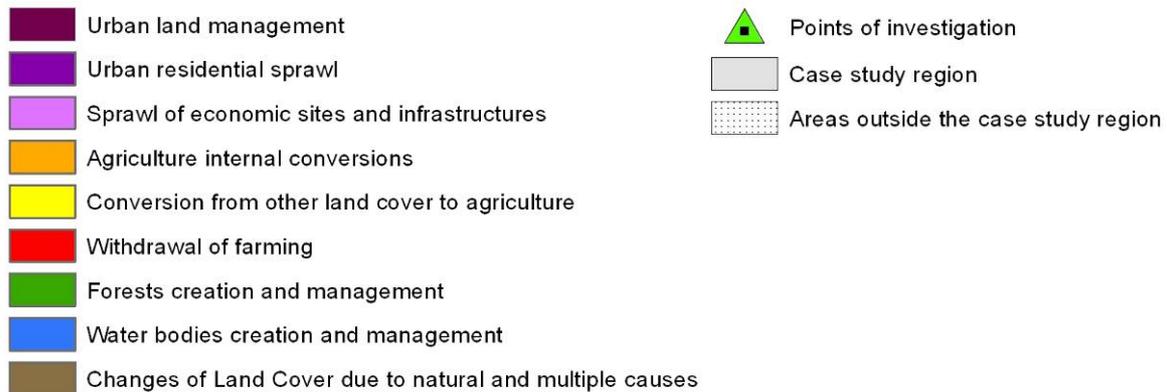
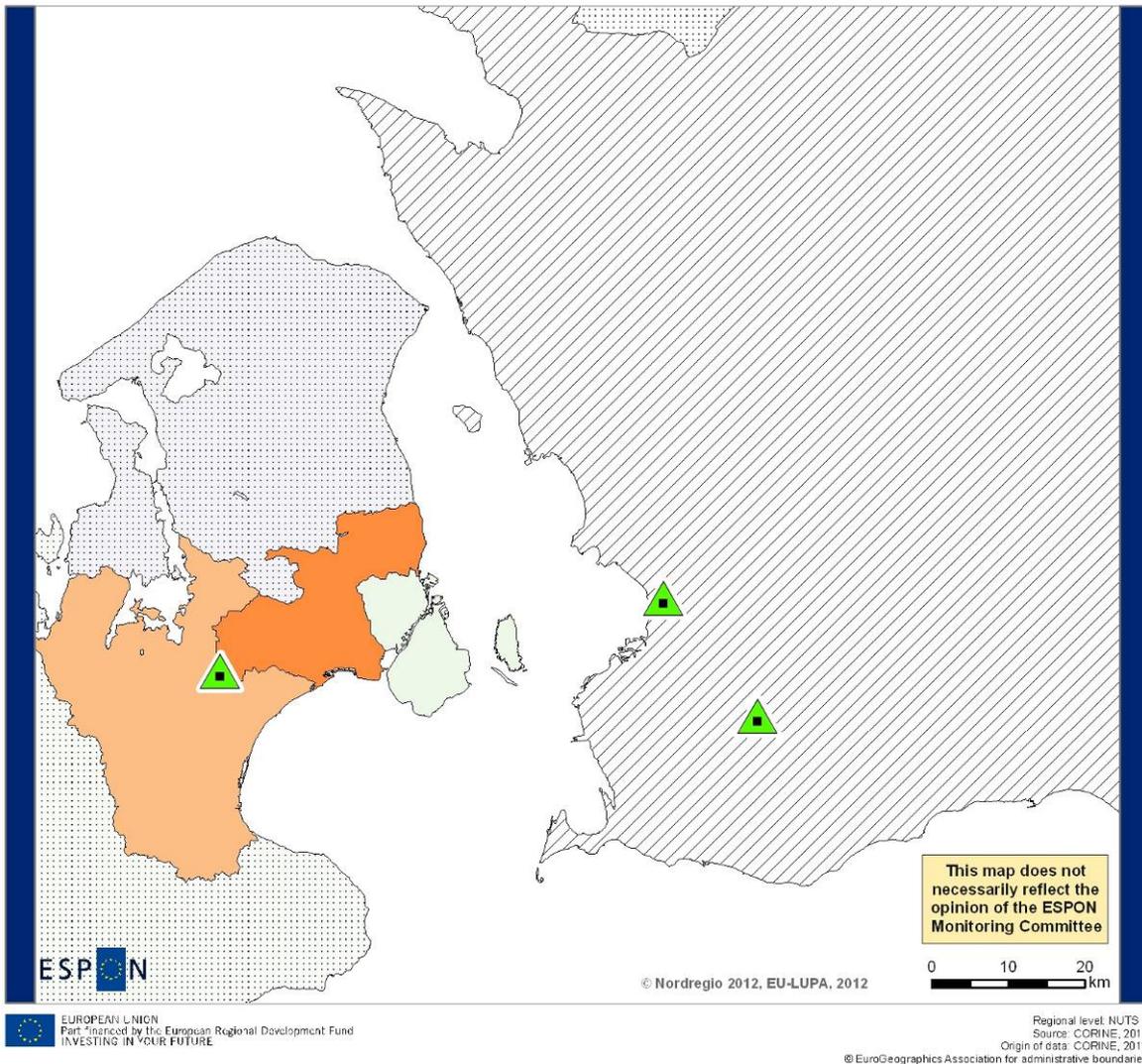


Figure 35 – Land Cover Flows 1990-2006

Source: Nordregio based on Corine Land Cover

Land Change Typology 1990 – 2006

Øresund Region



Land Change Typology

- Very high intensification with artificial surfaces replacing mainly natural areas
- Very high intensification due to specific areas of residential and economic sprawl
- High intensification due to residential and economic sprawl surrounding urban conversion
- Medium-high intensification due to diverse urban processes
- Medium-high intensification due to diverse urban processes
- Medium intensification due to some urban sprawl combined mainly with forest conversions
- Medium intensification - dynamic mix between agricultural/forest changes and urban sprawl
- Low intensification, dynamic mix between agricultural/forest changes and limited urban sprawl
- Low intensification mainly due to agriculture and forest changes
- High extensification due to forest and agricultural changes but specifically the withdrawal of farming

- Points of investigation
- Areas outside the case study region
- No data

Figure 36 - Land Change Typology 1990-2006

Source: Nordregio based on Corine Land Cover

4.2. Trends, actors and drivers of the changes (micro and macro scale)

Like other parts of the Western world, the Øresund region is in a structural transition. However, there are considerable differences within the region regarding the extent of this transition. Between 1993 and 2007 the share of value added from agriculture, forestry, hunting and fishery declined from 0.5 to 0.3% in the capital region, from 3.5 to 2.5% in Zealand region and from 2.8 to 1.5% in Skåne region. In that period the reduction of employees number in the first economic sector was of comparable scale. In the capital region there was a decline from 0.9 to 0.6%, in Zealand region from 6 to 3.7% and in Skåne region from 3.1 to 2% (*Øresund Trends 2010*).

A general situation of land use structure change in the recent years is influenced not only by the agricultural economic situation, but also by a strong pressure of new investments of agglomeration development. The significance of rural landscape becomes more crucial, as it is protected by some of municipalities and national law regulations. Such protection became the other side of main front of changes actors. Among the others, the regulations of immigration to Denmark should be mentioned, as these are very restrictive in comparison to Sweden.

Needs of new housing area are the leading ones. Their basis lies within Copenhagen and Malmö surroundings with labour market opportunities. In further localities, the purposes of housing pressure is changing gradually in favour of landscape, preserving the traditional rural and coastal landscape. These areas are most valuable. However rural landscape was well protected during the past decades by general plan of Copenhagen development, called "five fingers plan". The plan assumed new investments along the coastal line and the main transport corridors. Between these there are agricultural areas. The most effective administrative barrier to protect it, is to forbid new settlement building in rural areas. Despite of it, agriculture is retreating gradually further from Copenhagen and Malmö to Jutland and to the new EU-member states under the economic pressure.

Apart from rural landscape preservation by law and increasing value of plots intended for housing, another growing power is the knowledge industry and research activities, which are moving to rural areas to work in more natural landscape and clean conditions. They are interested in preserving such conditions on rural areas and have sufficient arguments as the sector develops. An example of such localization of an institution on rural areas is the new Nokia technological centre nearby Copenhagen.

Changes in the agricultural land use rely on intensification pressure, especially in the pork production. In the rural areas, especially relatively close to Copenhagen and Malmö, the important support of the landscape protection from agricultural production intensification has an economic basis. It relies on increase of value of properties situated in traditional rural landscape. That is why multi-functionality of such areas is introduced effectively. The functional changes of land use in rural areas are far stronger than changes in land cover structure. However they are gradually appearing in the agricultural land area reducing as well.

4.3. Contemporary and potential conflicts

The most important contemporary and the most likely future spatial conflict is related to the intensification of pork production, which has an impact on preservation of traditional rural landscape in the region and is lowering the land prices in the municipality. This conflict is related especially to the trends observed in Danish

agriculture. It can be solved by moving part of Danish farms conducting intensive pork production to the new UE-member states in the future. Agricultural land prices difference is conducive to it, so this process will appear probably just after buying the land by foreigners allowed in new member states.

There is no real threat of conflicts related to new transport or industrial areas developing. In the framework of new transport investments a huge external corridors are planned rather than new routes through the region. The only possible strategic future transport investment in the region is the new bridge between Denmark and Sweden. The possible two new external gates from the region are the tunnel under Fehmarn Belt straits from Zealand to Germany in 2018 and a direct bridge between Zealand and Jutland Peninsula in Aarhus surroundings in further future. Such new transport areas can appear in the capital region to attend raising number of daily commuters. New industrial areas will be rather rare as well, because the number of employees in manufacturing industry including construction is decreasing. This sector accounted for approximately 15% of total employment in the capital region, 22% in Zealand region and 23% in Skåne (*Øresund Trends 2010*). Even if the manufacturing industry were to decrease in all three areas, the reduction would be the greatest in the capital region. In all three parts, business services and wholesale and retail trade are outstanding.

4.5. Scenarios

Instead of traditional industry, high-tech sector is developing very fast. It demands very often clean environmental conditions, like e.g. computer related operations, medical and surgical equipment production, social science, consultancy regarding machinery or optical instruments and photographic equipment. The scenario of future development focused on high-tech manufacturing industry and service production is most likely, what can be supported by 2.6% of Danish and 3.9% of Øresund region GDP deducted to the R&D expenses (by OECD, 2007).

The process described above will be probably followed by further retreating of agriculture from the centre of the Øresund region and possible moving some of the big intensive farms with animal production to other countries. These will be forced to adapt by changing circumstances and growing needs of unpolluted environment for high-tech activities development and live in the region. To prevent it, gradual shifting from agriculture for leisure activities function of the land use in rural areas will take place. Different situation will take place in the areas of the Øresund region further away from development core. They can change the land use in connection with needs of energetic plants cultivation. Shifting from intensive pork production to the bio-energy production can be the most important direction of land use changes in agricultural areas.

Less likely, but possible scenario to be taken into consideration is that the agriculture in Denmark and Sweden, like in all Western Europe, will be forced by the international situation to face with an increased demand for supply than today. In this pessimistic scenario agriculture will come back to intensification of food production, which will be unfavourable to landscape and land use structure in the Øresund region. This scenario can mostly influence the land use changes in Swedish part of Øresund region, which has a great importance for the Swedish agriculture.

5. MULTIFUNCTIONALITY OF LAND USE

5.1. Functional differentiations

The Øresund region has a clear functional spatial pattern. In the centres of Copenhagen and Malmö agglomerations services dominate. In the surrounding of these cities centres there is a zone of settlement with housing areas and transport corridors. Close to transport hubs very often the areas of industrial activities are situated. Transport corridors with settlements are located also along transport corridors towards North and South along the coast line, in other three directions West from the city centre in Copenhagen case, according to “five fingers plan” and in the other two directions East from the city centre in Malmö case. Along the coastal line, but further from the agglomerations there is second houses area, the broader, the better accessible city centre is. In some towns of this zone, like Kalundborg, Koge, Helsingborg, Helsingor, Trelleborg, Ystad or Ronne on Bornholm Island, there are also relatively important international transport hubs with commercial ports or intermodal terminals. These are centres of logistics, trade and other services related to the function of such town. The most of Zealand area has a rather agricultural character with strong multifunctional land use for leisure activities, recreation and sport. Bornholm Island distinguishes strong role of tourism apart from traditional agriculture. Swedish interior has an agricultural function as well, but more extensive and with significant impact of multifunctional rural areas and, especially forestry.

5.2. Current multiple uses of land

Current state of land use is strongly diversified on all the region surface. A common example of multifunctional land use is joining of agricultural producing with functions of horseback riding area and wind power station. Also active environmental protection in national park favours multifunctional land use, like landscape protection joined with among others agricultural and forestry production or recreational activities. The coastal residential area joins prevailing housing function with recreation, tourism, energy production and small businesses, which do not require large area. Many of smaller farms nearby Copenhagen agglomeration are organic due to a big demand for healthy food in the region. Multifunctional land use became very effective in economic sense as well.

An example of industrial areas land use change last decades is I/S Hedeland, where a huge gravel and clay mining area on the outskirts of the capital region was converted in a big extent into leisure activities with all infrastructure and of very diverse forms. It was possible as a result of gradual buying land from companies by organization of three communes and two counties for that aim. In this area of artificial landscape there are among others: golf club, horseback riding paths, race track, amphitheatre, old railway, ski lift or wine yards.

5.3. Potentiality of multiple uses of land

Probably due to economic circumstances the number of functions will be still increasing. Popularity and demand for organic farming in the neighbourhood of Copenhagen agglomeration and future possibilities of moving large-scale market oriented farms to other countries with lower land prices and less restrictive

environmental protection will be helpful in introducing multifunctionality into rural areas as well. Function of agriculture will change to good quality food production source, not an economic activity only. Moreover, organic farming is easy to combine with leisure activities and rural tourism development, what is economically effective as well. This trend is observed currently.

The next very strong driver of future multifunctionality introducing will be the demand of joining agriculture and environmental protection with energy production, which will become more expensive. That is why introducing wind power stations in new areas and combining it with the other functions of land use will become necessary. Approximately 25% of Danish electricity is produced by windmills. The government policy is to double energy production from renewable energy sources during the next 20 years. However it will have a negative impact upon multifunctional land use, because the windmills limit recreational or residential function and disturb environmental protection in the surroundings. It drives to a current process of retreating windmills to sea surface, but in the future it may become insufficient.

Another aspect is the change of agricultural land cover caused by energy production demands. Even currently biomass plants are becoming more important as the energy source, especially the willow. Such land cover means nominally a multifunctionality increase as adds energy production to traditional rural functions, but due to growing densely and creating non-interesting landscape it limits other functions introducing. Less problematic for the landscape and multifunctionality is rapeseeds cultivation for bio-fuel.

We can expect a dynamic development of high-tech industry and research centres in rural areas as well. It will become necessary due to both better conditions to such activities compared to the city centre and land prices differences. Organic farming helps rural municipality to attract such enterprises.

6. POLICY CONTEXT OF LAND MANAGEMENT

6.1. Land use in the regional/local documents

Regional planning law and responsibilities division has changed in Denmark with the administrative reform in 2007. There were 13 Amts and 271 municipalities before. Now the administrative units are enlarged and joined into 5 regions and 98 municipalities. Most of municipalities has over 20 thousand inhabitants nowadays. In Skåne among 33 municipalities 15 has over 20 thousand inhabitants and 31 over 10 thousand inhabitants.

In previous administrative system the Danish municipalities were too small to shape land use within. Then responsibility for land management was at country and regional level. There were 12 regional plans, 271 municipal plans and about 1300 local plans. In new structure, the national planning is strengthened, there are 5 Regional spatial development plans and responsibility is moved down, to municipalities, which were enlarged. Especially rural ones are responsible for spatial planning to a greater extent, because they do not require permission on higher level for land use changes conducting, so they are able to perform a more complex planning. Impact of administrative change will be seen in the next 10 to 15 years.

In Sweden, the national law includes regulations that limit the rights of the municipalities, which have responsibility for the physical planning. National law regulates issues like areas of national interest or along shorelines of lakes and rivers. The central agencies provide advice for municipal planning. The county administrative board has to consult with the municipalities their plans and do the monitoring of handling national interest in municipal planning. They are also first appeal instance and can revoke municipal plan. Municipalities have planning monopoly, so called "*planmonopolet*". They produce comprehensive plans, detailed comprehensive plans, detailed development plans, area regulations and give building permission. Plans elaborated in municipalities can be revoke at national level.

In 2007 in Denmark there was a reform, both in terms of administration and development planning.

At the previous stage used the National Strategy and the 12 Regional Plans, 271 Plans and 1300 Municipal Premises Plans. After 2007, the authorities use the Strengthened National Plan, 5 Regional Spatial Development Plans, 98 Municipal Plans and as before 1300 Local Plans. The transition period to amend is the years 2006-2009.

Documents:

1) Øresund region

To maintain a high level of cooperation on both sides of the strait, Øresund Committee has formulated the Regional Development Strategy, which has horizon till 2020. The strategy includes 4 main aims:

- Knowledge and innovation,
- Culture and events,
- A diverse, yet cohesive labour market,
- Accessibility and mobility.

The Øresund region should be working on six fronts:

- using Öresund Direkt as a channel for providing an overview of the existing opportunities, regulations and frameworks;
- creating a strategy so that the knowledge resources represented within the region can be efficiently and effectively utilized to stimulate growth;
- initiating a process that enables children and young people to acquire knowledge of the cultural heritage and opportunities that arise on both sides of the Sound;
- improving opportunities for creative enterprises, art and knowledge based companies to work together on both sides of the Sound;
- improving the dialogue between Sweden and Denmark concerning investments in roads, railways, ports and airports;
- developing clean-tech solutions and promoting sustainable urban development to pave the way towards hosting a regional EXPO in 2022.

2) *Copenhagen Region*

a. Finger Plan for Greater Copenhagen

In 1947 two Danish architects Peter Bredsdorff and Sten Eiler Rasmussen presented the Finger plan for the development of Copenhagen. As the central city followed an existing compact city centre of the 1940s, and the fingers pointing along existing and future cities, he draped on infrastructural corridors radiated in five directions from the centre. The urban landscapes proper of Copenhagen comprise densely built parts in the city centre and in the local centres along the major traffic route. It should be noted that spatial models for urban development can be greatly influenced by the conditions of differences in natural environment (e.g. hills or wetlands) that impose constraints on urban development.

For 60 years, the "Finger Plan" was the basis for urban development, infrastructure and landscaping for the entire metropolitan area, and this influence is visible in space, and the landscape nowadays.

The plan in great detail indicated the direction in which space should be utilized within the "fingers" or in terms of land development, recreation and infrastructure. The authors devoted less attention to sites of "between the fingers", just defining them as green areas, consisting of farmland, forest areas, lakes and the Øresund coastline (the North and Helsingør, and to the South towards the town of Køge.

6.2. Influences of regional/local planning

Local and regional planning in Denmark has significantly changed during the last 20 years. Now the system is more focused on interactions between various land use types, is more complex than sector planning before.

After the last administrative reform enlarging of Danish municipalities and providing them with tools of spatial planning and responsibilities for it took place. However it is too early to make suggestions regarding the influence on future land use changes. Generally, current local and regional administration is effective in land management issues as well as preventing and solving spatial conflicts. It results from legislation

developed in the 1960s. One of examples of initiatives from administrative units concerning land use change in a desirable way is converting industrial landscape for leisure activities function in Hedeland.

The monitoring system relies on reporting of the major land use changes to municipality office, which need to be accepted and included into the municipal plan. Necessity of getting acceptance from local government and of being consistent with spatial plan is in Danish case effective way of both, monitoring of land use changes and spatial planning.

The newest transformation influencing land use changes in Denmark is claiming by current government the willingness of environmental protecting by public access instead of privatizing it.

Example:

In Nykøbing Falster, a new suburb was built – Slotsbryggen – which is close to the town centre and has green areas and views overlooking the water. There is room to move about – for cyclists, pedestrians, sailors, café - and cinema-goers. All of this exists within a relatively compact area.

7. CHALLENGES AND POLICY RECOMMENDATIONS (2020 PERSPECTIVE)

The major direction in the future policy should take into consideration transition of the region from high developed but with more traditional directions of land use changes, like e.g. urban sprawl, summer houses areas increase, transport corridors development, agriculture intensification and post-industrial areas reclamation, to more modern trends, which are facing with the new world challenges. This process means acceleration of the land use changes and new challenges regarding spatial planning. The most important sign of the transition are the turning directions of the changes in each of the strictly connected branches of regional economy, what must have an impact on the land use changes.

First of all, the concentration of urban sprawl in some isochrones from railway stations trend should be still consequently supported. It helps to develop more effective railway transport and modal shifting among daily commuting population. In the areas declared as rural (between the “fingers”) any forms of bicycle as the most common used vehicle should be supported.

Facing with summer houses areas development and pressure on new areas is becoming past challenge, because the most valuable areas for such purposes are already exploited and in the peripheral parts of the region more rural depopulated areas will appear and shall create an opportunity for such purposes due to permanent young people emigration and local populations ageing there. As a consequence, functions of such areas which are relatively well connected with agglomeration centre should be gradually transformed.

Intensification of agricultural production in the Øresund region is probably another process of the past. Retreating of agricultural productive function is already being observed. Converting rural areas should be conducted dually, depending on the strengths of given area. In the first direction, areas relatively well connected with agglomeration of the region should be transformed into leisure activities for citizens or summer houses areas. In the case of rest of such areas function of green energy production should be introduced, deriving from wind power plants or plant for bio-fuel cultivation. It is a necessary challenge to be faced with, due to predicted future energy prices rising. On the other hand, such function of rural areas is hard to co-exist with traditional rural landscape.

The last recommendation is strictly connected with predicted increasing significance of high-tech services, high-tech industry, and research activities in the region. These forms of activities usually demand clean environment and close-to-natural landscape is desired. These processes will be relying on both R&D expenditures made and adequate areas created. This is the next driver of demand to create aesthetic landscape areas in the agglomeration neighbourhood. It should be one of the most crucial aims of future complex regional planning.

Researchers of EU-FP6 project PLUREL made scenarios for urban development in Europe, based on the IPCC scenarios, well-known for climate change modeling. The scenarios were described in detail with storylines and then modeled with demographic and economic models, and finally with the “Regional Urban Growth”

model, developed by the University of Edinburgh, to calculate their effect on land use change for the years 2005 – 2025.

All scenarios show higher loss of natural surface around Copenhagen and in North of Zealand region than in the rest of Øresund region. In the B-scenario, “Peak Oil” and “Fragmentation”, the developments are more concentrated around Copenhagen compared to the A-scenario. This decrease in population density and the related risk of urban sprawl will be a major challenge for spatial planning.

The first map illustrates a superregional structure of cities, terminals and business environments connected by the rail network that will exist according to current plans for investments up to 2025. The second one is the competitiveness scenario map, which illustrates the infrastructure that could exist in 2025 after the expansion of fast land connections North of the Fehmarn Belt, Ring 5 and the HH connection.

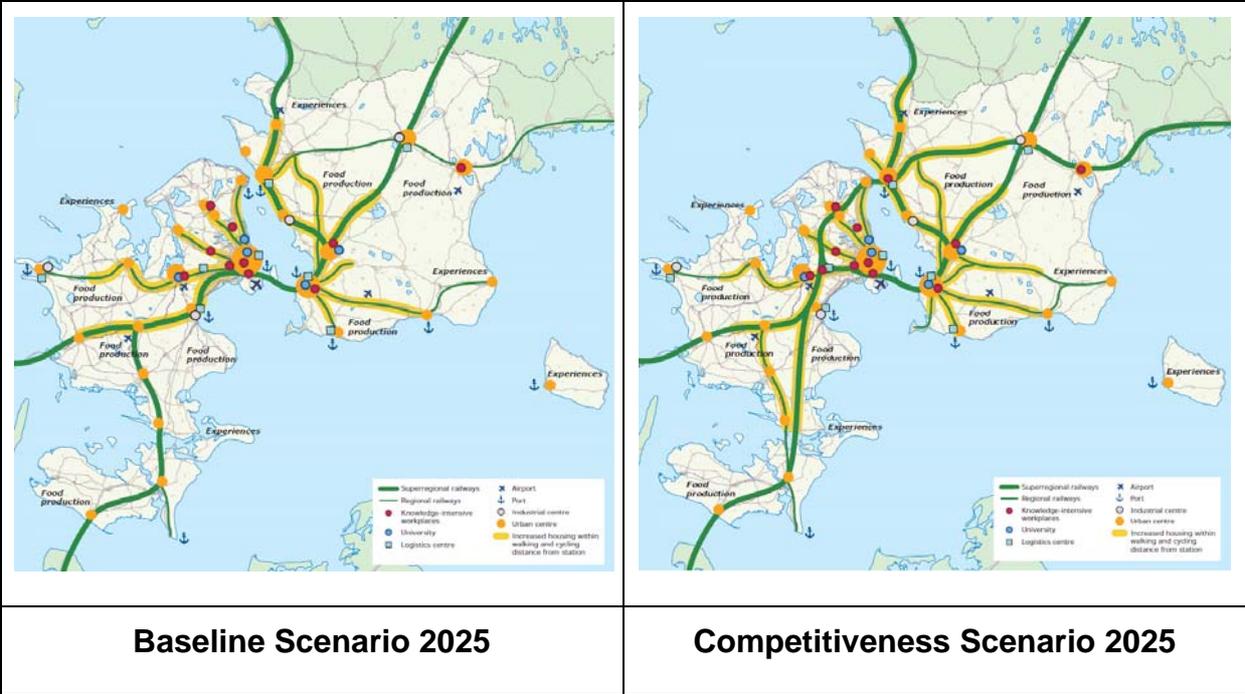
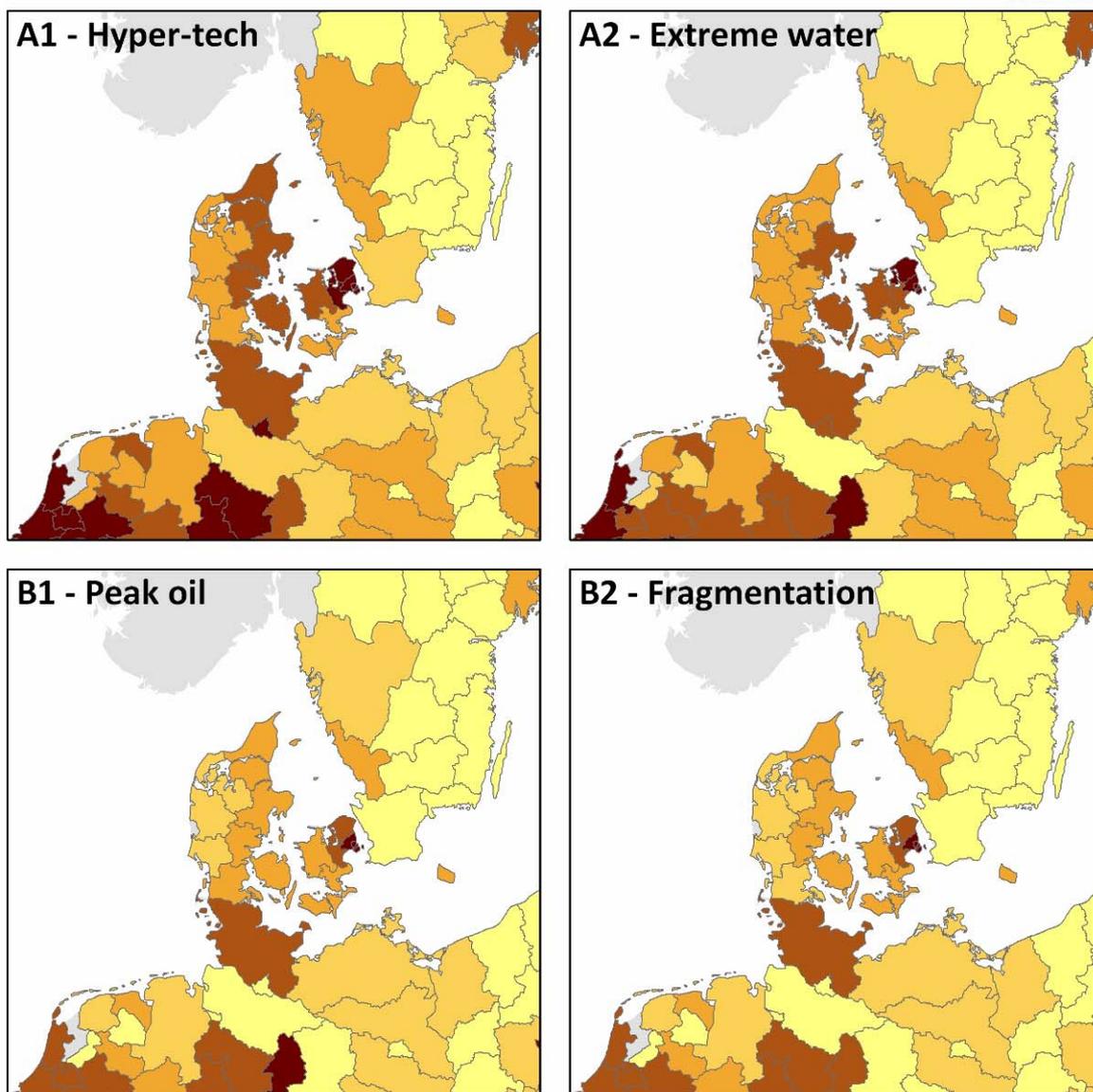


Figure 37 Scenarios for the Øresund region

Source: The Øresund region in 2025. Scenarios for Traffic and Urban Development. Skåne region.

Tab af naturområder 2005 - 2025



< 1 % 1 - 2,5 % 2,5 - 5 % 5 - 10 % > 10 %
Andel af ikke-bebyggede arealer i NUTS X regioner der vil blive bebyggede arealer.

Kilde: EU-FP6 PLUREL, University of Edinburgh, Austrian Institute of Technology

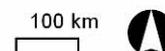


Figure 38 - Loss of natural areas 2005-2025

Source: Peri-urbanization in Europe. Towards a European Policy to Sustain Urban-Rural Futures. PLUREL Synthesis Report. 2011

8. CONCLUSION

The major land use change in the Øresund region during the last 25 years was recreation and residential area increase. This was an effect of urban sprawl, suburbanization, summer houses building expansion as a result of living standard improvement and transformation of rural areas for leisure activities with a lesser agricultural production function. General framework of regional spatial plans, especially in the capital region, were relatively effective in protecting the environmental (green) corridors, but to a less extent regarding traditional rural landscape of Danish rural areas preservation. However, due to the urban sprawl and agglomeration functions pressure, the agriculture was gradually retreating to more peripheral areas and to Jutland.

Simultaneously, industry transition to high-tech branches occurred, what brings today an impact on clean environment and well-organised landscape in agglomeration surroundings. In respect of transport infrastructure investments, the railway and bicycle transport networks development is currently a priority. Road investments are and will be taking place in the Copenhagen suburbs.

Energy production demands is another new driving force of land use changes within the region. The spatial conflict of wind power plants with other functions is a barrier in introducing them into the rural landscape, but concerning the future energy prices increase, it seems to be necessary as well as a broader introduction of plants cultivated for energy production purposes like willow (*salix*).

The 1990s and 2000s were the period of transition of the Øresund region from traditional forms of agriculture, industry and transport to more corresponding to the modern challenges. It reflects in contemporary land use changes and this process will probably accelerate due to some inertia after demands change last years.

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APPENDIXES

- Verification of land use changes typology in practice
- Interviews

EU-LUPA

European Land Use Patterns

Appendix 1

Verification of land use changes typology in practice

Land use changes discovered by Corine Land Cover pictures analysis were verified in practice by field study of three cases in Øresund Region. Verification were carried out by the sample of three squares 1 km x 1 km, where the changes were the most intensive in the region, but were processing in different directions:

- square 1. is situated in southern-west edge of Greater Copenhagen Region, ab. 4 km south-east from Roskilde (town ab. 45 th. inhab.) and ab. 40 km to the west from Copenhagen. It's inside Hedeland – former 15 km² area of gravel and clay maining, today leisure activities area. The square distinguishes very strong intensification of land use.
- square 2. is situated 1,5 km from seashore, to the north of Lomma (town ab. 8,5 th. inhab., ab. 5 km to the north of Malmo). The square distinguishes very strong extensification of land use.
- square 3. is situated ab. 2 km to the north of Svedala (town ab. 9 th. inhab., ab. 13 km to the southern-east of Malmo). The square distinguishes forest internal.



Figure 39a – Map of The Øresund Region and points of typology verification.

Source: own materials

Square 1.

The geographical coordinates

N 55°37.062'

E 12°09.899'

The land use changes in the square are connected to the function of Hedeland. Since ab. 1900 it used to be clay and gravel mining area. In 1978 it was declared by 5 administrative units (3 communes: Hoje-Taastrup, Roskilde and Greve, 2 counties: Copenhagen and Roskilde) as 1500 ha of sport, recreation and culture area. Today these functions are existing thanks to, among others: artificial slope for skiing, tourist railway, mini railway, horseback riding routes, golf course, race-track, amphitheatre. On the basis of interviews with inhabitants and operators of institutions situated in the area can be deduced, that the only land use change with significant spatial scale inside the square 1. is related to the new "Nature power fitness-bane" building. The other big artificial areas changes took place in 1990. and before. Intensification of land use in the framework of the agricultural activities relay on the vineyards cultivation area increase on the southern artificial slopes, thanks to specific local microclimate.

In this case general direction of land use changes is properly recognized on the basis of Corine Land Cover images. Although intensity of land use changes is far weaker than in 1990. or before, when new functions of former industrial area Hedeland were planned and introduced. Due to that contemporary processes are reflected in the land use changes typology correctly, however they don't feel to the type in typology in the dimension of their dynamics. The reason is age of the last Corine Land Cover image from 2006, which was taken into consideration. Typology of land use changes itself illustrates processes correctly in this case.



Figure 40a - Part of the Hedeland is still utilized as a mine

Source: own materials



Figure 41a – Part of Hedeland with the amphitheater and lake.

Source: own materials



Figure 42a- Golf Club

Source: own materials



Figure 43a - Nature power fitness-bane

Source: own materials



Figure 44a - Nature power fitness-bane

Source: own materials



Figure 45a – The pathway for horses

Source: own materials

Square 2.

The geographical coordinates

N 55°41.068

E 013°05.313'

The major contemporary land use changes are related to the special conflict between environmental and transport purposes of land use. The analyzed area has nature reserve Ostra Dammen inside, which protects pond with wildlife. On the other hand there is junction of motorway Copenhagen-Malmö-Göteborg-Oslo ab. 0,5 km to the east. It's important bus stop for numerous daily commuters of Malmö and Lund, who changes suburban buses and coaches. There are several new buildings related to the transport services, e.g. petrol station. There are new investments begun as well, like McDonald restaurant building. Under new investments and traffic increase pressure, wildlife reserve has been surrounded by the enclosure with info-tables.

New investments seem to be built up between 2000 and 2006, so probably in majority they influenced intensification of land use in this period. The estimated age of many new buildings is confirmed by analysis of the Google Earth images since 2005. Extensification of land use detected on the basis of Corine Land Cover images from 2000 and 2006 analysis under the influence of changes within agricultural land use, which still dominates. However the functional importance of these changes is weaker than importance of changes related to new investments described above.



Figure 46a – The nature reserve Ostra Dammen

Source: own materials



Figure 47a - The fence of the reserve, located along a busy street

Source: own materials



Figure 48a – The bus stop located near the reserve Ostra Dammen.

Source: own materials



Figure 49a - Service buildings located on the opposite side of the road, near the nature reserve

Source: own materials

Square 3.

The geographical coordinates

N 55°32.374'

E 013°16.271'

The land use changes in this case can reflect processes in the Skåne rural interior, the most forestage area in the Øresund Region. The square surrounds lake Yddingesjon, (ab. 3 km²), and is situated on the southern-west of the Holmeja village. This case was chosen due to land use changes in the framework of forests detected. The character of this square indicates strong role of recreational purposes of land use during the last decades. There are many kilometers of horseback riding paths and old Bokskogens Golfklubb in the area. The most important new investment is big horseback riding arena. The forest takes relatively small area in the square. Inhabitants indicated, that the most important land use changes last time have taken place just to the east of the square, where the forest where partly cut down due to trees disease a few years ago.

In this case the type of land use changes reflects the reality, but shifting of the square was recognized. Changes of land use inside the forest were detected a few hundreds meters to the west from reality. However in the scale of whole elaboration and for the general conclusions from the land use changes in EU such mistake can't change anything. It hasn't got any impact on the assess of the quality and accuracy of typology itself as well.



Figure 50a - Woodland and the recreation area

Source: own materials



Figure 51a - Horseback riding arena

Source: own materials



Figure 52a - Lake Yddingesjon

Source: own materials

Conclusions:

Field studies as an attempt of typology verification seem to be good method. Although the conclusions and observations should be selected according to the scale of typology itself. That's why general assessment of the typology is rather positive. Specific and the most extreme land use changes have been proven during the investigation. A few little mistakes detected should be rather treated as difficulties of typology verification method, not the fault of the typology itself. Some of mistakes are simply coming out from the lack of new data.

Nevertheless one extremely important conclusion considering typology and its general assumption needs to be stressed. All investigations are taking into consideration land use changes in special dimension, expressed as area of land use changes, even if they are described by the functional change. In some cases, like e.g. square 2., it can be tricky, because importance of functional changes of land use can't be measured by area of changes.

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European Land Use Patterns

Appendix 2

Field study – interviews questionnaires



Region: The Øresund Region

Place: University in Roskilde

Person interviewed: Rasmus Ole Rasmussen

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

I. Socio-economic factors of land use change

- 1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?**

First of all the Øresund Region is a growth pole, general, when you look at Nordic countries. We should be aware, that a lot of things, which we are talking about, like the development, we should regard Denmark together with the other Nordic countries. It's because we had more than hundred years of cooperation. It means, things happen in Denmark will be depending on what happen in the other Nordic countries. Presently universities, studies in the Øresund Region, especially in the Copenhagen Region is very attractive for the students from the other Nordic countries. Majority for the Øresund Region is to stop young couple in a region. Having a bridge is also a country growth pole for both part of Øresund.

Peace between Sweden and Denmark was back in XVI century, so from 300 years Scania is a part of Sweden. Before it was part of Denmark. Nationally, historical it is a problem for Danish, but for Scanians even more. It is a liberation movement in the Scania Region, the political party, which wants to make Scania a part of Denmark again. It is popular trend among Scania people, because the demographic connection is very strong. Economically it is some truth also, because this region is closer to Copenhagen than to Stockholm. There are 500 km from Malmo, the capital city in the Scania Region to Stockholm. The region is a very peripheral in the Swedish. It has been very natural to devote a lot of economic activities exercised in the Danish side, because an interaction is much easier. In Denmark, in Copenhagen, the labour force from the Swedish side is much more wanted than from Danish side because the Swedish is more polite to costumers. When you go to The Fields, which is the largest shopping mall in Copenhagen area, most of the shops employed people from Sweden, more than from Danish side, because Danish are rudier.

In the growth pole is more young people, but when you look in details in region you will see also ageing parts. You will find a central region, with Copenhagen, where mostly the young people live. But an important issue is a distance, because if you make transport isochrones of one hour from Copenhagen it cover a hole region. You will be able to come from any part of the region.

In Øresund Region it isn't so important where you were born, because people change their place to live a few time in their life. Migrations patterns in Denmark, in general, much more depending on where you are in your life circle. When you are young person, you are looking for a flat in the center of town, when you established yourself as a family you want to go to suburbs, you want to kids enjoy an environment, live in small community. And then, when children move from home the older people chose a settle in place like Roskilde or other medium size towns but still

with this one hour transport to Copenhagen area. It's not necessary to live close to your family, because of good transport infrastructure. Family structure isn't important for migration issues, because Denmark is such a small country.

Movement is very high, and again it's about a life faces. Is very important for where you choose to settle, much more than if it takes 20 minutes to work or half a hour or hour. If you find nice place suits a face of your life, you choose it.

- 2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?**

New settlements have a huge impact on movements in all Zealand and are more wanted by people coming from other parts. The south part of Zealand isn't settling by young people and labour force, because there haven't got work there.

Also part of Jutland is threatened by depopulation. The problem with Odense is that the travel to Copenhagen by train takes 1 hour and 10 minutes. So Odense is a region, which loses population, while Aarhus, situated opposite, is the second largest town in Jutland. Is attractive for people in Jutland region.

You will find some people who go to Copenhagen, get an education and come back to hometowns, but movements are generally from west to east direction.

Women are more mobile than men; they tend to looking for education opportunities. They are moving to the Copenhagen area and bigger towns.

All the areas around Copenhagen, Odense, Aarhus are the places with domination of woman, especially young. The peripheral area is dominated by men, basically men, who depend of traditional economic activities, while in urban area you can find new economic activities.

But also good connection with core development can be threaten. If you build a bridge from land to island, it will make an outflow. Very often when you make an infrastructure you expect that it will help a peripheral region but in fact make it opposite way.

In Denmark the legal settling is that you divide between urban and rural regulation of land use. In practice you can not go to rural area and start building a town; you need to have municipal governments agreement and also regional governments approve and sometimes the state approve to start build a house in rural area. Because it suppose to be rural, farming areas, not residential areas. But during last twenty years the flexibility has increase, 20 years ago it was very difficult to get permission to establish a new town in rural areas. You were supposed to focus on development within what has already been designated for even activities. It easier now and it has a huge impact on settlements. All Copenhagen area becoming the region with a new settlements and larger concentration of population. Not in central Copenhagen, because there becomes more and more business district. But all the suburbs around Copenhagen and then along the transport routes, where Roskilde is situated.

The settlements are rather linear, but it's a strict regulations. The Copenhagen area has been very well know from the "Finger Plan", because if you put palm on Copenhagen, you will see that all transport lines are like fingers and green areas is between. It still attempted to maintain that structure, that you have green wedges going into town areas. Still less and less because the area close to town is very attractive.

The Zealand is an island, so the area is limited. The bridge connections make "fingers" longer, but also we have limits in traveling isochrones.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

Areas around cities used to be intensification areas, but nowadays it's changing.

Good infrastructure and small surface of region caused, that farmers can located theirs farms in periphery and wake up early in the morning and go to the city with their fresh products. They are not depending that much on being close to the town. Instead some of the agriculture areas around Copenhagen have been investment areas, so they buy them and expect that in ten years the government convert these areas from agricultures areas to building areas and they can gain a lot of profits. And to do not have many expenses in having the area – they can just leave it with no agriculture productions.

When you see how permission was distributed during last 20-30 years it is a very a sensible investment. Investors just have to have money and can wait 10 years for the profit.

The next reason why the areas are not using in agriculture production is European Union agriculture policy: UE paid for not producing on some areas.

A third parameter, also important, is thing like horseback riding has become extremely popular for children. Everybody can buy a farm, which was twenty years ago a high productive, dynamic producing farm or pork producing farm. Stopped the production (the neighbors are also happy about, because their life quantity increase) and buy 20 horses and establish a horseback riding school.

Intensive agriculture area has changed, the Jutland areas have become more and more intensive agriculture production, while Copenhagen area has become more extensive. This area have more and more multifunctional profile: an area with organic production of vegetables and fruits, which is very high price, with a horseback riding and sometimes windmills; the net profit will be higher than when the land was used for intensify producing.

In changing time form of farm building are not despairing, because they are very much wanted as residential houses for people working in towns. 15 years ago it was 200 000 farms, today is less than 50 000. It's constant decrease in professional farms. They had a huge increase in organic farms, which are usually a very small, because is hard to get a permission to call the product organic. Organic products are very much wanted in Denmark. Especially organic milk: most of the intensive production of milk takes place in Jutland, especially in southern part of Jutland. In Zealand Region there are a lot of small milk farm, which sell it as organic. Milk is the most wanted organic product.

It has been a lot of changes in crops structure in the Øresund Region, what we can see in landscape. 20 years ago in Zealand all the small lakes and hedges tended to disappear. It's a lot of investments in areas for not producing agriculture products but to gain profits, like converted agriculture areas into residential areas.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

According to soils' map of the Øresund Region, up to the north of Copenhagen area has pore soils, central part of Zealand has pretty good soils and on the south are excellent soils, but the best soils are treated most extensively. It's simply, because people are moving out from these areas. People there have monopoly of producing sugar beets for sugar production. Historical they have close connection to Poland because when the sugar industries developed after 1900 there was a huge immigration of Poles. Now there is a highest out migrations and a lot of economics problems: the ageing of the population, people without jobs, who are not able to have an apartment in Copenhagen Region tended to move to this area, because there they can get an old farm, house for almost nothing. And it creates a lot of social problems: especially drug addict.

According the EU policy you actually get money for hold agriculture using up. There is a law, that if you have biofuel or trifuel crops in this area, which means that you leave it without producing, you get subsidies from the government.

Untilled land area increase. You can see on the maps that intense agriculture lands were converted into less produced. But only agriculture produced area because there are a lot of other purposes, for example horse riding areas. There you can buy 20 horses and you can get 100-200 Danish coronas per hour for letting the children do the horseback riding and at the same time you can had the areas with park, where they were riding around. It supported also from EU as agriculture program.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

Industry on this area, especially black industries, where you produced heavy metals, are very seldom. Mostly industries in Denmark have a knowledge components included. Basically most of traditional, black industries have despaired totally in Denmark.

Denmark don't have much ore material like iron, lead and coal because almost all area was created by the ice, except for one island. But they have a lot of gravel, sand for construction industries. Roskilde area has been one of a major produced of these materials for constructing the Copenhagen buildings, but now they are created as residential and recreation areas (like Hedeland). 20-40 years ago producing gravel materials were an important issue.

The transport infrastructure is increasing, but the problem is that two path of road bring people from the western part of Zealand to Copenhagen. But is not enough,

because every morning there is basically traffic from about 10 km before Roskilde up to 5 km after Roskilde, so people will stay there for 3-4 hour driving. It's faster to go there by train. But now there are three paths in each direction, there are a content pressure on expanding the transportation network.

The new government has an idea to introduce a payment for entering Copenhagen by car, it's expected that it will reduce an jam and transfer people from cars to train and public transport system.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

The Øresund region has a lot of coastal regions and there are very popular, both for residential and touristy proposals.

When you drive along to north from Copenhagen it's basically huge houses, there all rich people are living along to the coast. Whole coastline is cover by residential areas, the longer you have to travel houses is cheaper, but still quite expensive.

It's multifunctional region, due to the law in Denmark prohibits an own of land strip close out to public use. All the coastal areas are considered as public areas. This means, that you can buy the house, which is situated next to the sea, but you can not prevent visitors, who go along the coast. You can not monopolize some of these areas.

The coastal areas are also interesting for business, which don't need a large area. Previously some of these areas introduced windmills, and it was very popular, people invested in windmills, which produce electricity. Nowadays residents and tourists have objective about noise. New windmills are bigger and its arise on the sea.

It's easier to get a permission to build a residential house area than to build a hotel.

Previous hub areas were converted into residential areas, and this trend is in every town. The coastal transport doesn't exist any more. The Copenhagen harbor area also was converted into residential area.

It's interesting because it shows a combination of residential areas, knowledge based industries, tourist places and culture activities.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

It depend on how you define land use; people working in agriculture think of land use being what is grown on the fields, what kind of plants, but due to multifunctionality land use is much more. Very often what is growing on the field is secondary issue.

A lot of knowledge industries and research activities is moving to rural areas because people wants to work in nice green conditions, like Nokia has a big technological centrum near Copenhagen, but in a green area. The consequence of land use is that the productive part has nothing to do with land cover. That's why economy plays a huge role in land use, not because is important what's grown but is important what's taking places in the areas.

Land use has different dimensions.

II. Environmental issues

- 1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?**

There are policies in Denmark about expansions in forest areas, which means that as much land as possible will be convert into forest areas. The forest areas in Denmark take 10-15% of land cover and the intentions is to go to 20-25% in 5-10 years.

There are protected areas in Denmark, where you are not allowed to do some things, e.g. dig up orchids.

One of the major issues in protecting areas in Denmark today is not to protect areas by preventing people to access to this area, but to maintain a diversity of activities, which they can make in these places.

The first national park in Denmark was in Greenland, because it was far away and easy to make a national park. Creating of national parks hasn't had a big impact on land use. Some of these protected areas were more open to public access. According to the Danish law, all areas should be public access; nobody can prevent people to go on some area.

The National Park of Zealand is the first national park has arisen 5 years ago. They have no tradition to have national parks in Denmark. They have traditions to protected spots. All the new national parks are multifunctional. It required that maintain agriculture, forestry, recreations and large spectrum of activities. The idea is not only to protect nature but also to protect culture, landscape. It's the major difference with other countries, where they protect environment in passive way.

When you use national park for different activities you will have highest biodiversity than when you will leave it and agree to monopolize by one spice.

The forest areas are increasing, one of the ideas is to have a combination of managed of forest areas, but not just makes pine forest. Some of them managed for public access, others are very old forests, where you can not drop old trees.

There are two types of forest in Denmark: national forest, managed by state for everybody and private forests. It's depend one from the other. Private forest owners have to complain with some regulations. You can own the forest, but it will be still

open for public access. It's restriction what you can do in the forest, many of the forest areas are kept for hunting purposes. It pays a lot of money to have selling these permits to hunting. It's another function of forest areas.

There are some private own forest, which are strictly commercial, but typically not for pines, because Denmark is not able to complain with prices of producing pine trees in Poland or Sweden. In Denmark it's typically beech and oak forest.

The coastal area in Swedish part is similar like in Denmark, because of open field, residential areas. The forest areas in Scania are much more popular like a touristy space. There are a lot of Danish people, who have a cabins or farms in a Swedish side of Øresund in the forest to enjoy life. It's popular from many years, about 50, that Danish people buy a banded house in forested areas.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Due to environmental regulations we had in Denmark back from 1960, we know how much pollution it would be able to get out. There are strictly regulations on filters, what you can do on land, how to protect water surplices. The biggest threats is agriculture, because farmers said they are living in the nature and protect it, but they use all nutrition, poisons. They don't need to do that, they have in Denmark so many organic farm, that showing that it isn't necessary to use chemicals. They do it because large production with less human labor involved pays better. Many of this terrible farms moving to Poland, because it's cheaper to buy large areas and start this unhealthy production.

Intensive agriculture is move from Øresund region to Jutland, for example. It's interesting what happen in Denmark agriculture in last 30 years, because when Denmark joined to EU, people from Holland move into Denmark and started production. And when Poland joined the EU, farmers from Denmark move there. This trend is because land is cheaper and law regulations are less demanding in less developed countries.

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

Flooding is interesting, because we often are talking that climate change and sea levels will be increasing. It was some flooding in urban areas which become an issue. A major point in this connection is the places, where has had the flooding use as excuse a climate change. We have an huge area covered with roads, buildings, there is no places where water can disappear. Human created this disasters, when they don't have a valid flood system. There are a couple of places with this problem.

Even in the central of Copenhagen was a flood, a problem with a metro system, when they have too much rain in too short time. But again it has to do with sewerage system, which wasn't improving or increase from years.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

The major socio-economic and environmental function of land use:

- residential,
- agriculture (organic, intensive),
- recreation,
- industry with knowledge component,
- tourism,
- national park with many function like agriculture, forestry, recreations and large spectrum of activities,
- transport,
- business centre,
- production of energy from renewable sources.

2. Multifunctional land use - which of the functions in your region co-exist?

It does not only co-exist, the owners of farms create multifunctional land use: they produce on the farms, they have horseback riding activities, and some of them invest in windmills.

Also in national park we can find not just protecting function, but also agriculture, forestry, recreations and large spectrum of activities.

The coastal residential area act a recreation, tourism function. Also we can find there a small business, which don't need a large area.

3. Which of the functions are the most important in the context of land use?

In the Øresund Region the residential function is the most important in the context of land use and much influence how land cover look like. It's important in static land use; establish existent from 50 to 200 years so if you build house, university or shopping centre it will be there for next hundreds years. So in that sense it create static situation.

Some extent also, forest, because it growing very long, it's long term investment.

4. Is the number of functions of land use increasing or decreasing?

The number of function increases. The law in Denmark distinguish between urban and rural areas; money from taxes, which you pay in urban areas is much higher than in rural areas, so people who are using land for producing purposes want to keep them rural. But people who are looking for residential area, they are allowed to build in rural area need to convert it into urban area. There are different interests in rural area.

5. To which extent is the land in your region used in multifunctional way?

It's very high extent, because of increasing numbers of functions. In rural area the number of functions increase in dynamic way, because farmers don't use anymore land just for agriculture production, but also for recreation, energy production. The coastal areas are using for touristic, energy production, business and settlement (especially second houses) way. The protected areas are using for protect environment, biodiversity, but also for recreation, agriculture. Urban areas have more and more green spaces, which are used for shorter visit, but also in nearby it's a lot of organic farms.

6. What kind of functions co-existence is:

a) the most effective?

Energy production, agriculture production, leisure time, like horseback riding but also using farm like place to recreation, where you can spend two weeks, kids can pet the animals and enjoy the environment. Organic farming.

b) the most desirable?

Combination of living, working and enjoying environment seems to be in the case of Denmark very efficient way.

c) the most common?

In the suburbs e.g. of Roskilde: residential area and also knowledge base, economic activities, research centers, producing pharmaceutical product. Very much depending on people, who come here and work in knowledge, live in residential area and between green spaces: a new forest was established.

d) the most difficult?

The preventing of intensive agriculture: abandonment poisons using. It have a huge impact of living condition of the area, on ground water (because all consuming water in Denmark is from ground water). The poisons, which they use today don't have impact now, but in 25-50 years time. Probably most dangerous for environment is when too much economic activities impact on the soil.

7. Which of the functions of land use are the most important for the future regional development?

Energy production is the most important issue to replace the oil and coal industry. The major production of electricity in Denmark is based on coal. Used to import the coal from Poland, but now Denmark imports it from Australia. And only around 25% of electricity today is producing by windmills. The government policy is to double energy from renewable energy sources in next 20 years.

IV. Spatial conflicts

- 1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

A major point in this connection is that the spatial planning in Denmark is more focus on interaction between different types of use of the land. The changes in land use planning, which has been going on during the last 20 years accepting the fact that you can not do sector planning, you can not do planning for agriculture, then planning for residential areas, but you need to do complex planning.

- 2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

It depends a little bit on where in the region you are. Because people, who have the nice, big houses around coastline, are not interesting to get in to many people visiting the areas: that's one kind of conflict. Another conflict is this about the noise become from windmills. So some recreation activities are in conflict with energy production. One of the consequences is this moving the windmills to the sea, but there are also people objective for seeing windmills in the distance.

- 3. Which of the actors are the most dynamic and successful in obtaining new land?**

It depends totally on what government determine, because when you go back to the 60', the social democratic government who started introducing these environmental laws, which protect the environment and in this same time supporting renews development.

During the last 10 years coalition government have destroying a lot of the accomplished precious law. From two months there is new social democratic government who claim, that they want to maintenance environmental protection not by privatize it, but instead make a public access to environmental areas.

There was the municipality reform a few years before, when 2400 municipalities was converted to 98. Municipality become larger and instead there was giving a lot of rights to determine how the land should be used. It's interesting to observe how this reform will have impact on land use.

4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

Besides windmills the biomass is the most important renewable energy sources in Denmark presently.

All larger towns have a distributing system where a combination of traditional coal fired plants but also biomass plants becoming more important. The most efficiently Salix is a common crop for producing biomass. Salix needs to grow 3-5 years before is high enough and for most people is not considered like very interesting land cover, because it is wood but usually is very densely grow, so you can not take a walk there like in forest.

The rape field is a efficient way of producing oil, biofuel, but in the same time, in March, when it is white and yellow is fine, but for rest of the year is not so interesting view. A very important law introduced by again the previous government was that you can not keep land uncovered from vegetation. When you harvest the rape seed you let the rape continue to grow, to have constant land cover. All idea would be to make sure that you make use ecological nutrition and soils is available as well. This law protects the environment from erosion, from going to much nutrition to the rivers, but again is a question how boring the landscapes are.

The multifunctional of landscape consists in the fact that when you are driving you know that you are in different zone, land and you enjoy the environment.

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

With the previous structure of municipals were too small, to take responsibility for managing the land, so it was situated in higher level: country or regional, where did the all land planning. But now it moved down to municipals, so basically we don't know until 10-15 years from now what the impact will be from this new structure. An important consequence of delegating responsibilities down to the municipal level will be that they have closely interaction with the population in these areas.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

The local and regional administration is effective in land management and in preventing and solving conflicts related to land use. It's go back to the all legislations of develop from the 1960; protection of the small rivers, small biotypes or complex landscape components has been pretty effective.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

The general monitoring system exist. You need to report to the municipality the major changes in order to establish forest area. It need to be included in the municipal's plan and accepted by municipality. If you want start forest activity or you want to establish a new houses it needs to be not only in front of municipality, but municipality need to accepted as be a part of municipal's plan. It is a effective in creating spatial planning.

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?

From the islands on south of Zealand and from south part of region the travel to Copenhagen takes 1 hour and 20 minutes by car, it's too much. It's a border not decided by the bridge between islands, but decided by the transport distance. The same thing happens on the Swedish side. Those areas becoming still more multifunctional are those which laying in isochrones on one hour travel from Malmo or Copenhagen.

Bridge between Denmark and Sweden make more influence on land use than border. We should be aware that from 100 years the cooperation between Nordic countries sets very few limits what you can do in another Nordic countries. You can travel between countries without passport, with legal papers you can buy a house everywhere, languages are similar, so it easy to move between countries.

Before the bridge was build time to go by boat for the other side of Øresund took approximately one hour.

In the pick of the traffic, the theoretical isochrones of one hour reduces its surface. People tend to get flexible hours in the job in towns, because some people leave at 5am and go to work earlier, prevent all the traffic. From all parts of Zealand is excellent public transportation, but people still choose to go by car, even it takes them double time.

2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?

The coastal areas are using for touristic, recreation way. Coast north of the Copenhagen is very popular for residential and small business areas. These areas are using for producing bioenergy by windmills.

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.

Unique recreation areas as part of residential areas have been increasing and focus on during last 25 years. Opening up the law for urban and rural areas.

The municipality response more, because they don't need go on the higher level to get permission on changes in rural areas. Now they can do more complex planning.

- 2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.**

It's pretty close to realistic situation. It's important to observe how the urban areas are moving into different types of rural areas: agriculture, forest. Because it has different impact and ways of interaction with previous land cover situations. In the areas where there are shown down grading of land use moving from residential area to more open space. The Nordic promote local recreation areas and lot number leisure areas. The good example is Hedeland, the old graver mine, which is now recreation area.

Region: The Øresund Region

Place: University in Roskilde

Person interviewed: Jespar Brandt, Esbern Holmes

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

Woman migration from rural area to cities is an urban phenomena and don't have clear impact on land use changes.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

The Finger Plan was created in 1947 and until 80' the Copenhagen Region was growing correctly with strategy and look like palm. From 90' the urbanization was still high in fifth zone.

The region is combination of monocentric development, like Copenhagen with some small multicentric elements (like Roskilde). Copenhagen is in top density of population.

In XXI century the land use changes wasn't high on urban area of Great Copenhagen. The highest were on rural areas, which become urban. The changes in urban area weren't observe because the major changes were in 70'and 80'. Nowadays just area in fifth zone is still developing.

The area from Copenhagen to Roskilde is the largest urban area; 15 years ago the university in Roskilde wasn't in urban area – now it is – so it is the largest urbanization project in whole Denmark. It transforms agriculture land in urban.

A new trend is to convert agricultural land to industrial areas, transport infrastructure (like in Kobe, which is in Finger Plan).

In 1972 the zoning system in Denmark was divided the land to urban, rural and recreation zone. These zones were until 10-15 years ago strictly maintains because it was very broad consensus on contact of zones. This system said that it can not be any urban area in agriculture zone. It was just compromise for communication networks. It protects rural areas for agriculture production. So for many years it was strictly complied. From middle of 90' it was not so serious.

It was a big pressure for urbanization in rural areas. The legislation was so strict, that you could have farm just when you lived on this farm. All that strict regulations were broken in last years, so today is easier to non agriculturist to buy a farm. And when you go to these open space areas, with attractive landscapes between villages, you see that many of this might be farmers in the former times, but many of these also have second job, like a car repairs. Formally it is agriculture land, but it is functional

shift in many of these areas. It might be a part time farmer, but they use buildings for many purposes. You have to get a special permission to build in open lands, which is not agriculture. You can not see relation between development in population and development in occupational structure. The all the changes cause modification in legislation are well done, but we cannot see them in landscapes.

Because of the changes many of animal's farms were moving out the agriculture area in Zealand. Many of buildings are available for new solutions now.

The functional structure was changing more strong than the landscape or land use.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

In long period a lot of animal's farms moving out. There are very few farm with strictly specialization, which started in 1970, when Danish agriculture was diverse. But after that time there were a lot of specialization farms (pig farms, milk production).

Two types of specialization in Zealand – 42:45 and grass production and pigs.

Due to the principles of sustainable development. You must have so many square meters of land for each animal unit. If you have general tendency of many farmers with non animal production and animal's farmers can use them to register their land as a balanced of their pig.

They can use neighbor's non animal farm as a balanced for their pig farm.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

The average size of farms is increasing, but you still can find a lot of small agriculture farms, especially with owners, who are the part time farmers. Is a taxation tendency, because if your house is registered as farm house is tax quite differently.

A lot of part time farmers, who have about 50 acres or less, keep their farms just because of taxes reason.

In Denmark is quite a lot of small farms, the middle ones were despaired and there are a lot of large farms.

The most dynamic producing group is the pig farmers, who buy lands, not always in one piece, but often fields are spread over in many areas. There are a lot of villages, where two or three farmers take care about all fields in this area in practice. They rent it from small farmers.

There are some traditional pig farms, which started production 100 or 200 years ago.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming

pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

- 7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.**

II. Environmental issues

- 1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?**

Denmark is a highly urbanized country, so there are not a lot of natural, environmental elements. This is why researchers focus on small elements, like small lakes, trees, rivers. They realized that these small elements are so important for landscape, for perception the space.

They monitored about 32 places (about 2x2km) and checked the results in details. The results showed, that especially in 60' and 70' with this very rapid structure development many of these small biotypes disappeared.

In 80' and 90' they saw the stabilization in general, in average stabilization of the biotypes. In some areas were stabilization and increase of biotypes, in other they disappeared. It was clear, where is the process of intensifications of agriculture and more monotonous agriculture landscape. One of the mean reasons of this stabilization was haunting; it was due to grows of other functions of land use.

They observed multifunctionality of agriculture, the period of 80' was dominated by the trend in agriculture, which was holding increasingly more specialized only in agricultural production.

In the south agriculture was also the social problem, because farmers have difficulties with finding a wife. You might be a farmer with huge agricultural production, you have a nice place to live, you have place for haunting, recreation. There might be other types of income for framer until that time it was mostly productivity. Some of the big farms make about 20% of income for haunting. They don't pay tax from it.

In 80' and 90' the stabilization was because farmers realized that the landscape was important for them for other purposes.

The last national inventory was in 1996.

Monitoring was continuing as a part of national monitoring system (Novena) from NATURA 2000 side.

Small biotypes in the agricultural landscape have part in this monitoring system formally for political reason, because it's only monitoring outside the NATURA 2000.

The monitoring has been made in all those areas in 2006. But the result has never been published. The reason is lack of money or priority of Nature 2000 sides.

The results said that in last 10 years trend to taking away all small biotypes is still grown down. Agriculture in 90' was more or less including to take in consideration

types of land use. This changed after 2001, also because political reasons, agriculture sector focused on the production again.

With the results of land use there are really growing tendencies between agriculture interest and other, e.g. recreation interest. This tendency is matter of scale and regional development. There is a trend that agriculture sector would like to have a new establishment of region organization, where we can have really agriculture development and leave the rest for nature or for urban development.

Some theories about local development:

Development of small biotypes shows figure 53b, fragmentation on general linear and area biotypes.

In 50' and 60' there were negatively changes. In next decades it was still negative trend. In early 90' became positively. But nowadays is negatively again. The most important reason is that the agriculture sector has a rather strong political support.

If you go to on the very detailed level of land use you can see a relation between development of land use of these small elements, very detailed land cover development and the urbanization. In Denmark most people live in Copenhagen area, so there is a pressure of different interest on countryside. We couldn't find any clear correlation between the distance from urban centers to the area where we make investigations.

% of change	1954-1968	1968-1980	1981-1986	1986-1991	1991-1996
Linear biotypes	- 0,6	- 2,3	- 1,3	- 1,3	0,9
Area biotypes	- 0,5	- 0,8	- 0,8	- 0,8	0,3

Figure 53b – Development of small biotypes. Changes per year.

In the beginning of XIX century there were big farms that were placed on the better soils. Most of the farms in historical time belong to one man. In many cases farmers kept their farms in the villages but they have slide of land outside the village. It was mostly private land, instead of having a collective farming.

If you see at the border to the next villages you had in general the more extensively use land, which we can analyzed also from social economical side; the small farmer came up in this periphery. This was periphery also from nature point of view, because it was wetlands, and the major farms was located in the centre of village, on good soils.

Today these farms are big farms, most of this land is big fields and most of the small biotypes, bounds, channels disappear. There are fields around the village, but in periphery are locating all small farm which have very often been sold to people from cities or kept the agriculture and get an extra income from part time work in city.

Urbanization of this area is also popular; because people from towns buy farms and houses here, have horses and other kind of leisure.

Spatial segregation: lands with better soils are using for big fields, agriculture land and in the periphery are very diverse land use and land cover. You mind see when you see detailed that more and more people also settled on this areas. And suddenly you will have lower population in areas with big farms. The problem is what happen in

the village. Because it might have been 10 farms in village and 2-3 of them can be leave, some could be bought be people from towns. In one of cases one of the farmers has a pig farm, so it could be not very attractive place and other can be. This is process of differentiation of the villages.

The example: area has been divided into zones: land use in the periphery is differentiated, there are a high intensification of agriculture in this zone.

In small or larger scales problems can look different, even you can say in one scale that it was not any change in area and in other you can see a lot of changes.

Region: The Øresund Region

Place: Hedeland I/S

Person interviewed: Erik Juhl, director of planning company, landscape architect

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

Some 100 years ago the land owners began extracting gravel and clay in Hedeland. From the beginning of the 1950's the suburbs of Copenhagen grew southwards and westwards and the plant side increased. Processes in 1960's and in 1970's around were very rapidly destroying several hundred hectares of the finest farmland and transforming it into a wounded and uninviting landscape. Gravel extraction, dumping grounds, lorry driving and environmental problems had to be controlled. Between 8 and 12 m below ground surface clay were incidental exploited as well. An increasing awareness of the necessity for improvement led to idea of joining forces in order to reverse the unfortunate trend of affairs and, concurrently with the extraction, form a recycled and reshaped new landscape – not for agricultural use but for recreational purposes. A large and unique landscape for leisure activities for all the people moving into the areas south and west of Copenhagen.

I/S Hedeland is a publicly owned partnership with 5 partners: the municipalities of Grave, Roskilde and Hoje-Taastrup and, in the near past, former counties of Roskilde and Copenhagen. Partnership and cooperation between municipalities in Denmark is common. The partnership was founded in 1978, and its main task is, through purchasing of land, to plan, construct and run the 1500 hectares of excavation area to preserve it and lead recreational function. The surroundings were clean up from pesticides and fertilizers used in agriculture in the past. There is no industry and agriculture using pesticides and fertilizer any more here, to preserve clean ground water from excavation of chemicals. This activities are forbidden and situation is controlled very strictly. After buying the land there was a lot of planning works for diversified forms of recreational land use provided by private company from Copenhagen with 25 planners and landscape architects. Planners took into consideration for instance neighborhood of noisy activities to Roskilde Airport nearby or opportunities of plants preservation in some areas. Until now some 700 ha of the total area have been taken over by the partnership, and approximately 100 millions DKK have been invested in the project. The settings for the different leisure activities are planned by I/S Hedeland, but their construction and current running don't receive grants from the partnership.

Reshaping the landscape demanded to transporting about 1 million cubic meters of ground per year. Nowadays Hedeland holds a large number of distinctive features, including a 50 meters high skiing hill at 80 meters above sea level with the pond below filled by fresh water level from limestone about 32 m above sea level. Between 6 and 8 million cubic meters of fresh water yearly is pumped to Copenhagen from here. There are wine terraces with about 3000 of even 25 years old vineyards and amphitheatre created for extra money for such purposes during Copenhagen being European Capital of Culture in 1996 and hosting every year a huge opera for 4 thousands of people, which is one of the most famous attractions of Hedeland. Visitors can choose between numerous leisure activities, like e.g. walk paths, 10 ha

of power track with equipment for different exercises, angling, motocross track, race-track, golf course or iceland horses horseback riding. There are playgrounds for children of different age here as well. There is also cars driving test center. During the winter time it's also possible to ski here. Sand and gravel were used to connect whole area by 40 km of horseback riding paths and 15 km of internal roads. Railways serving mining and brickyard, which was working before war, are used for sightseeing now. The yearly budget of landscape planning counts 800 thousands Euro. Buying the new land from contractors costs from 50 to 80 thousands DKK per hectar.

In some areas nearby roads with network infrastructure, land is predicted to houses development or barbecues sides. Industrial, for instance gravel mining, activities are allowed after preparing detailed plan with detailed information about transportation, noise, dusts, time of mining, how many cubic meters yearly and many others and after permission of municipality for such activity. The investor needs to have plan of landscape afterwards as well. Before starting, deposit of 200 000 DKK per hectar is demanded. Such strictly protected landscape and forbidding some kind of activities in neighborhood of development core is hard, but slightly easier thanks to equalising of municipalities budgets, so suburban municipalities developing settlements, residential areas and industry, very often give the money back to poorer municipalities. It's also easier and cheaper to prepare recreation area after postindustrial terrains, than on the agricultural areas.

Gravel digging in the past has provided the basis for an interesting flora and fauna in the area. Here are more than 365 species of wild plants, including six unconditionally preserved species of orchids. It's possible thanks to providing the area with ab. 2 million cubic meters of clay from outside in the past, what is not allowed any more due to danger of bringing poisoned ground and spoil the ground water. The many wild flowers also contribute to attracting several species of butterflies. Many species of birds, non-migratory as well as migratory, use Hedeland as their foraging and breeding place. The lakes and canals of Hedeland hold a large population of aquatic insects, amphibians and species of fish, and on the lake shores a large number of wild ducks and waders can be seen. In some areas 500 ha of forests are introduced.

Region: The Øresund Region

Place: Sorø, Region Zealand authority, section of regional development

Person interviewed: Lars Tomlinson, Anne Brehmer

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 26.10.2011

Regional planning structure is composed from national level, regional level and local level. Since 1998 in Denmark there is 14 counties, which were joined in 2006 into 5 administrative regions. Then overall number of 273 municipalities decreased by enlarging them and give them some responsibilities of former counties. Region Zealand is one of five administrative regions. It takes majority of Zealand Island, excluding only Greater Copenhagen Capital Region, and a couple of smaller islands surrounding it. The Zealand Region has a transitional character, because it connects southern part of Sweden (Skåne Region) with Fyn Island and northern Germany.

The major task of regions is health sector. In Zealand Region it takes ab. 95% of total regional budget of 2,1 billion euro. The Region Zealand employs ab. 15 000 people, but only ab. 400 of them works in administration. The rest is mainly employees of hospitals. However the other important tasks of regions are regional development, cleaning of contaminated soils and transportation system. In Region Zealand ab. 40 people is employed in the section of regional development. This section, including transportation, has a budget of ab. 70 million euro. In the transportation system the major responsibility is to organize an intermunicipal bus and train lines, which are desire apart of state lines. In Zealand there are regional 30 bus lines and 4 train lines nowadays. This task budget has a budget of ab. 40 millions euro.

Regional development is supported by regional strategy. Before administrative reform there was a restricted aerial functional planning. After the reform such way of detailed planning is moved to municipalities, and regions creates holistic comprehensive strategies including common vision of urban and rural development and interregional and international connections. This planning structure is more polycentric, although regional level haven't got adequate tools to apply regional vision of development in restricted way. The act includes environmental, cultural, economic, educational and infrastructural issues as well. However the strategy is a short text document and it doesn't include any maps of delimited areas of specific functions. The municipal strategies of development and restricted aerial plans are linked to this complex regional strategy. However also regional strategy is linked with the strategies of Denmark, Sweden, Germany and Poland. All in all former planning system was easier to apply, but it's better to have holistic across sector planning system with all linkages between different units and different levels. However after four years of practice this new system becomes easier. The growth and sustainable development is impossible without common and holistic way of thinking about development of e.g. educational system, labour market and business development.

Region: The Øresund Region

Place: Soro, Region Zealand authority, section of regional development

Person interviewed: Jesper Reumert

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 26.10.2011

Region Zealand has a transitional character. Communication with neighboring regions can be easier thanks to bridges. Bridges to Skåne and to Fyn Island already exists and new bridge to Sweden in northern part of Zealand, bridge by Fehrmann Belt and, eventually, bridge to Aarhus in western Denmark are planned. It helps in mobility and commuting issues and enlarges the potential of the region. Nowadays debate about advantages and disadvantages of investment in eventual direct link to Jutland Peninsula.

Another important challenges for the region are to improve relatively low educational level of inhabitants and to create a new business clusters. Currently Zealand Region has relatively low number of economic clusters and low level of innovation in comparison to neighbors. It hasn't got main core of development, but a lot of small towns with no important tensions. The challenge for regional development is to show the common goals and encourage municipalities to work together. Functional center of the region is out of it, it's Copenhagen, where many daily commuters work. More other important challenge is also to equalize imbalance, because northern part of island and areas close to Copenhagen have much better situation with economy, education, health care and venture capital.

The most important strengths of the region are potential to development of green industry and green energy production. The new link between Copenhagen and northern Germany will give some development possibilities as well. First of all accessibility of Copenhagen with all facilities and labour market by cars and by trains for all inhabitants of the island will increase. Apart of it the region thanks to countryside, nature and seacoast is attractive residential area. Although Zealand region has rural character, due to neighborhood of Copenhagen here are mostly untypical rural areas. People living here are in big number daily commuters and only part time farmers. The another opportunity is to promoting of bio-energy based on algas, hydroenergy and wind power stations.

To achieve a goals of the regional development, growth forum and regional council exists. Growth forum consists from representation of research institutions and educational sector, municipalities, both sides of labour market and partners from regional council, so both public elected politicians and members of commercial institutions. This unit creates each four years the holistic strategy of business development and every year action plan, which is more concrete and operational. The budget of funding of activities counts ab. 20 millions euro yearly, within ab. 9 millions from regional development funds and ab. 11 millions from EU structural fund, among the others from INTERREG. The goal is to search for connection between regional general strategy and strategy of business development, which is more concrete and has sources of financial support to apply. To do this, the most important

is building facilities for dialog about plans and networking, what is hard to measure and evaluate, like all human capital.

A big part of regional planning activities is devoted to role of transport networks going through the region. The municipalities of Zealand Region mostly belongs to municipalities with the highest commuting ratio in Denmark, much higher than municipalities from Greater Copenhagen agglomeration itself. The region gives an opportunities to live in cheaper house in good facilities and relatively comfortable transport infrastructure to daily commuting by train or by car. The next biggest cities in Denmark, Aarhus and Aalborg, have far smaller zone of intensive daily commuting areas. A potential daily commuting to Copenhagen labour market is good illustrated by measurements of mobility on Øresund Bridge. Since 2001 daily number of people crossing it increased from 4 thousand to almost 20 thousand. The highest increase took place in mobility by trains. On the basis of this case there are any predictions about changes of crossborder mobility and labour market potentials after building a linkage to northern Germany. However predictions are so simple because new connection will be a link between two rural areas, not between two growth poles. That means, that profits will be in longer terms and more risky. There is also danger that it would be only convenient linkage for transit between Skåne and Copenhagen, and even Oslo and Stockholm with all Norway and Sweden, on one side and Hamburg and Berlin on the other, which will cause stagnation for the towns located nearby current routes. E.g. Oslo has an idea to be one-day city, what means that it has 8 hours road and train accessibility to European metropolis, like Berlin. This can be done only through collaboration with Øresund Region. First strategy of regional development was stronger influenced by politicians of Øresund Committee. The newer version is expressing wider look at the regional development and further perspective. This transport corridor is going to be developed until 2018, and hopefully will be resulting in considerable stimulation of regional growth. 7 700 cars and 3 800 passengers of trains are expected on this link every day. However it will use in big part lands reclaimed as sea low terrains and will haven't got much influence on land use structure and landscape directly. On the other side in Jutland towns are concentrating along main motorway for decades, where are attractive localizations for many companies. Such indirect impact on land use changes can be expected in the case of Fehrman Belt transport corridor. In 2007 the ferries transported over the Fehrman Belt approximately 6 200 vehicles every day. After new investment, thanks to Øresund Bridge and Fehrman Belt, Region Zealand will become STRING Region at the crossing of routes, what will strengthen of its growth. It's an example of using of belonging to Øresund Region as a potential to development, but seeing another opportunities connected with neighboring of Germany as well. However generating growth in long-term sense is more uncertain than generating movement, because it equally depends on accessibility and business structure. For instance it's a chance for development of food enterprises and tourism, so for rural areas, but e-learning for better educated population and staying of young people on rural areas are desired.

There is also one project from INTERREG fund processing, together with Greater Copenhagen and Skåne Region. It lasts 2 years and its budget counts ab. 35 millions DKK. It analyses potential growth caused by connecting Helsingor and Helsingborg by new bridge, which could release overcrowded Øresund Bridge. The conclusion is, that this investment should be followed by connection of eastern and western Denmark through Kattegat. It's currently under political discussion.

During all big new projects in the region, the positive short-term impact on enterprises is observed during the construction time. The long-term effect is more desired, but harder to achieve as well. Its importance is even bigger when we are focusing on sustainable development with share of green energy production. Therefore there is many initiatives focused on green technologies here. The purpose is aiming to create Cleantech Cluster by Copenhagen, which demands developing the Region of Zealand to be one of the world's leading cleantech areas. Copenhagen Cleantech Cluster is a network organization bringing together cleantech players across sectors. The network is open for all players involved in the cleantech industry, from supplier to support, research or business development. Thus, the cluster represents cleantech environments across industries and value chains. The cluster is assisting with knowledge, contacts, help to start a business and market it in Denmark and abroad, for workers in cleantech in research institutions and companies and for people thinking about starting a business. A partners are: Copenhagen Capacity, Riso DTU, DI, Copenhagen University, municipalities Roskilde, Lolland, Kalundborg, Frederikssund and Albertslund, CAT Science Park, Danish Hydraulic Institute, Oland A/S, SEAS NVE, NCC, Siemens Denmark, Better Place Denmark, DONG Energy, Novozymes, HALdor Topsoe, Copenhagen Resource Institute, Ernst & Young, Vestas, Business Link Zealand, Business Link Greater Copenhagen, GEUS, EnergyMap.dk and Symbion Science Park. The Cluster is financed by Region Zealand, Region Greater Copenhagen, the EU Structural Funds and a large number of companies, organizations and knowledge institutions.

Purpose for Energy Cluster Zealand creating is to bring together climate forces in Region Zealand and the 17 municipalities in order to create smart energy solutions. The Energy Cluster Center will generate the municipal lift in climate competencies giving municipalities better tools to combat adverse climate change and create new business opportunities. The Energy Cluster Center Zealand is launching clusters within energy and energy saving solutions and serves as a center for creative forces that develop insight, knowledge and inspiration for green energy options. The project teams climate experts from Region Zealand, the 17 municipalities, businesses, educational and research institutions and other stakeholders. Through dialogue, activities and exchange of experience the clusters are developing new ideas for future intelligent climate solutions. Energy Cluster Center Zealand aims to disseminate results from projects in the 17 municipalities and Region Zealand, so anyone who has interest in developing new energy solutions should be interested in it. The partners are: Kalundborg Municipality, Lolland Municipality and the Municipality of Roskilde (on behalf of the 17 municipalities in Region Zealand), Regional Growth Forum Zealand and Region Zealand. It is financed by Region Zealand, Kalundborg Municipality, Lolland Municipality and Roskilde Municipality.

Biofuel Initiatives in Region Zealand aiming to increase the use of bio-resources for energy purposes in Region Zealand and facilitate bioenergy projects. The project has established a project organization to identify the potential for biofuel. It is a project manager for specific projects with focus on assessing business potential of the various projects, including feasibility studies. Biofuel Initiatives presents plans and suggestions regarding the use of the region's biomass resources for energy purposes. The partners are: Roskilde University RUC, Riso DTU and the Green Center. The project is financed by Region Zealand and the project partners.

Renewable Energy Technology engineering is aiming to develop a short, high level course in the field of renewable energy engineering techniques. The project has

produces a paper on a new course in renewable energy engineering. The course aims at the combination of renewable sources of energy and the planning involved in implementing such schemes. During the course the students will acquire basic knowledge of planning and implementing schemes including a variety of renewable sources of energy. The practical part of the course will, if approved, take place on the Community Test Facility of renewable energies on the island of Lolland. The partners are: Centre for Electric Technology DTU, Roskilde University, Los Angeles County (California, USA), International Wind Academy Lolland and DONG Energy. The project is financed by Region Zealand and The Ministry of Education.

Bio/Bio-composites is to investigate natural fibers and bio-resins and the related process technology for manufacturing of the so called bio/bio-composite material and thereby extend the knowledge base for a commercial use of these materials. Bio/bio-composites is a practical research project where the results are also published in the form of specific components. Bio/bio-composites have investigated a novel material technology where textiles of flax fibers have been combined with polymers made from biomass to a composite material. The project has worked together with industrial designers to show the visual possibilities for bio/bio-composites. This project is helpful for producers of e.g. furniture or other shell structure parts can be replaced with bio/bio-composites, making the product more sustainable. Designers who are interested in working with the latest green technology can also contact bio/bio-composites. The partners of the project are: Riso DTU, Regional Growth Forum Zealand and industrial designer Martin Larsen and textile designer Karina Nielsen Rios from Biennale for Crafts and Design. The project is financed by Region Zealand.

Predicting of future agricultural production need is difficult now, so it's hard to say how idea of creating green region will be influencing land use structure.

Region Zealand is very focused on two issues: to improve level of education to enforce labour market and to create green region of high technologies, which are not harmful for climate balance.

EU-LUPA
European Land Use Patterns

***The Bayonne – Donostia-San Sebastian
Eurocity in the context of the Basque
Country Region
Case Study Report
Appendix 5***

Applied Research 2013/1/8

Konrad Ł. Czapiewski & Mariola Ferenc



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1. INTRODUCTION TO THE REGION

The main focus of the case study is the Basque Bayonne- Donostia-San Sebastián Eurocity in the wider context of the Basque Country Region¹ in northern Spain.

This cross-border conurbation extends from Bayonne (France) to Donostia-San Sebastián (Spain) along 50 km of the Atlantic front of the Pyrenees, on both banks of the River Bidassoa, the mouth of which marks the border between France and Spain. The main towns in this coastal cross-border conurbation of 600,000 inhabitants are those of the Bayonne-Anglet-Biarritz Conurbation community on the French side and Donostia- San Sebastián on the Spanish side.

It is the natural access route between the Iberian Peninsula and Western and Central Europe. It forms a true urban corridor and is located on one of the main road axes existing between the Iberian Peninsula and the rest of Europe. This situation as an obligatory point of passage for road traffic naturally results in a high flow of traffic at different levels (local as well as trans-European) and of different natures: people (cross-border workers, tourists, patients, students, etc.) vehicles.

Both territories share a common Basque cultural heritage and throughout history have lived together through periods governed by mutual goodwill and the desire to promote reciprocal needs and interests, and, as has occurred in other border areas, also through periods of confrontation and estrangement. In effect, the special circumstances of the twentieth century made the Franco-Spanish border very strong.

The process of European construction allowed the emergence of new interpretations of the territory and the appearance of new responses to the needs and challenges involved in a growing interdependence and in global competitiveness. One of the most significant aspects of this is the disappearance of internal borders within the European Union.

Cross-border cooperation operates within a very clear context of voluntary action and is based on a melting pot with a common culture. These premises date back to Spain's accession to the European Community in 1986 but it only really took off as from 1993, the date when a "Eurocity" project was launched, associating the Diputación Foral de Guipuzcoa and the communes of Fontarabie and Irun on the Spanish side, the District of Bayonne-Anglet-Biarritz (which has since then become a conurbation community), and Saint-Jean-de-Luz and Hendaye on the French side. (<http://www.espaces-transfrontaliers.org>).

This coastal conurbation includes not only these main towns (Biarritz, Anglet, Bayonne, Saint Jean de Luz, Hendaye, Irun, San Sebastian), but also a number of medium-sized and small towns (urban villages) that have a very important role as residential areas and as working places too. This is why this international region is seen as a "system of human settlements", a poly-nuclear area (Dubois-Taine, 2004).

Several issues have been clearly identified during this time, mainly related to transport (motorways, tram-train, ports, airports), health (emergency medicine) and culture (identity and the Basque language).

¹ In some documents and maps the Basque Country Region is also called Euskadi in the Basque official language.

In terms of the structure of this cooperation, a Bayonne- Donostia-San Sebastián cross-border observatory was formed in 1997 under the form of a European economic interest grouping (EEIG), consisting exclusively of the Diputacion Foral de Guipuzcoa and the BAB District. It was transformed into the “Cross-border Agency for the development of the Basque Bayonne-San Sebastián Eurocity” in 2000. This structure is both a technical and political tool aimed at revitalising cross-border cooperation through four missions: to conduct or commission studies, seek funding, coordinate public or private initiatives and develop joint initiatives with national authorities and at the European level. Since then, significant projects have been developed: a prospective document (White Paper in 2000), a cross-border convention on waste treatment, the creation of the Consorcio Bidassoa-Txingudi (legal structure including Hendaye, Irun and Fontarabie), and the project which is currently under preparation: the Atlantic-Pyrenees Euro-Institute.

Since 2008, there have been a new impetus to the cooperation and the project has been relaunched on two themes: the broadening of the Eurocity and a review of the white paper according to two priorities, mobility and sustainable development. A study on mobility and travel patterns in the Eurocity is currently under way: the report on an initial inventory phase has recently been submitted, and the next two phases are intended to give rise to practical projects. The topic-based priorities for sustainable development are being validated.

Summarizing the general characterization of the analysed region, we can point out some of the elements, which will influence the land use and land use functions changes:

- coastal region with a dynamic development of the touristic functions;
- intensive suburbanization processes and migration from interior of Spain and France to costal parts of the countries;
- important transport road;
- big heterogeneity of the landscape (Pyrenees mountains and costal);
- transnational co-operation within a strong cultural and historical interlinks;
- well developed spatial planning structure.

In order to better understand the land use dynamics occurring in this area it is important to have a wider territorial perspective. That is why we have analysed the area in the context of the Basque Country Region (NUTS2) in northern Spain and also the French Department of Atlantiques Pyrénées (Department 64) in the Region of Aquitania.

The Basque Country Region, also called Euskadi, is a NUTS2 Autonomous Community located in northern Spain (7,234 km² and 2,169,038² inhabitants) consists of three provinces, specifically designated as "historical territories":

- Álaba (capital: Vitoria-Gasteiz)
- Biscay (capital: Bilbao)
- Gipuzkoa (capital: Donostia-San Sebastián).

It occupies 1.4% of Spain surface. Araba is the biggest province, it encompasses 42% of the Basque territory (3037.3 km²), second Bizkaia with 31% (2217.2km²) and the smallest Guipuzcoa with 27% participation in the surface area (1980.3km²).

² 1st of January 2010. www.ine.es

The population density, at about 327.37/km² just below the EU average, but the distribution of the population is fairly unequal, concentrating primarily around the main cities.

Almost half of the population is concentrated in the Greater Bilbao metropolitan area.

The French department of Pyrénées-Atlantiques, covers the arrondissement of Bayonne and the cantons of Mauléon-Licharre and Tardets-Sorholus. Within these conventions, the total area is 2,869 km², shared by three provinces such as: Lower Navarre (1,284 km²), Labourd (800 km²) and Soule (785 km²). It had 647,420 inhabitants, as of 2008. Population density is 84.68 /km².

The analysis in the report is based mostly on the statistical and literature review.

In the report there will be three spatial levels of the detailed investigation.

- Some of the analysis will be made for area covering the Basque Country Region, statistical NUTS3 units such as: ES211 (Áraba), ES212 (Guipuzcoa) and ES213 (Bizkaia) – see figure 1, and the Department of Atlantiques-Pyrénées (FR615). For this broader analysis we have also included the neighbouring province of Navarre, NUTS3 ES220.
- Some of the research will focus on the context of the Basque Country Region (Spain) and analysis will be made on a very detailed location of some elements of spatial organization (settlements, industrial districts, arable lands, forests, roads and other elements).
- Also the special attention will be focused on Bayonne- Donostia-San Sebastián Eurocity (costal part of the units Gipuzkoa and Lapurdi).

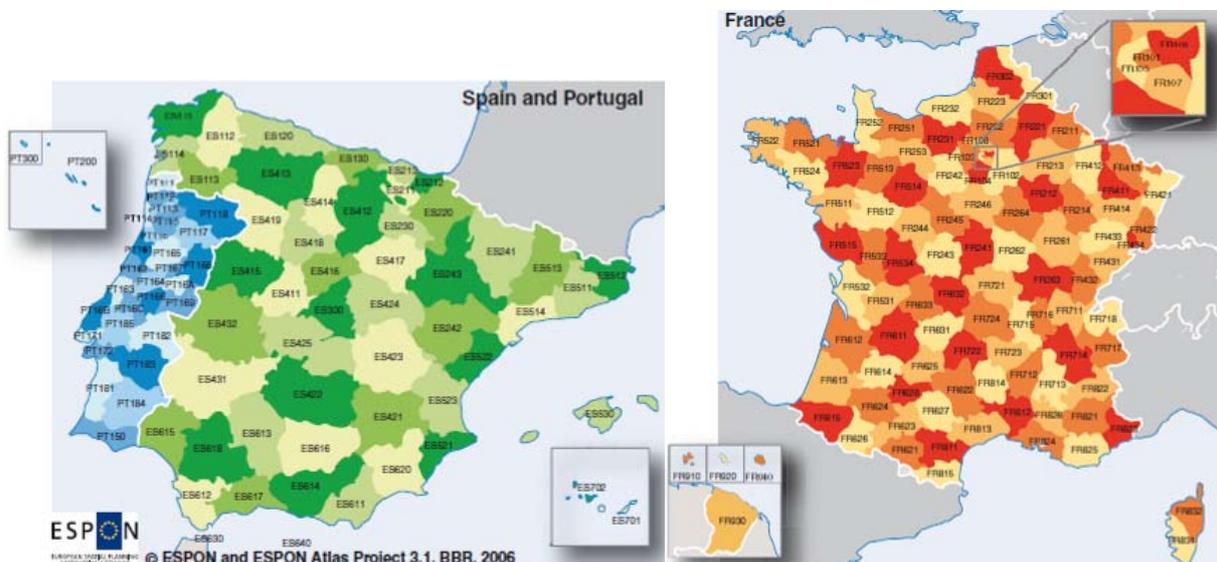


Fig. 1. Division of the Spain and France into the NUTS3 units

Source: ESPON Atlas (2006).

Also, very important data and pieces of information were collected by the authors during the field study in the Basque Country Region and the Atlantique Pyrénées in the period 8-14 January 2012.

The study was organized in cooperation with Tecnalia Research and Innovation and personally by Gemma Garcia Blanco. During the study tour four interviews were conducted with:

- Prof. Eugenio Ruiz de Urrestarazu - Vice-Rector of the University of the Basque Country, geographer.
- Montserrat Garcia Merillas - Representative of Association of Basque municipalities – EUDEL.
- Alfonso Sanz Araujo – Director of Spatial Planning at Department of Environment, Spatial Planning, Agriculture and Fishery in the Regional Government of Basque Country.
- Javier Franco – Senior Researcher specialized in Integrated Coastal Zone Management at AZTI Tecnalia, technological research centre.

At this point, the authors would like to express to them their sincere thanks for the interesting interviews.

2. CHARACTERIZATION OF LAND USE AND LAND COVER

2.1. Definitions of land use

In our report we will use two important terms: land cover and land use.

The first one corresponds to a physical description of space, the observed (bio)physical cover of the earth's surface (Di Gregorio, Jansen, 1997). It is that which overlays or currently covers the ground. This description enables various biophysical categories to be distinguished - basically, areas of vegetation (trees, bushes, fields, lawns), bare soil (even if this is a lack of cover), hard surfaces (rocks, buildings) and wet areas and bodies of water (sheets of water and watercourses, wetlands). This definition has impacts on development of classification systems, data collection and information systems in general. It is said that Land Cover is "observed". This means that observation can be made from various "sources of observation" at different distances between the source and the earth's surface: the human eye, aerial photographs, satellite sensors.

For the second one, various approaches are proposed into the literature. Two main "schools" may be distinguished. Land use in terms of functional dimension corresponds to the description of areas in terms of their socio-economic purpose: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc. Links with land cover are possible; it may be possible to infer land use from land cover and conversely. But situations are often complicated and the link is not so evident. Another approach, termed sequential, has been particularly developed for agricultural purposes. The definition is a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources. Contrary to land cover, land use is difficult to "observe". For example, it is often difficult to decide if grasslands are used or not for agricultural purposes. The information coming from the source of observation may not be sufficient and may require additional information. In the case of agricultural use, farmers may bring information, for example if cattle are present or not, if they are grazing. It is also possible to use characteristics on the spot indicating the presence or absence of cattle.

2.2. Surface and structure of land use

Surface and structure of land use is strictly connected with a topography of the region (Figure 2). The physical structure of land in this region is highly diverse. From north the region is limited by the Bay of Biscay – the coastline has 225 km, including 104 km of beaches. Coast in each of three region has a different characteristic. In Vizcaya in general big beaches are located. In Guipuzcoa there are bigger fluctuations in altitude, rocky coast is common. There are a lot of estuaries. The coast in Lapurdi is plainer, beaches are longer and the fluctuation in height is smaller. The coastal area in whole region is formed by many valleys with small rivers.

South part of region is occupied mainly by a high plateau called teh Araba plains. Rivers flow in southern direction from mountains to the Ebro river.

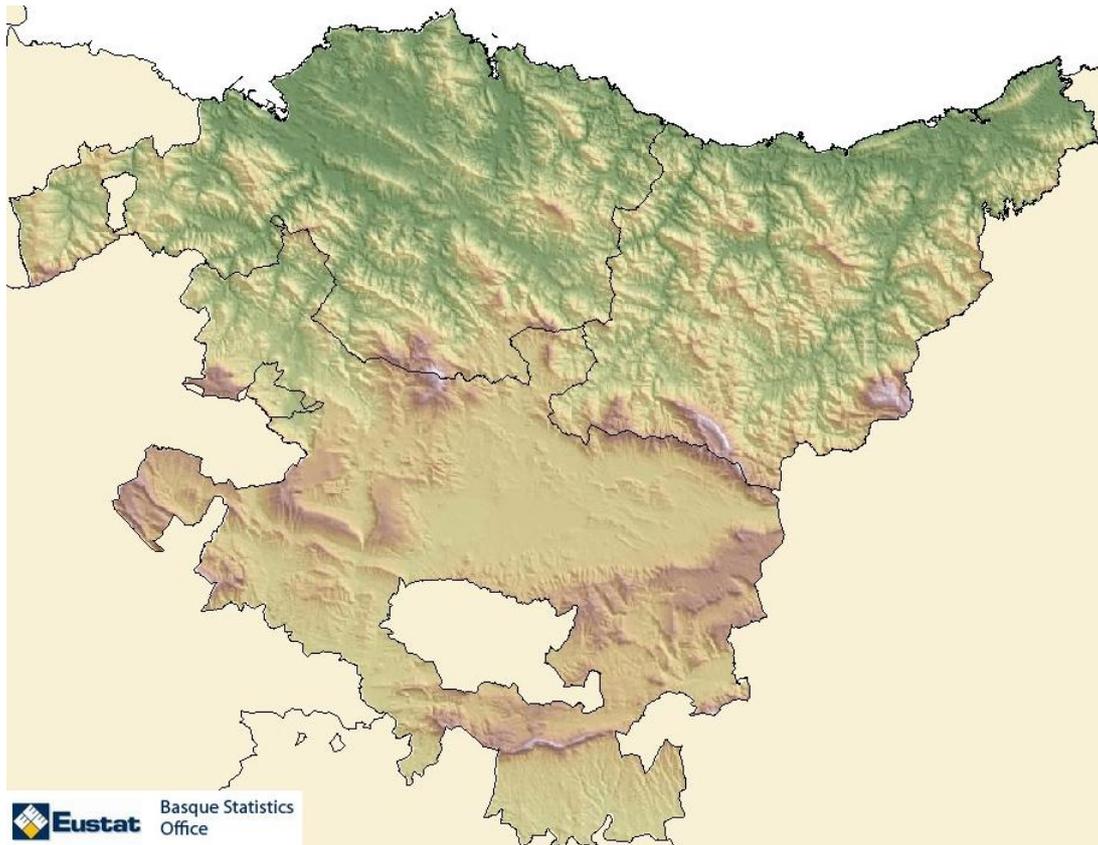


Fig. 2. Topography of the Basque Country (autonomous community)

Source: <http://www.eustat.euskadi.net>

We can divide the Basque Country into a few functional parts. Over 90% of Basque Autonomous Community could be considered as rural area. The remaining areas are urbanized.

A high proportion of hill and mountain areas, large denivelations (height differences) of area or location on a rocky coast determine the type of vegetation and activity, which can be seen in this region. 92% of land in the Basque Country is covered by undeveloped land like forest, agriculture areas and special protection areas. The highest percentage of this type of land we can observe in Araba, which is a mountainous area. But differences in relative numbers are not very strong. On the whole, the Basque Country is dominated by agriculture and forest areas; other types of lands constitute just 8% (Figure 4).

Three types of land use dominate in the Basque Country: forests, special protection area and agriculture with farmland. Forest dominates in Araba: this form of land use covers 31.5% of region's surface and 34% of green areas in the region.

We should notice that the quality of forest is not the same in each region of the Basque Country. Nowadays, there is just 5% of good quality natural oak forest in the whole region, as compared to originally 80%. Most of the areas, which in statistics are classified as forest, in reality is occupied by plantations of trees.

The quality of forest in Araba is very high as compared to others region. We can see on Figure 3 that mostly in Araba there are forests and in Guipuzcoa and Bizkaia there are mostly plantation of forests. These are usually eucalyptuses and pines.



Photo 1. Plantations of forests on the hills.

Source: own materials.

In relation to protected natural areas, a situation, in which only 5% of the country had some kind of protection in 1994, has gone. Currently in the Basque region, 22,7% of the territory included one or more kinds of protection, to mention: *Red Natura2000*, *Ramsar List*, *Red Basque ENP* (National Park, Protected Biotope, Tree Singular), *Biosphere Reserve Urdaibai network of ecological corridors* and *Areas of Natural Interest of the DOT*. These figures along with the protection of resources and species established on the basis of the law 16/1994 of the Basque Parliament of 30 June on the *Conservation of Country Basque*.³ To this we must add the subsequent Law 3/98: the *Environmental Protection of the Country Basque* and the many programs under way to restore biodiversity throughout the whole territory. In recent years a lot of plans have been developed; such as the *Sectorial Territorial Management Channels of Wetlands* (already approved) and *Agro-Forestry* (on-going project) that extend and materialize the provisions of the DOT, which include management and protection strategies concerning specific environmental systems and natural most sensitive territory. It has, in short, a large number of instruments to achieve sustainable land management and ensure the preservation and improvement of space and natural resources.⁴

Agriculture land, which represents 10-11% of all lands in the Basque Country (Eurostat 2012), is located mainly on the bottoms of valleys and in plain areas.

The kind of agriculture depends on the terrain. The arable land dominates in Araba, where although the altitude is high, but denivelations of the terrain are relatively small. In the other two provinces, scrub grassland and pastures areas dominate.

The hierarchy of the Basque Country is organized around central cities. Industrial centers and rural villages play the defined roles. It has evolved into a City-Region in which boundaries of the centers, functions and activities spread over territory ever wider and more diverse. The corridor San Sebastian – Bayonne, is a highly urbanized coastline. There live more than 600,000 inhabitants in main cities on both side of the border. This conurbation is located on the Atlantic front of the Pyrenees, where the river Bidassoa determines the border between Spain and France. One of

³ EuskalHiria_Net.Nueva Estrategia Territorial. Diagnostico. Re-estudio de las DOT.

⁴ Ibidem

the main factor, which determined development of the conurbation was a location of the main road that connected the Iberian Peninsula with the rest of the Europe. Every day 9,000 trucks pass through, here.

Developed land in the Basque Country occupies 8% of the whole area, but in Bizkaia it's 10% and in Araba 6% of the entire territory. The urbanized land can be classified as residential land, land for public uses (infrastructure, parks) and land for business. These three kinds of land use are equally represented in the Basque territories.

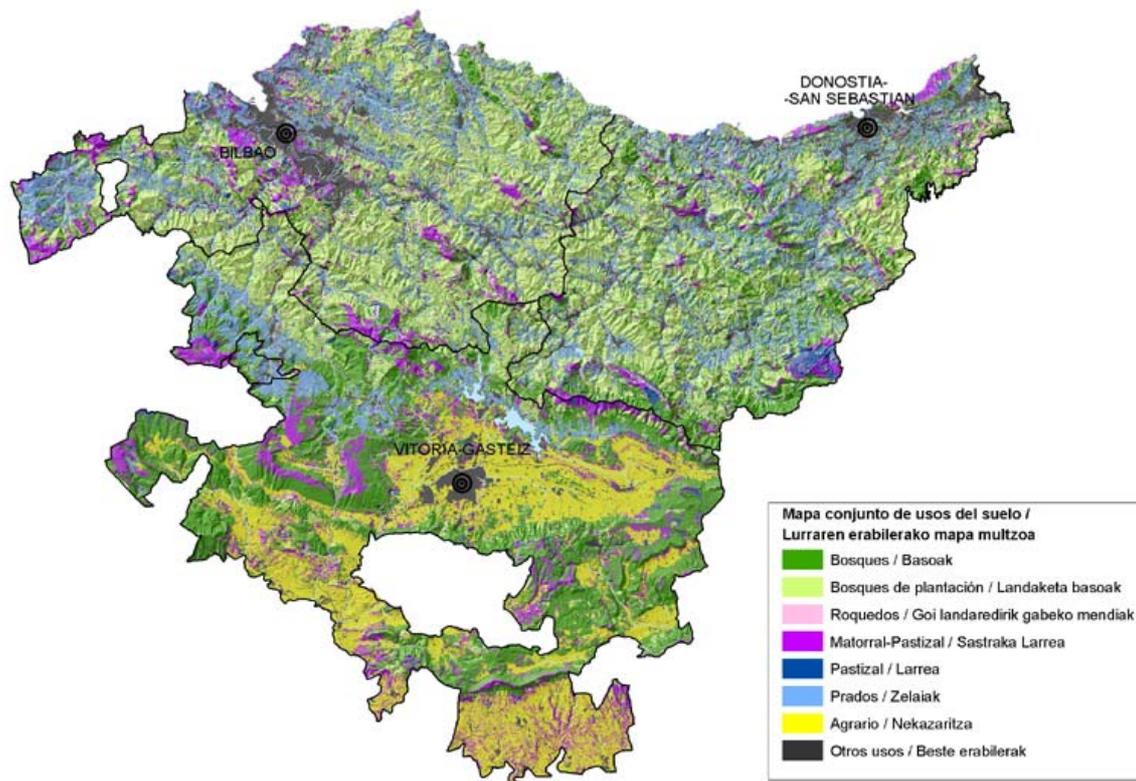


Fig. 3. Map of land use in the Basque Country

Source: <http://www.eustat.euskadi.net>

Translation: Bosques – Forests, Bosques de plantacion – Plantation of forests, Roquedos – Rocks, Matorral-Pastizal – Scrub-Grassland, Pastizal – Pastureland, Prados – Grasslands, Agrario – Agriculture, Otros usos - Other Uses

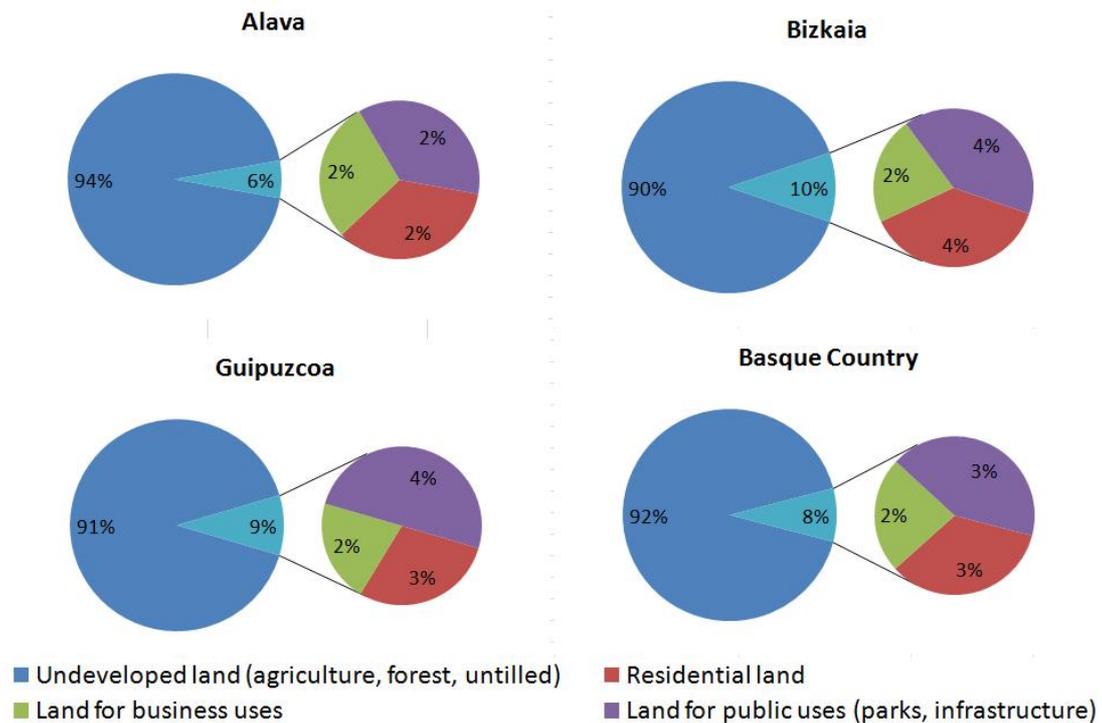


Fig. 4. Land use in the Basque Country in 2011

Source: <http://www.eustat.euskadi.net>

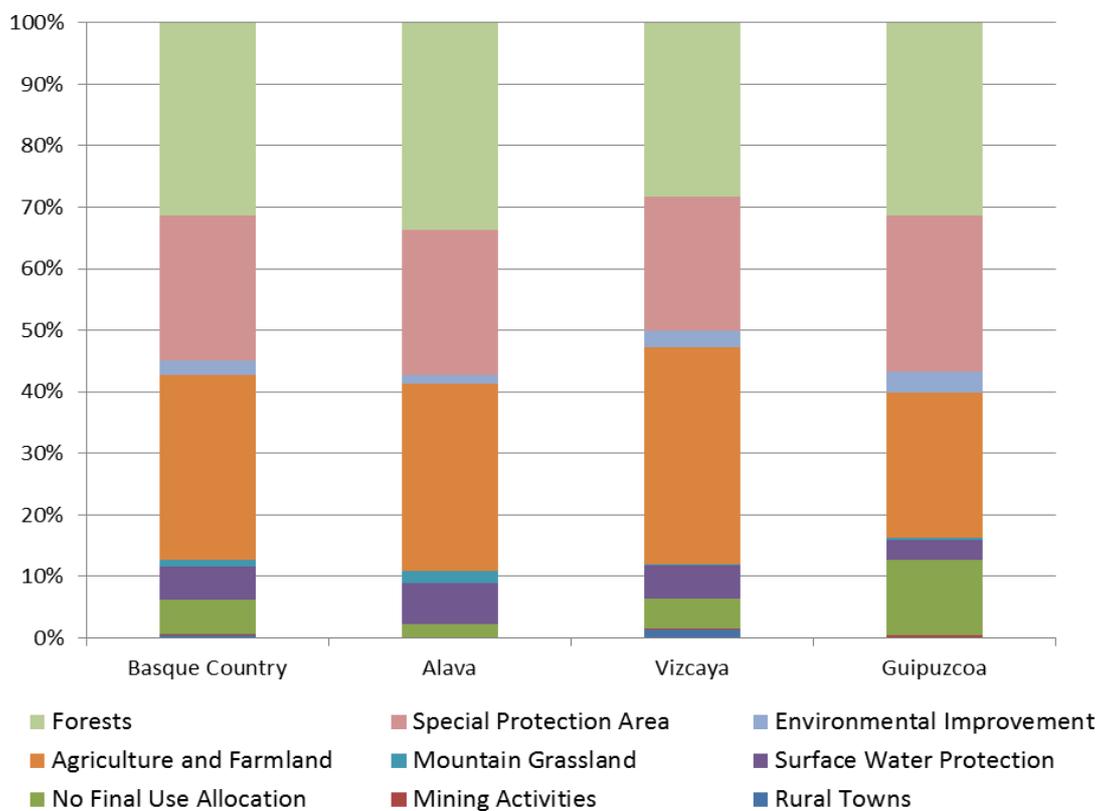


Fig. 5. Undeveloped land by type in Basque Country in 2011

Source: <http://www.eustat.euskadi.net>

2.3. Land cover specific

Based on the Corine Land Cover, the picture of the region under study is not unequivocal. On the basis of the map (Figure 6) in the region of the Basque Autonomous Country and Navarra, forest areas dominate. During the interviews it was underlined that these are mostly plantings and plantations of eucalyptus and pine.

In the Atlantique Pyrénées, majority of the area is classified as pastures with annual or permanent crops. In this part of the region, topography favours allocation of grass land.

Most of the areas of Navarra and Araba are occupied by arable land. Main factor that determines the situation is a topography of the region: denivelations (height differences) are low. The climate is of high significance: subtropical sea, south of the region passing into the continental, dry. Relatively - especially in the northern part - harsh. Southern areas require irrigation. Agriculture developed primarily in the river valleys and in irrigated areas. On the gentle slopes and valleys are grown wheat, corn, grapes, sunflowers, olive and vegetable and fruit orchards. In the north of the region there are large areas of forest, which is related to the harsh climate and terrain.

Urban areas are found along the coast and in valleys. Together with the development of urbanization the region was connected to a communication/transportation network. Thus, the areas located along the transport lines have become attractive to investors.

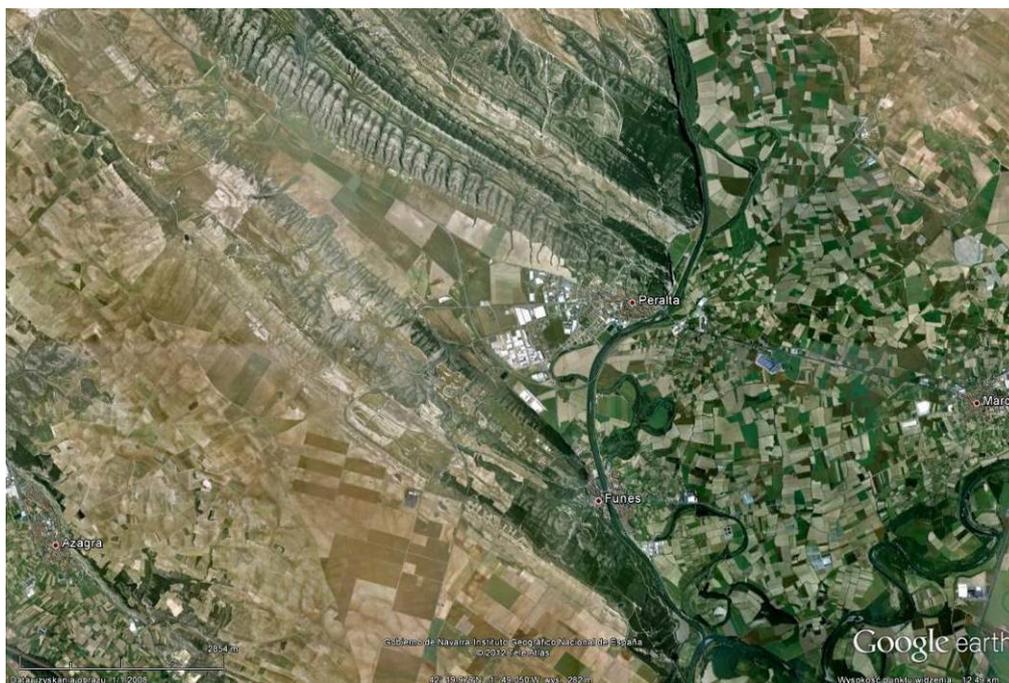
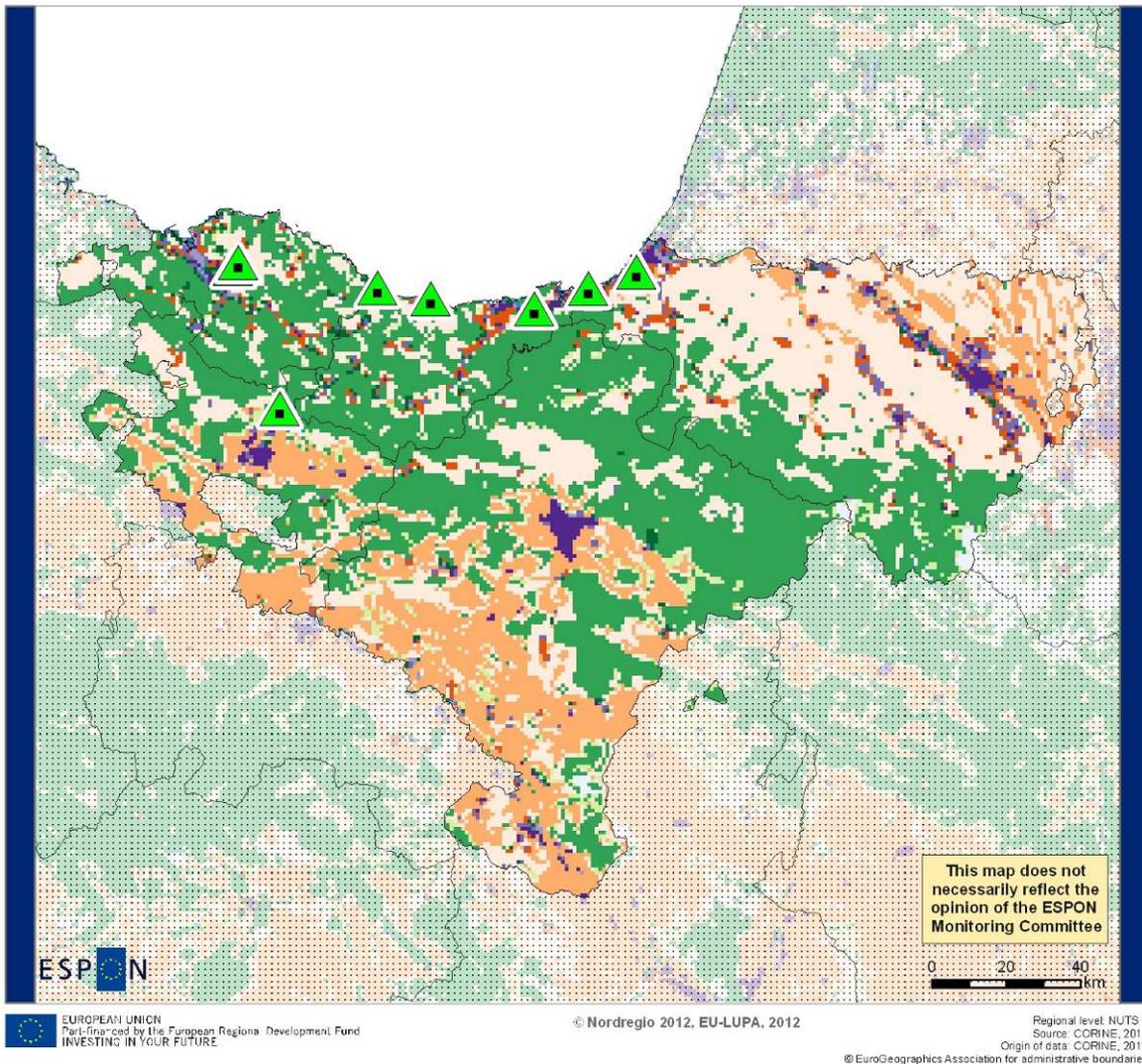


Photo. 2. Arable land in the valley of Rio Agra and (Navarra). Impact of topography on land cover

Source: Google Earth

Stable Elements of Land Cover 1990 - 2006

Eurocity Basque Bayonne - San Sebastian



Stable Land Types

- Urban cores and metropolitan areas
 - Suburban residential and economic areas
 - Special urban areas with relation relationships to the marine environment
 - Arable land in predominantly rural areas
 - Pastures and agricultural mosaics in peri-urban or rural community areas
 - Forested areas and agricultural mosaics in peri-urban areas
 - Rural forest
 - Pastures, agricultural mosaics and mixed forest in predominantly rural areas
 - Transitional woodland or sparsely vegetated areas
 - Lands primarily associated with water courses
 - Sparse vegetation, wetlands, water bodies and snow or arctic conditions
- Points of investigation
- Areas outside the case study region

Fig. 6. Stable Elements of Land Cover (1990-2006)

Source: Nordregio, based on Corine Land Cover

2.4. Technical management of the land use

Infrastructure plays the important role in the Basque Country. Since the adoption of DOT (territorial master plan in the Basque Country) in 1991, the connection from Lisbon to Paris through Basque Country was marked out. The different plans are oriented toward this connection: for example highways and harbours. The high-speed train follows these plans.

Technical infrastructure in the whole of Spain was changed after II World War, thanks to considerable revenues obtained from foreign tourists. According to professor Urrestrazu, in the last 20 years, there has been an extraordinary urban expansion. The compact urbanization disappeared and now urban sprawl is more common. The government tries to cope with this by applying the legal restrictions. The problem with urban sprawl is complicated in the Basque country, because of topographical features of the land. The only place where the infrastructure, settlements and industry can expand are the bottoms of the valleys. It poses a problem also for social life, because, in the Basque Country, cities are places for maintaining and building social relations. With linear urbanization in the bottoms of the valleys these relations will be disappearing, because of the problem with mobility.

The Basque Country economic situation is one of the better ones in the whole EU. GDP of the Basque Country per capita was 18% higher than in the European Union in 2010 (Eurostat 2012). Traditional industry in this region is steel and shipbuilding. Bilbao was the centre of industrial revolution during the 19th and in the first half of the 20th century, owing to iron deposits located near the city. During the economic crisis in the 70s and 80s of the 20th century these activities provided a background for development of other sectors (new technologies and services). Being in possession of highly developed industry, Spain had to take care of development of its technical infrastructure.

In Spain, the infrastructure development programme began to be implemented in the late 1960s. The Government regards the development of road and railways infrastructure as a priority with the key objective of national development and tourism. Spain chose the way of construction of roads by granting concessions to private companies. Nowadays, we can see results of that choice: Spain starts to export knowledge to other countries. 6 out of the 10 best building or roads' management firms come from Spain.

The beginnings of the construction of the motorway network were not too impressive because of a lack of capital and fuel crisis. Real progress in this area began after the accession of Spain into the European Union. In the years 1986-1993, 13.5 billion ECU were invested in infrastructure from EU funds. In 2009, only in the Basque Country, there was approximately 4,209km of roads, 6.5% of which were highways (273km)⁵. Assumptions made in the late 1960s have proved themselves, thanks to extensive infrastructure, tourists began to arrive massively, and that's why tourism and services are one of the main engines of economic development. A poor network of roads and railways may also discourage foreign investments, hence its rapid development is one of the most important preconditions for investment in a particular place.

⁵ Eurostat 2012

As can be seen on the Figure 7 the most developed network of infrastructure is located in big cities and in municipalities located around them. There are also situated, in the aforementioned places, the main transport corridors of the region

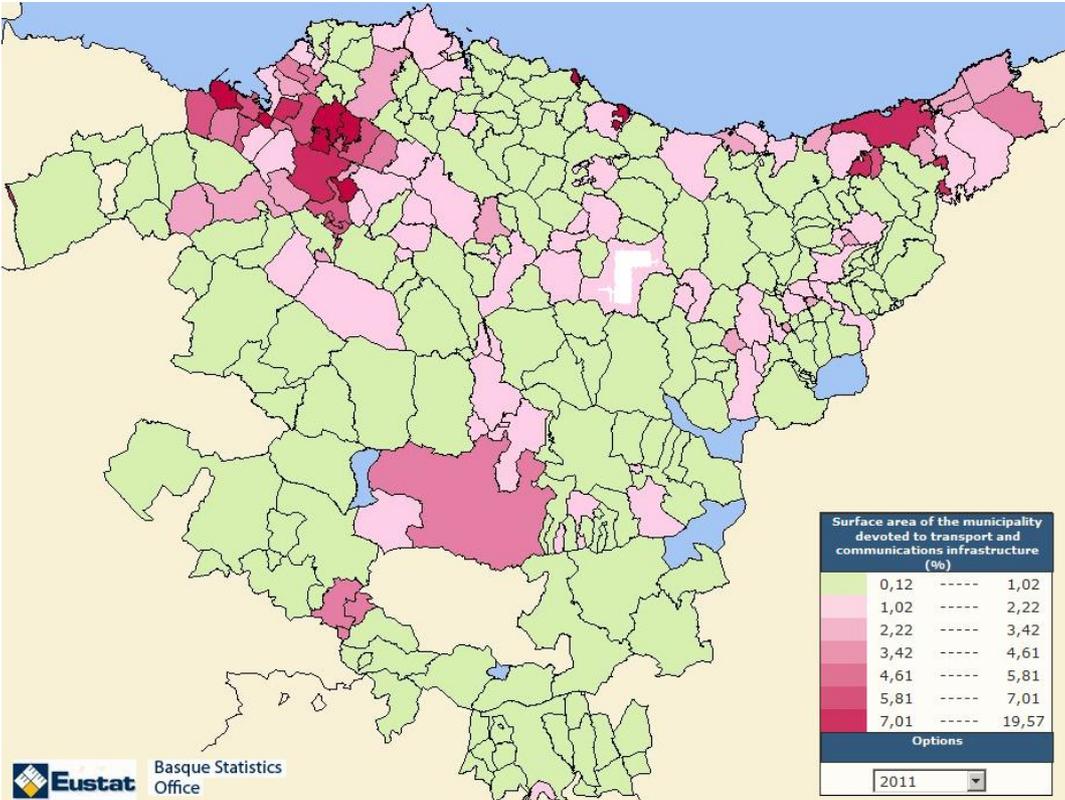


Fig. 7. Surface area of the municipality devoted to transport and communication infrastructure (%) in 2011

Source: <http://www.eustat.euskadi.net>

2.5. Major trends in historical context

The Basque Country’s coastal location in the North is of great importance (it’s an asset). After the Civil War (1939), there were observed a big migration from Spain towards the harbour and metal industries. In the last 50 years Spain has undergone more profound social transformation than any other country of Western Europe. In the 1950s most part of it was a poor, agricultural country, where only 37% of the population lived in cities with more than 10,000 inhabitants. Currently, this percentage is 70%. As a result of migration to cities, many agricultural areas were depopulated. The 1960s saw initially a spectacular economic growth, largely associated with the development of tourism.

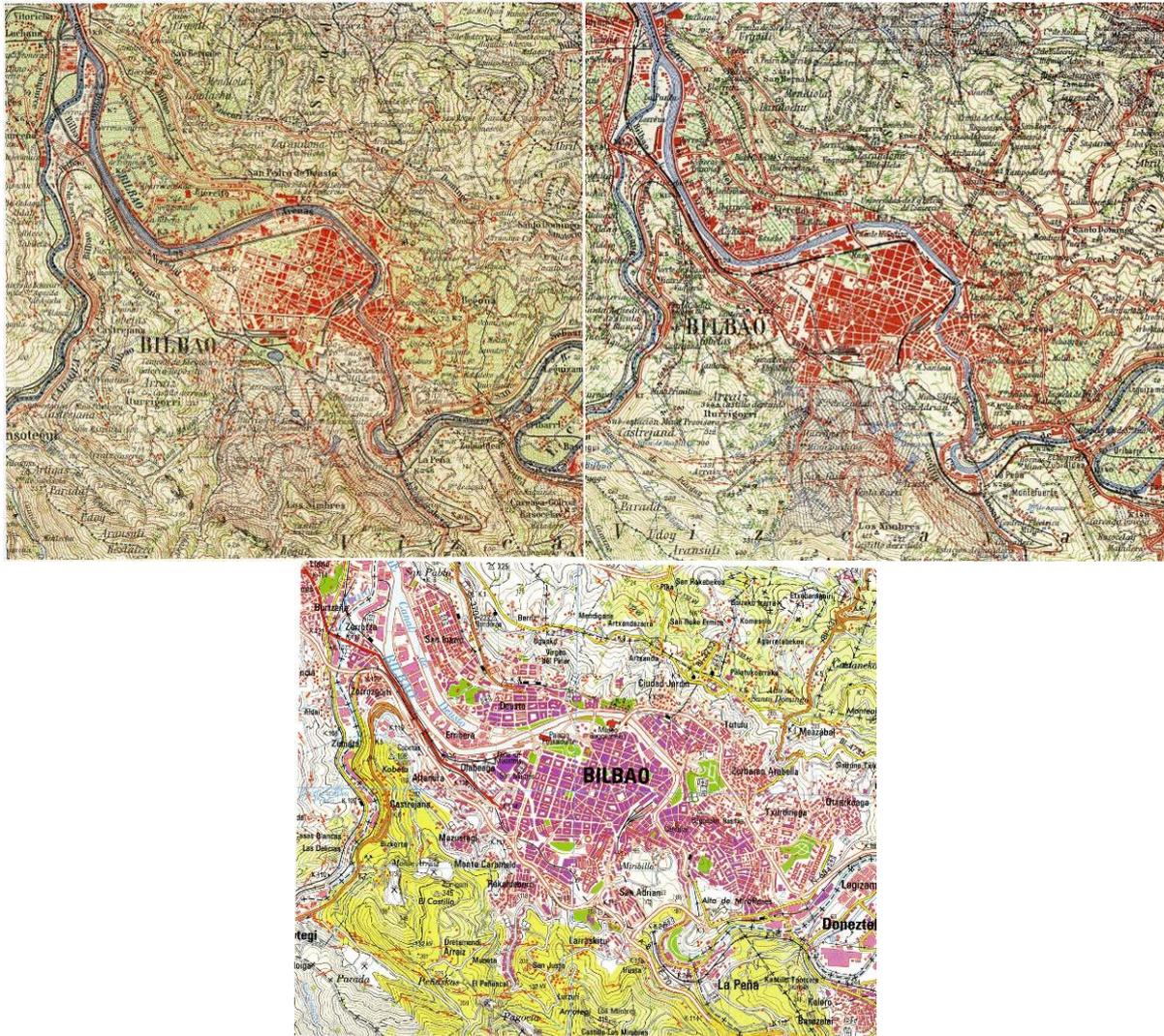


Fig. 8. Growth of Bilbao agglomeration – maps from 1942, 1958 and 2003
 Source: Imagen y Paisaje (2002, p.194-195).



Photo 3. Bilbao and its surroundings.
 Source: own materials.

After the death of General Franco in 1975, Spain became a constitutional monarchy; until the mid-1990s, it was ruled by socialists, who conducted a series of reforms:

educational, infrastructure, health, and also strengthened the country's position in the international arena (in 1986 Spain joined the EU). After this, with democratization process (1980), Spanish industries were maintained and also its infrastructure was improved to support industrial activities. The Basque Country is a small territory with large population density and big industry that employs a large number of workers. With the coming of 1980's crisis (industrial), all industrial areas were reconverted to keep workers. They were restructured to develop a high-quality industry. In the last years, territorial balance has grown with well-developed infrastructure, industrial parks, research parks and, above all, better services. The small towns (<2500 inhab.) have gained in population at the cost of bigger cities. This has been achieved because urban planners have managed to change people's preferences.

Although the DOT (general land plan for the Basque Country) was definitively approved by the Governing Council in 1997, in actual fact, it had been already implemented in the late 1980's. Its development coincided with a critical period in the history of the Basque Autonomous Country. It was the time when the end of the model based on the traditional industry became evident. This was a crisis situation where a system was no longer valid but still no other has emerged to replace it. The crisis manifested itself in a demographic decline and lack of economic dynamism, with rising unemployment, business closures and reduced investments. In this context, DOT was developed as an instrument that should respond to specific management objectives and territorial coordination but also to a configuration and proper territorial initiatives to boost the process of change towards a new stage of development.

Increasing number of population is not equal in all municipalities. There are some municipalities where the population growth has been significant (such as Vitoria-Gasteiz, for example) others, with no changes at all, and even the ones that witnessed a decline in population (Sestao municipality for instance). Important movements from big cities to the small municipalities were prompted by a popular tendency to look for an alternative style of life. This trend has forced the revision of the urban planning that should secure new land for residential uses in those small municipalities which are experiencing influx of newcomers.

3. NARRATIVE OF CHANGE IN RELATION TO LAND USE

3.1. Socio-economic

In 2010 the total population of Basque Country was 2 169 038 inhabitants. In the last 110 years the total population of that region increased by 3.6 times. The highest increase was observed in the years 1950-1980 and was associated with the intensive industrialization processes – the rapid growth of population in that period was especially observed in Biscay subregion (Bilbao Agglomeration). Since 1980, the stabilization in population in the Basque Country has been observed.

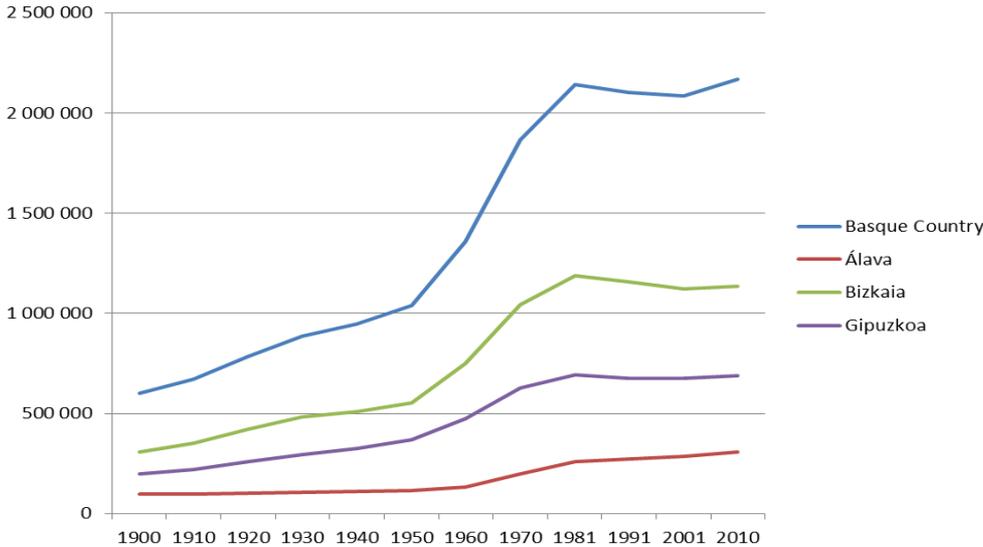


Fig. 9. Population in the Basque Country in the years 1900-2010.

Source: Own calculations based on <http://en.eustat.es>.

Such pattern of demographic development is also visible on the maps presenting the population in other regions since the late 1990s. In 1920, it can be observed that there was a relatively equal distribution of population in the whole of Spain, but after II WW the concentration of population in six areas started to take place – Catalonia, Valencia, Andalusia, Galicia, Madrid and the Basque Country, and depopulation of the inland of Spain. Concluding, what is the most important for land use changes in the last 20 years is the fact that the Basque Country is one of the regions in Spain with the biggest concentration of population, but for the last 30 years the number of inhabitants has been rather stable there.



Fig. 10. Population in Spanish regions as of 1920, 1960, 1991 and 2007

Source: Atlas Nacional de España – Demografía (2008).

The best and most classical way to illustrate the first mentioned situation is the map of density of population. It is clearly visible, that the highest concentration of population is observed on the coastal areas (including the Basque Country) and in Madrid Metropolitan Area.

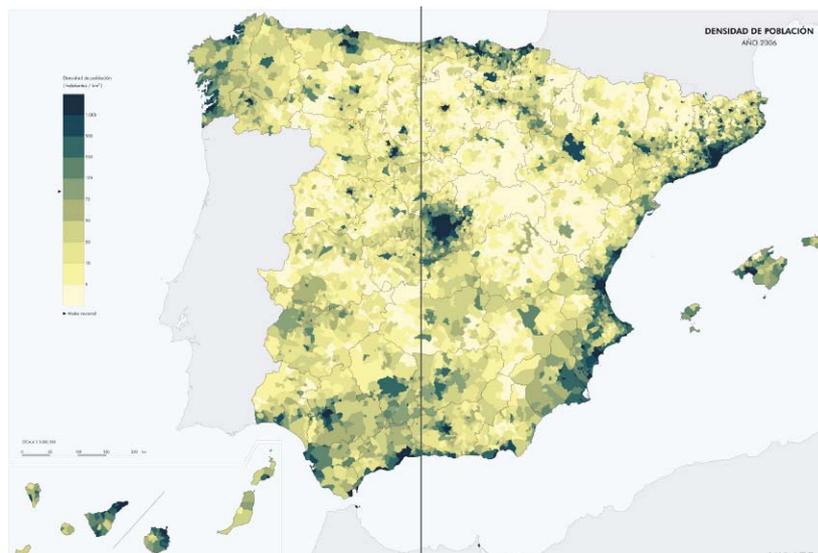


Fig. 11. Density of population in Spain in 2006

Source: Atlas Nacional de España – Demografía (2008).

On the other hand, the best way to illustrate the second important feature of the Basque Country region – the stable number of population in the recent years, is the map with the absolute changes of the population in Spain in the years 2001-2006. It is clearly visible that two core regions on the Atlantic Coast (Galicia and Basque Country) did not increase its population as fast as it happened on the Mediterranean Coast and in the Madrid Region.

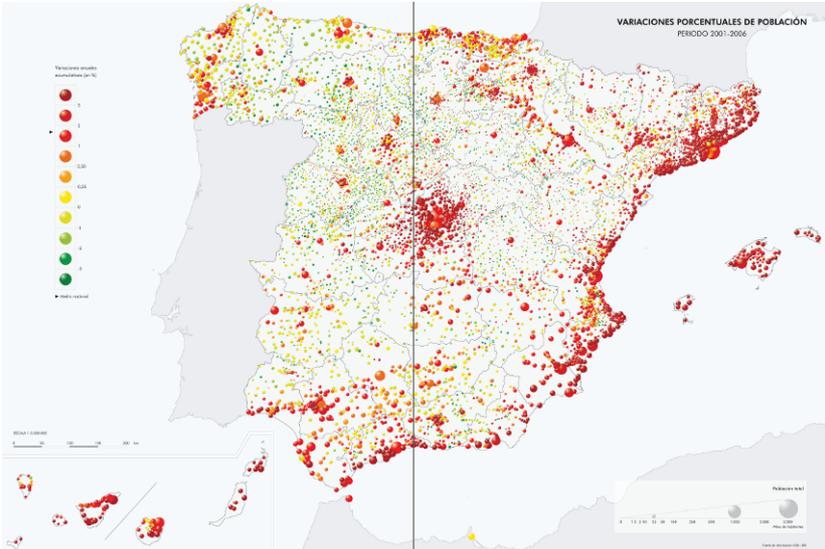
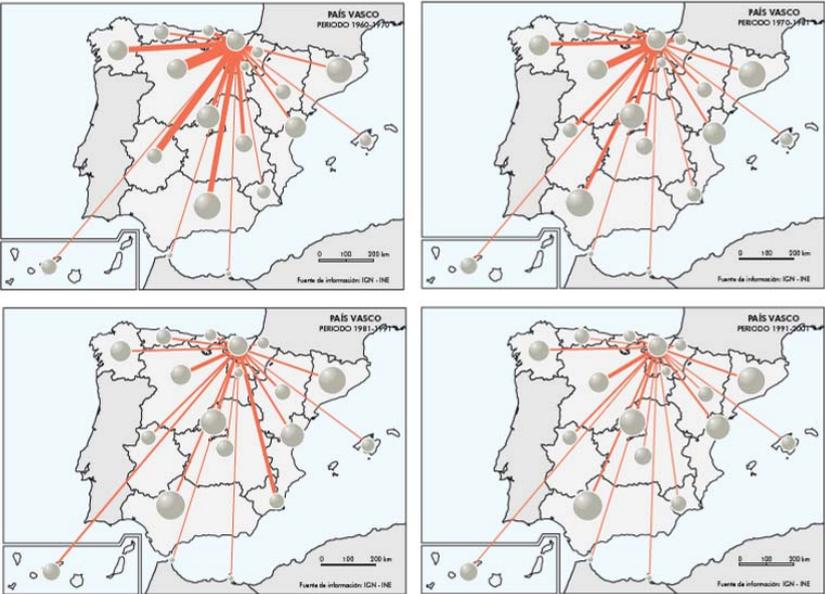


Fig. 12. Changes in population in Spanish municipalities in the period 2001-2006.

Source: Atlas Nacional de España – Demografía (2008).

Stable number of population is connected both with stable value of natural increase, as well with much smaller migrations in the recent years in comparison with that observed in the 1960s and 1970s.



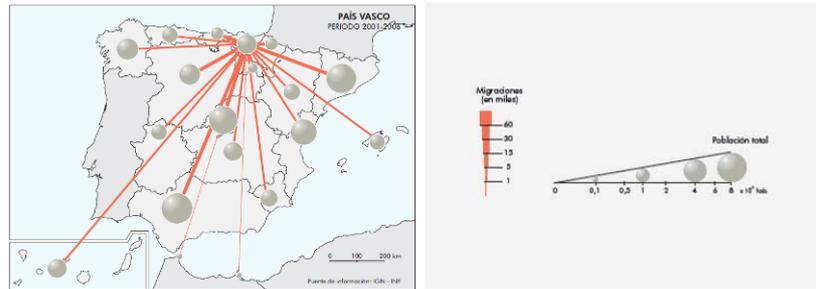


Fig. 13. Directions and number of inhabitants migrating to Basque Country in the decades of 1960-2006.

Source: Atlas Nacional de España – Demografía (2008).

Important and characteristic thing of the Basque Country is that the concentration of population is observed in Bilbao Agglomeration and Donostia-San Sebastian Agglomeration, along the coastal and main transport corridors. The inland of the Basque Country (i.e., mostly the Araba subregion) is very sparsely populated and except for Vitoria-Gasteiz there are no any bigger settlements.

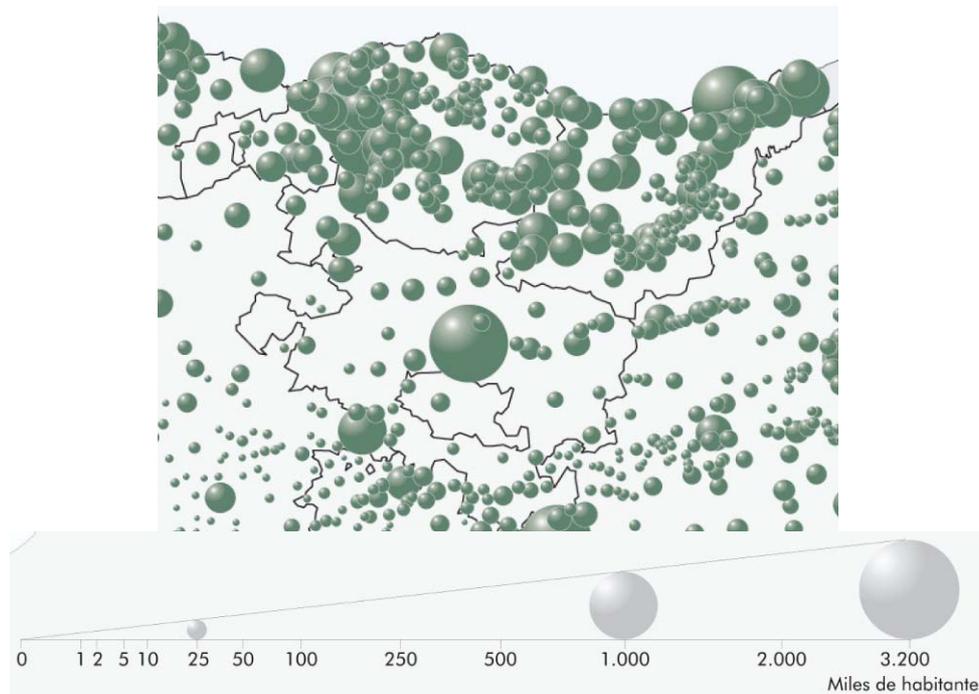


Fig. 14. Population in municipalities of the Basque Country in 2006

Source: Atlas Nacional de España – Demografía (2008).

There is rather adverse age structure in the Basque Country, from economic point of view. Around 17% of inhabitants are below 20 years of age and 60% are aged between 20 and 59.

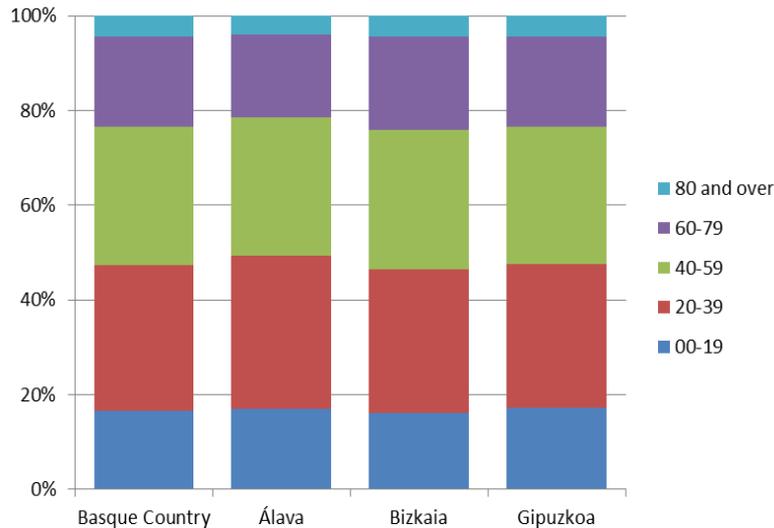


Fig. 15. Share of population according to age groups in the Basque Country and its districts in 2005

Source: Own calculations based on <http://en.eustat.es>.

Summarizing the demographic processes, it can be mentioned that big industrialization processes in the 50s, 60s and 70s of the 20th century accelerated the growth of population – both by migration and natural increase. The growth was compact – which means that together with an increase in population also the infrastructure (transport, technical and social) was developed. Nowadays, we can observe negative or weak positive natural increase and also small emigration from Eastern Europe, North Africa and Latin America. But, importantly, over the last 20 years, a huge urban expansion has been observed. Intensive development of the biggest towns (especially Donostia-San Sebastian, Bilbao and Vitoria) takes place. Those big cities attract people to move there. However, these processes can be highly problematic for sustainable development of the region. Since there are a lot of medium-sized cities that can experience a decline in inhabitants as well in working places. Thus we can observe the concentration of population, services and decision makers' in few places. According to the opinion of one of the respondents (prof. Eugenio Ruiz de Urrestarazu) such process can be dangerous because it could lead to disturbance in the territorial balance that has been maintained up till now.

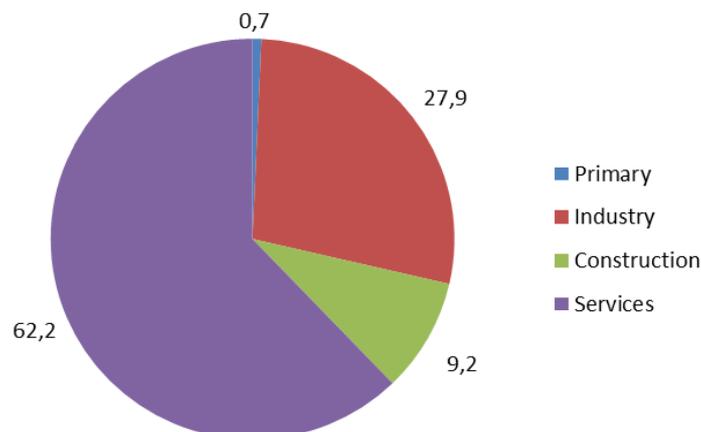


Fig. 16. Gross added value by sectors in the Basque Country in 2008

Source: Own calculations based on <http://en.eustat.es>.

The Basque Country is characterised by a high level of employment in industry and services. In the main cities (Bilbao, Donostia-San Sebastian), the highest share of people is employed in services. In other parts employment in industry and construction is of high importance.

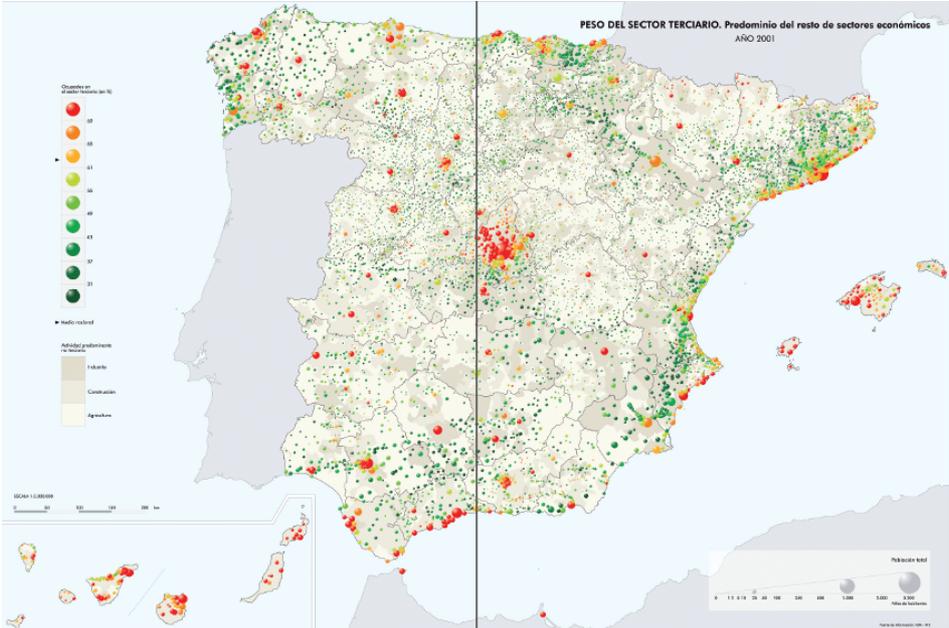


Fig.17. Share of workers employed in the third sector in 2001
 Source: Atlas Nacional de España – Demografía (2008).

General socio-economic situation in the Basque Country is essentially positive, when compared with national average. When taking into account such measures like number of active population, wages, unemployment, etc. it follows from these that almost all the Basque municipalities have a better position than the average noted in the country.

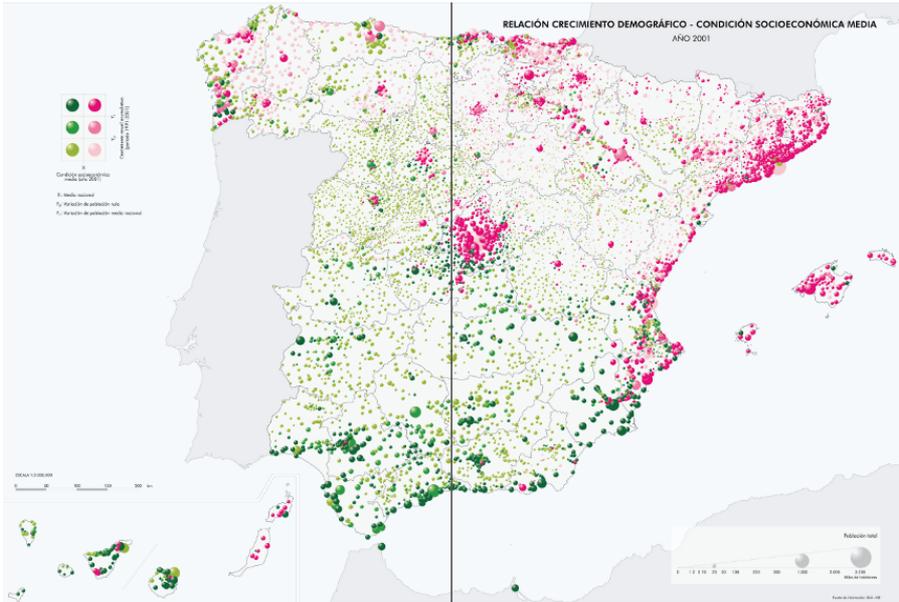


Fig. 18. General socio-economic situation in Spanish municipalities – pink colour means better situation than the national average
 Source: Atlas Nacional de España – Demografía (2008).

3.2. Environment

On the whole, the climate in the Basque Country is much wetter than that of the other parts of Spain – it is largely due to the direct influence of the Atlantic Ocean. The precipitation in the Basque Country (as well as on all the Northern coast) are twofold or even threefold higher than the Spanish average. The influence of the ocean is also visible in terms of average temperatures – winters are a little bit warmer as compared to the interior and colder in summer. The span of annual amplitude is not so big.

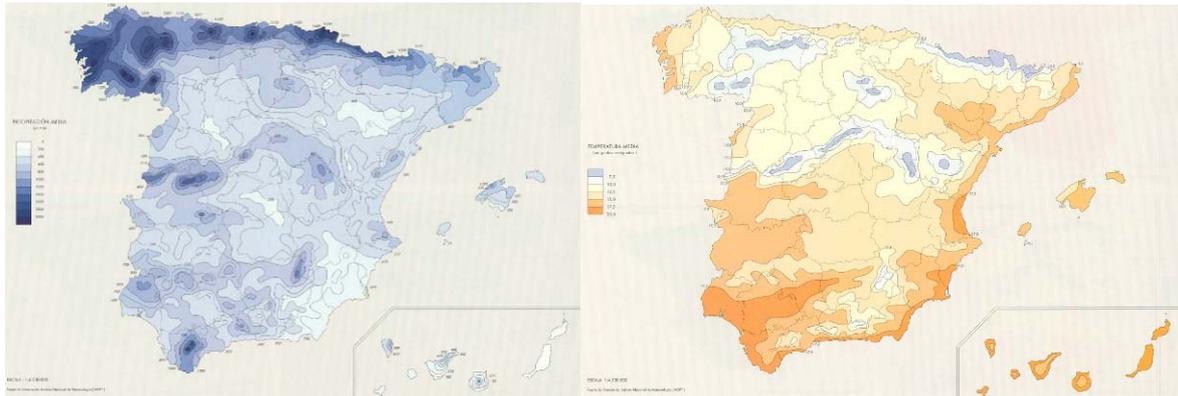


Fig. 19. Average precipitation and temperature in Spain.

Source: Atlas nacional de España – Climatología (1992).

In general, the relief features of the Basque Country are highly diversified. The highest point of the region (Aitxuri 1 551 m a.s.l.) is maybe not much impressive, but the relative differences of the altitude are important. Such relief influences all kinds of human activity – roads construction, housing, infrastructure, etc. It has also influenced the land use – more about that will be mentioned in the next chapters.



Photo 4. Diversified landscape of the Basque Country.

Source: own materials.

The quality of soils is rather poor, which is why only about one fourth of the land is utilised as an agricultural and farm land.

Air quality has been improving year by year. In 2005, the average percentage of days with good and acceptable air quality in cities was 93.6%, while in 2010 it was 99.6%. Still the fast development of the region influences the CO2 emission, but the general trend noticeable in the last few years reinforces the reduction of the emission.

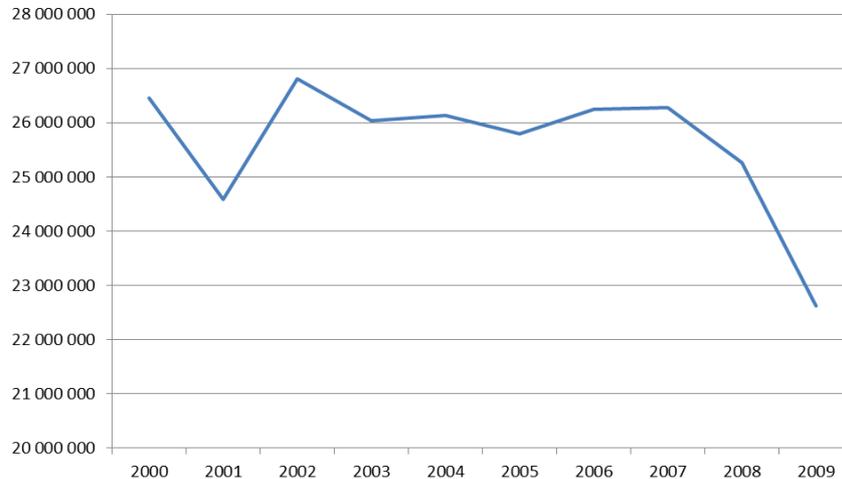


Fig. 20. Total greenhouse gas emissions (in CO2 equivalent tons) in the Basque Country in the years 2000-2009

Source: Own calculations based on <http://en.eustat.es>.

At present, the two strategic documents can be mentioned that are focused on improving the quality of environment

The *Basque Environmental Strategy for Sustainable Development 2002-2020* approved on June 2002, in the context of a long-term strategic view in line with the undertaking made at the Earth Summit in Rio de Janeiro in 1992 to draw up strategies for sustainable development in each territory.

The five environment goals of the Basque Environmental Strategy for Sustainable Development are the following:

1. To ensure clean and healthy air, water and soil.
2. Responsible management of natural resources and waste.
3. Protection of nature and biodiversity: a unique asset to be fostered.
4. Balance between territories and mobility: a common approach.
5. Limiting effects on climate change.

The necessary conditions for the successful implementation of the strategy are:

1. Integrating environmental variables into other policies.
2. Improvements in current legislation and its application.
3. Encourage the market to develop in an environmentally-friendly way.
4. Enable the public, the authorities and businesses, making them jointly responsible, and modifying their behaviour in favour of sustainability.
5. Research, technological development and innovation that takes care of environmental matters.

The *Basque Country's plan to tackle climate change* (2008-2012) has strategic goals such as:

1. Reduction in greenhouse gas emissions to +14% in relation to 1990's levels.
2. Increase CO₂ absorption to 1% of 1990's emissions by forest and agricultural management.
3. Minimize the risk to natural resources, above all to biodiversity, hydrology and soil resources.
4. Minimize the risk to human health, urban and socioeconomic systems.

The way to reach these goals is by 4 thematic strategies that include 120 actions:

1. Less carbon intensive energies – reduce its share in the energy, industry, transport, residential, services, agriculture, forestry and waste management.
2. Adaptation – anticipate climate change and preserve natural ecosystems, protect human health and adequate infrastructure and socio-economic systems.
3. Knowledge – develop scientific-technical and social knowledge in order to observe the environment, knowing the problems and creating solutions. It has to involve the Basque Science, Technology and Innovation Network, businesses and the Basque Government.
4. Governance – coordinate the Basque Government, regional government and municipalities to be an example and raise public awareness of climate change.

3.3. Government and policy

In Spain, the regions enjoy a relatively big autonomy. Especially such regions as: Galicia, Catalonia and the Basque Country have even bigger independence in their policy than others. In the Basque Country there is the Basque Parliament and also the Government. For example, in Spain, each region is carrying out its own Rural Development Programme (similarly to Germany or Italy). Each region has its own strategy of development and planning systems. There is the Basque regional department that is responsible for spatial planning, but also each municipality according to the existing law has some possibilities to stimulate its socio-economic and spatial development. So the general hierarchy of government in the Basque country is as follows: (1) there is the Basque general government, then (2) three provincial councils, and, finally, (3) municipalities and cities. Those different levels have different competencies or powers, but, on the other hand, these are very complex,

The planning system of spatial development is very well developed in the Basque Country. According to opinions of Alfonso Sanz Araujo (Director of spatial planning at Department of Environment, Spatial Planning, Agriculture and Fishery in the Regional Government of Basque Country) the planning system works perfectly and the responsibilities for each level are suitable enough. Generally, the land planning in the Basque country (LOT) have been in existence since the 1990s. There are different tools for implementing this law:

- DOT – guidelines for the whole of the Basque Country,

- PTP – territorial planning in functional areas. The Basque country is divided into 15 functional areas. The one area has 12-15 municipalities;
- PTS – sector land planning (houses, flooding, energy and rail infrastructure, etc.).

Below is a brief summary of the mentioned documents⁶.

The DOT (*Directrices de Ordenación Territorial/Territorial Master Plan*) were approved in 1997 and since that time have constituted the reference for a harmonious and coordinated development in the Basque Country, based on a criteria of interconnection and integration, so that the regional and sectorial plans and municipal planning could not be processed independently. All these should pursue coherent objectives that are consistent with a global vision, not being particularistic or contradictory to the environment or to the rest of the Basque Country.

The main objectives are to:

1. Protect and improve natural resources.
2. Reinforce and rebalance urban system.
3. Improve Basque Country integration with Europe.
4. Improve urban areas.
5. Potentiate medium cities network.

In recent years (2006-2011), the DOT has been reviewed and the most important innovation is the concept of “Euskal Hiria” (Basque City – Bilbao, San Sebastian and Vitoria) which tries to create a Euro-region capable to compete in the European context.

Drawing on the example of PTP of Donostialdea (*Planning of the Functional Area of Donostialdea*), the role and main aims of PTP documents can be described.

The functional area of Donostialdea has an extension of 376 km² with a population of 400,000, which gathers 13 municipalities.

This plan was ended in 2008, being useful for 16 years. The main objective of this plan is to give a concrete form to the general advices of the DOT and to go beyond the limitations of the municipal planning.

The main considerations of the plan are the following:

1. The territory as a support system for natural resources and the primary sector.
2. The territory as a residence and work area for a population of 400,000 people.
3. The territory as a strategic location in the transport and communications corridor in Europe.
4. The territory as a social, cultural and urban reference because of the status of the capital of Gipuzkoa province - an important city in the urban system of the Basque Country and an essential part of the eurocity Bayona-San Sebastián.

As was mentioned earlier, there are many sectoral plans (PTS). Here some which are connected with land use changes will be listed.

PTS de Suelo para Actividades Económicas y Equipamientos Comerciales (Sectorial Planning of Land for Economic Activities and Trade Equipment) was ended in 2004,

⁶ The overview of the strategic documents was prepared by Tecnalia Institute.

being useful for 16 years. It was proposed by the DOT with the following determinations:

1. Identify the location of the public promotion of land to economic activities and trade equipment.
2. Quantify the necessary surface and characteristics of each actuation in the territory.
3. Asses about the economic viability of the proposed public inversions.

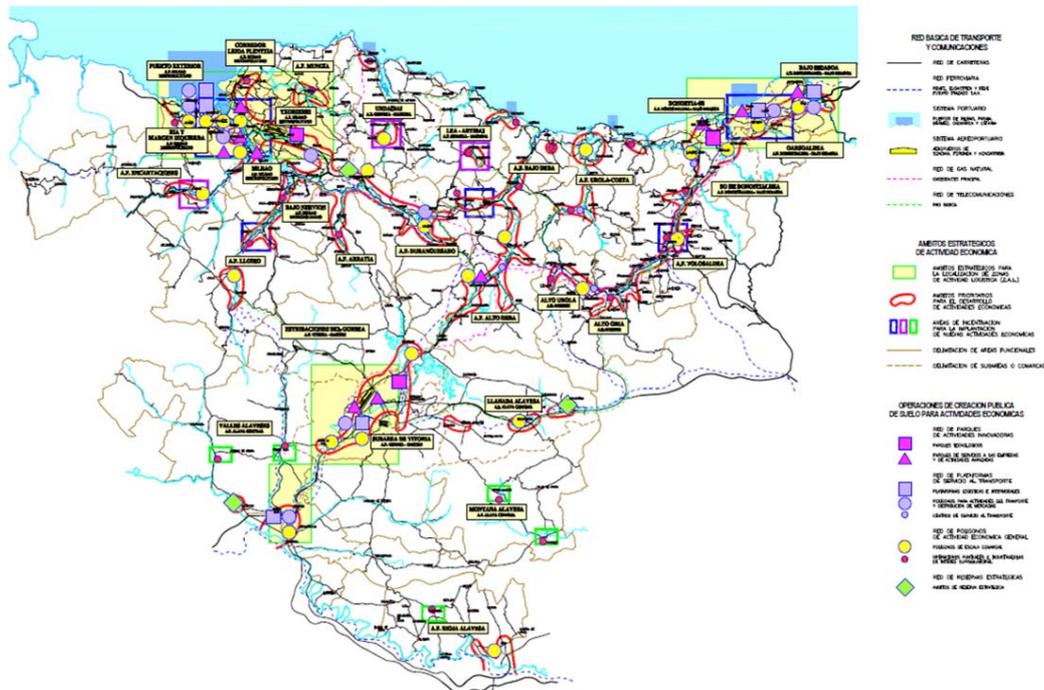


Fig. 21. The map from the sectoral plan – identification of economic zones in the Basque Country

Source: *PTS de Suelo para Actividades Económicas y Equipamientos Comerciales* (2004).

PTS de Protección y Ordenación Litoral (Sectorial Planning for Coastal Protection) was ended in 2004 and assumes the following objectives:

- Define coastal zones to be planned.
- Inventory coastal heritage to be protected.
- Create a useful division of coastal zones for integration of different uses.
- Protect and conserve natural resources of coastal zones.
- Safeguard public access to coastal zones.
- Define and specify planning for rias (a long, narrow inlet formed by the partial submergence of a river valley)
- Define guidelines to give authorizations for uses in coastal zones.
- Establish a programme of actions on the coast.

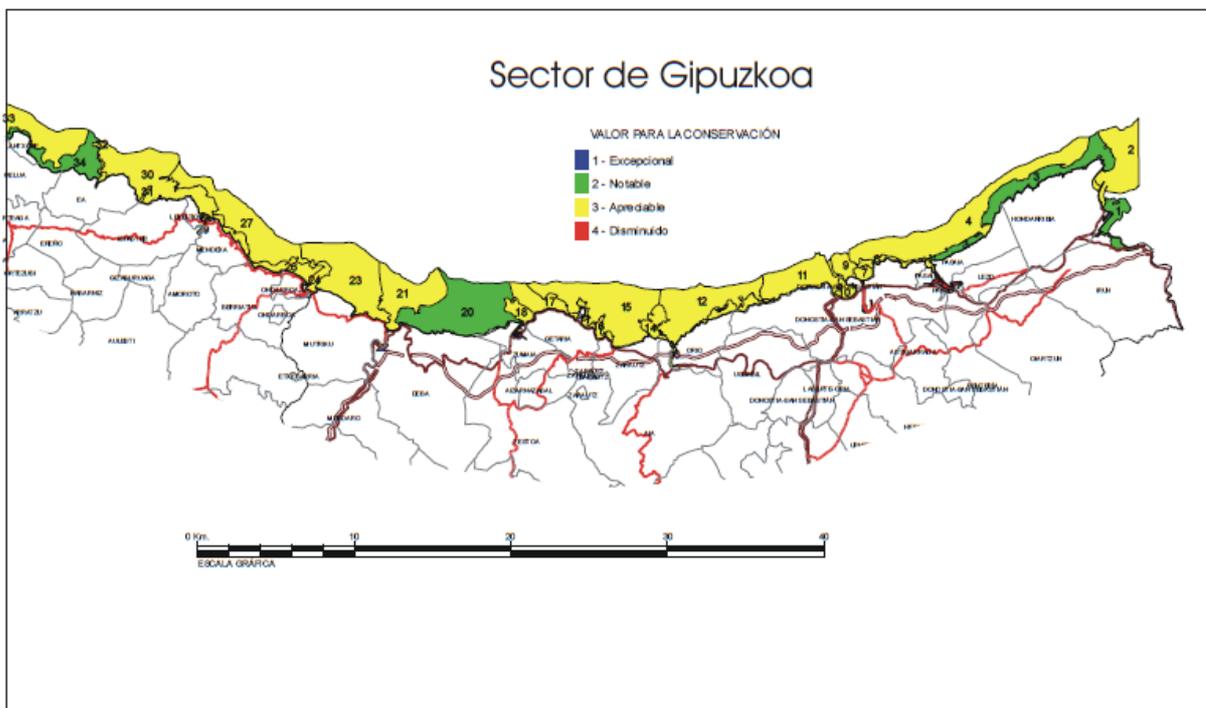


Fig. 22. Conservation value of coastal zones in Gipuzkoa

Source: *PTS de Protección y Ordenación Litoral* (2004).

PTS Agroforestal (Sectorial Planning for Agricultural and Forestry) – plan started in 2001 but has not been yet ultimately approved, because some individuals and lots of public administrations (regional departments, municipalities...) still have not managed to reach consensus. The main objectives are the following:

- Define and protect agricultural land.
- Fix the rural scene in order to know the situation and the characteristics of the exploitations.
- Define a territorial planning with a rural perspective.
- Define a legal system and actuation instruments to defend the sector from non-forestry or agricultural uses.
- Gather the planning criteria of other plans and programmes like DOT or rural strategic plans.
- Unify concepts and criteria about non-building land.
- Make compatible rural and environment protection.
- Coordinate sectorial rules and policies to make easier the application.
- Assure the diffusion of the document in order to integrate the agricultural and forestry policy with other sectorial policies.

Each year there is a monitoring of a current land use stage. The results are published in a book titled "*Udalplan – Sistema de Información Geográfica y Banco de Datos Territoriales de la CAPV*". Example of an interactive tool to search for spatial coverage of one municipality (Legutio) can be seen below. This is a very good tool for on-going monitoring and evaluation of the changes in spatial planning.

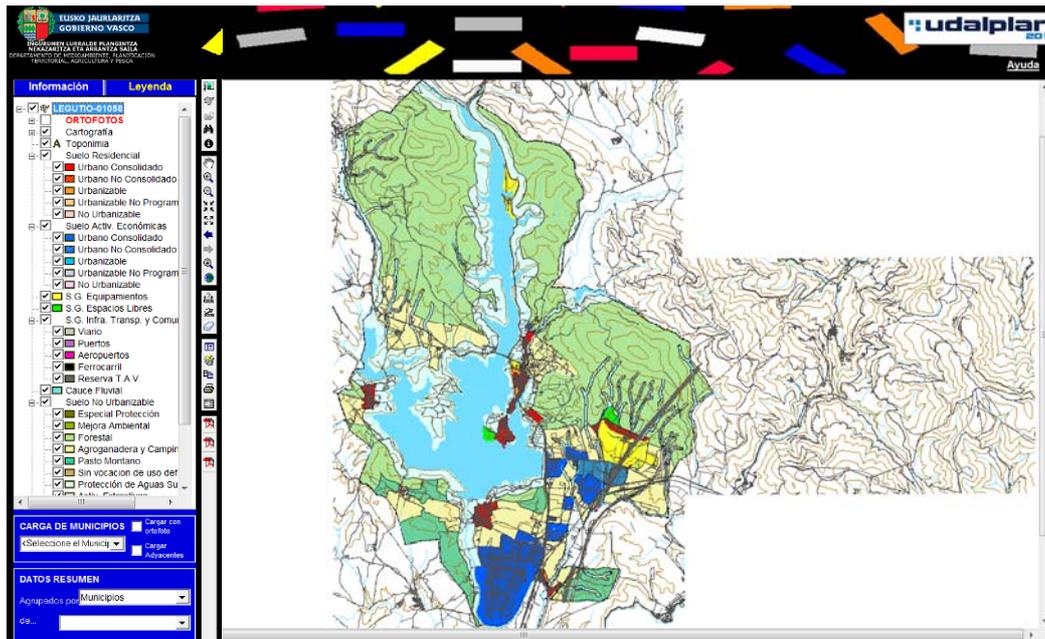


Fig. 23. Spatial coverage of Legutio municipality (in the north from Vitoria-Gasteiz)

Source: Udalplan 2011 (2011).

It has to be underlined that important element of the contemporary changes of spatial planning are the territorial and horizontal strategies of development mentioned above. They provide a set of important and useful tools in rational planning.

Because an important element of the case study is a Eurocity Bayonne-San Sebastián, this structure needs also to be mentioned about shortly.

In January 1993, the primarily responsible institutions – i.e., the Provincial Council of Gipuzkoa and the Biarritz-Anglet-Bayonne Urban Community (then the District Community) - signed an agreement committing the signatories to foster cooperation between the institutions on both sides of the border. The cooperation project aims to deal adequately with the challenges posed by the Single Market and seeks to position the Bayonne-San Sebastián conurbation in a competitive situation within the European urban system. Then, the cross-border observatory was formed in 1997 under the form of a EEIG, consisting exclusively of the Diputación Foral de Guipuzcoa and the BAB (Biarritz – Anglet – Bayonne) District. It was transformed into the “Cross-border Agency for the development of the Basque Bayonne-San Sebastián Eurocity” in 2000. This structure is both a technical and political tool aimed at revitalising cross-border cooperation through four missions: to conduct or commission studies, seek funding, coordinate public or private initiatives and develop joint initiatives with national authorities and at European level. Since then, significant projects have been developed: a prospective document (White Paper in 2000), a cross-border convention on waste treatment, the creation of the Consorcio Bidassoa-Txingudi (legal structure including Hendaye, Irun and Fontarabie), and the project which is currently under preparation: the Atlantic-Pyrenees Euro-Institute (<http://www.espaces-transfrontaliers.org>). On the general level the sectorial policies and common interests in the Eurocity can be listed as below:

- environment - the air, the coast and the mountains;

- culture - joint proposals;
- tourism - synergy and complementarity of Biarritz and San Sebastián;
- social services - mutual acquaintance especially in the sphere of child-care
- sport - concentration on legal issues;
- public health - the harmonisation of public health policy in the field of epidemiological and financial information (*The Basque Eurocity...*, 2004).

3.4. Location

The location of the Basque Country is one of the main advantages in its development. At a first look its location can be treated as a peripheral one – far from capital city and on the border of the state. But, taking into account that Spain is rather federal state and not a centralized one and that the Basque Country has a relative high independence, the distance to Madrid is inferior in importance. Through the Basque Country runs one of the two main road axes linking the Iberian Peninsula and the rest of Europe. This situation whereby it as an obligatory point of passage for road traffic, naturally results in a high flow of traffic at different levels (local as well as trans-European) and of different natures: people (cross-border workers, tourists, patients, students, etc.) vehicles (24,000/day). Such amount of vehicles – is above average values on the European scale. A third of the vehicles are trucks and, in summer, the flow of cars increases threefold.

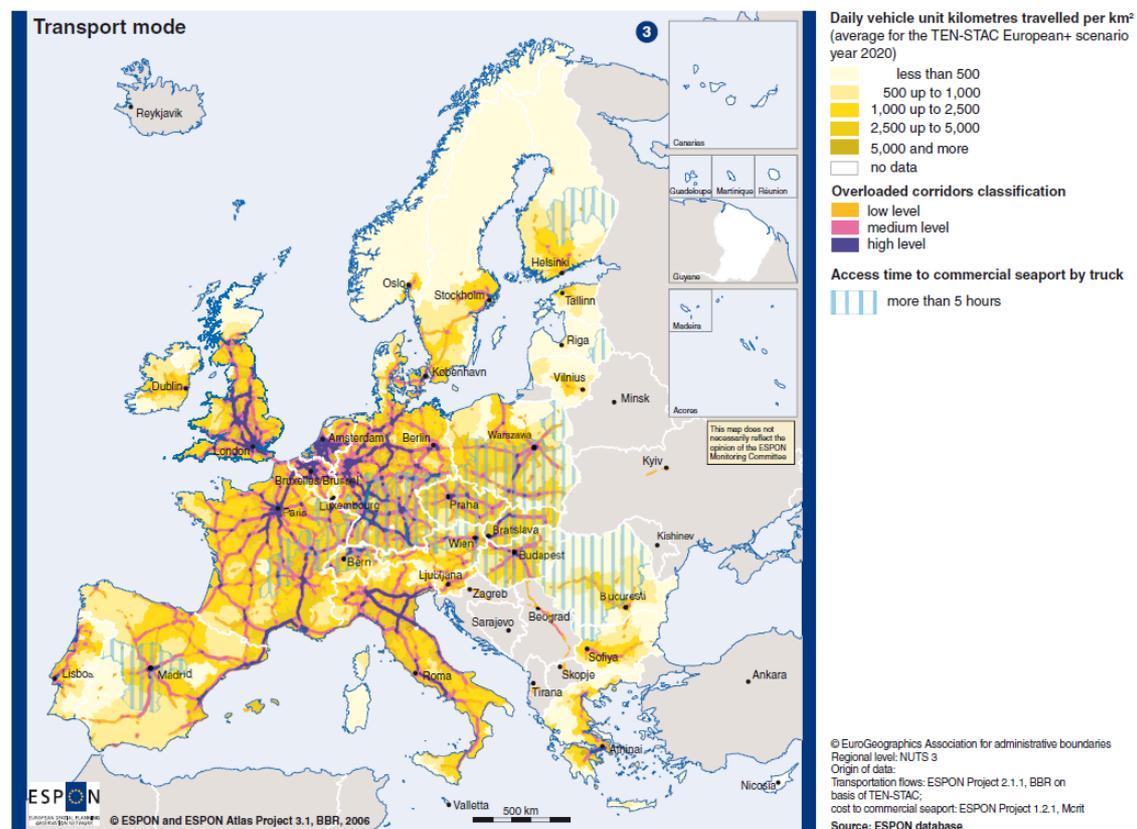


Fig. 24. Transport mode in Europe
Source: ESPON Atlas (2006).

Also, connections by other means of transport are very well developed in the Basque Country. There are direct ferry connections to the United Kingdom. In addition, train connections are of key importance – the same transport corridors as motorways. In the Basque Country, there are two important sea ports – in Bilbao and near to San Sebastian (Harbour of Pasaia). The Basque Country has got three airports. First, Bilbao Airport, is located 9 km north of Bilbao – with over 4 million passengers per year being one of the biggest ports in Spain. There are direct flights to many European capitals and other cities. A fast development of that airport is observed – for example, in 2000 there were 2.5 million passengers. The second one, San Sebastián Airport, is located in the municipality of Hondarribia. The airport serves a few domestic flights only. The last one, Vitoria Airport, is situated near Vitoria-Gasteiz and is a commercial airport⁷.

The railway network is connecting the Basque country with France and the rest of Spain. In parallel to accession to the EU, Spain has started the construction of fast speed railway lines. Nowadays, in the Basque Country the high speed rail network between Bilbao, Vitoria-Gasteiz and San Sebastian is under construction. “The Basque Y” will transport cargo and passengers. In plans, there are short segments between main station in major cities and their industrial zones (Figure 25).



Fig. 25. The Basque Y – high-speed rail network

Source: <http://www.euskalyvasca.com/en/home.html>

The project aims to elevate the Basque Autonomous Country to the status of a future core region. The project envisages to bond together the European space by facilitating the North-South connection, from Madrid to Paris, or the West-East link, from the Atlantic Ocean to the Mediterranean Sea. It has a huge potential for revitalization and transformation of the territory lying far beyond its administrative boundaries.

⁷ Airports' homepages.



Photo 5. Construction of the new transport infrastructure – near Bilbao.

Source: own materials.

Processes such as the transformation of Bilbao have helped this city to recover its role as a centre of advanced services, commerce and entertainment for a wide territory north of the peninsula and South of France. Trade, the number of visitors and tourists, traffic flows and attraction of foreign investments are some indicators of the growing consolidation of the core concept and the new prominence of territory.

Thanks to such location, there is a fast development of road infrastructure and also logistic centres as well as other industrial and services infrastructure. Concluding, the location of Basque Country in relation to European circumstances is highly favourable. The development of transport connections and surrounding infrastructure is an important factor in land use changes and land use functions' changes, which will be taken into account more deeply in other chapters.

What is also important to general overview of this region are good internal connections. Between all three main cities (Bilbao, San Sebastian and Vitoria-Gasteiz) are motorways and national roads. Also, other smaller and bigger towns can be easily reached via high-quality transport roads. The challenge for the future development of the region is to increase the number of people using the public transportation instead of private cars.



Fig. 26. Road infrastructure in Basque Country

Source: Atlas Nacional de España – Demografía (2008).

3.5. Conclusions in the context of land use

Concluding the general description of the narratives, some of the elements which have very important impact on the current changes of the land use should be underlined.

- (1) Big density of population. The Basque Country is one of the most densely populated areas in Spain, but for the last 20-30 years stagnation has been noted in the total number of population. It is an effect of a stable population natural growth and a small migration from other areas of Spain and other countries.
- (2) Diversified settlement system between coastal area and interior. Concentration of population in three capital cities (Bilbao, San Sebastian and Vitoria), some development of the towns in the coastal and transport corridors and relatively uninhabited inland areas of the region.
- (3) Relatively sustainable development of a coastal zone. Because of the relief (rocky areas with some bays and estuaries) the settlement cannot be so intensive as on the Mediterranean Coast. That is why the changes are not so rapid and so intensive. Development of tourism in the Basque country has never been as intensive and massive as on the Mediterranean Coast and on islands. It was much more selective, restricted to some well situated and well educated visitors (examples are visible till now – the Film Festival in San Sebastian or San Sebastian as a Cultural Capital of Europe in 2016).
- (4) Relatively highly favourable socio-economic condition of this region – the level of unemployment is lower than national average, the wages are higher and general level of development is above national average too.
- (5) Rapid industrialization processes in the 50s, 60s and 70s of the 20th century. Industrial activity is still an important element in the regional economy. However, nowadays, a revitalization of some industrial areas can be observed, adapting these areas to the services, residential or public developments, as well as establishing open spaces. Highly intensive development of transport infrastructure – railway, motorways, harbours and airport in Bilbao.
- (6) Development of the main cities – projects that facilitate the development of social infrastructure, creation of towns with special regard to aesthetic considerations (destruction of some roads, industrial buildings, etc.), promoting public transport, creating big towns much more compact and complex.
- (7) Diversified relief determines, to some extent, the development of certain socio-economic and infrastructural elements – i.e., settlements, linear elements of infrastructure, land use.
- (8) Attention paid to improvement of the environment quality – by way of social programmes and strategies – e.g. promoting the public transport, improving the quality of air.

- (9) Highly important element in the rational planning of land use and land use functions is the law regulations in the Basque Country. The set of legislative documents – such as strategies, plans, GIS tools – and hierarchical planning system provide superior and effective instruments for complex and rational spatial planning. The spatial and sectorial strategies, and the ways of implementing and monitoring these, are an important tool that is useful in harmonious and planned development of the region.

4. ANALYSIS OF LAND USE CHANGES

4.1. Dynamics and directions of land use and land cover changes

The Basque Country is strongly diverse in the land use structure respect. We can separate some specific regions with different land use and land cover: the urbanized cities (Bilbao, Vitoria-Gasteiz, and Eurocity Bayonne – Donostia - San Sebastian); agriculture land in Araba, mountains region in Guipuzcoa. All these regions are well connected by transport infrastructure: express roads and highways.

In this report, we focused primarily on the Basque Country which covers only a part of Spain. In some paragraphs we focused on Eurocity Basque Bayonne- Donostia- San Sebastian, which is located on the both sides of the Spanish-French border. The analysis varies its point of view in accordance with the needs and statistic base.

Dynamics and directions of land use as well as land cover changes are analysed on the NUTS 2 and NUTS 3 level.

Figure 28 presents also land cover flows noted in the period 2000-2006. Land Cover Accounts summarize and interpret the $44 \times 43 = 1892$ possible one-to-one changes between the 44 Corine land cover classes. These changes are grouped to so-called flows of land cover and are classified according to major land use processes:

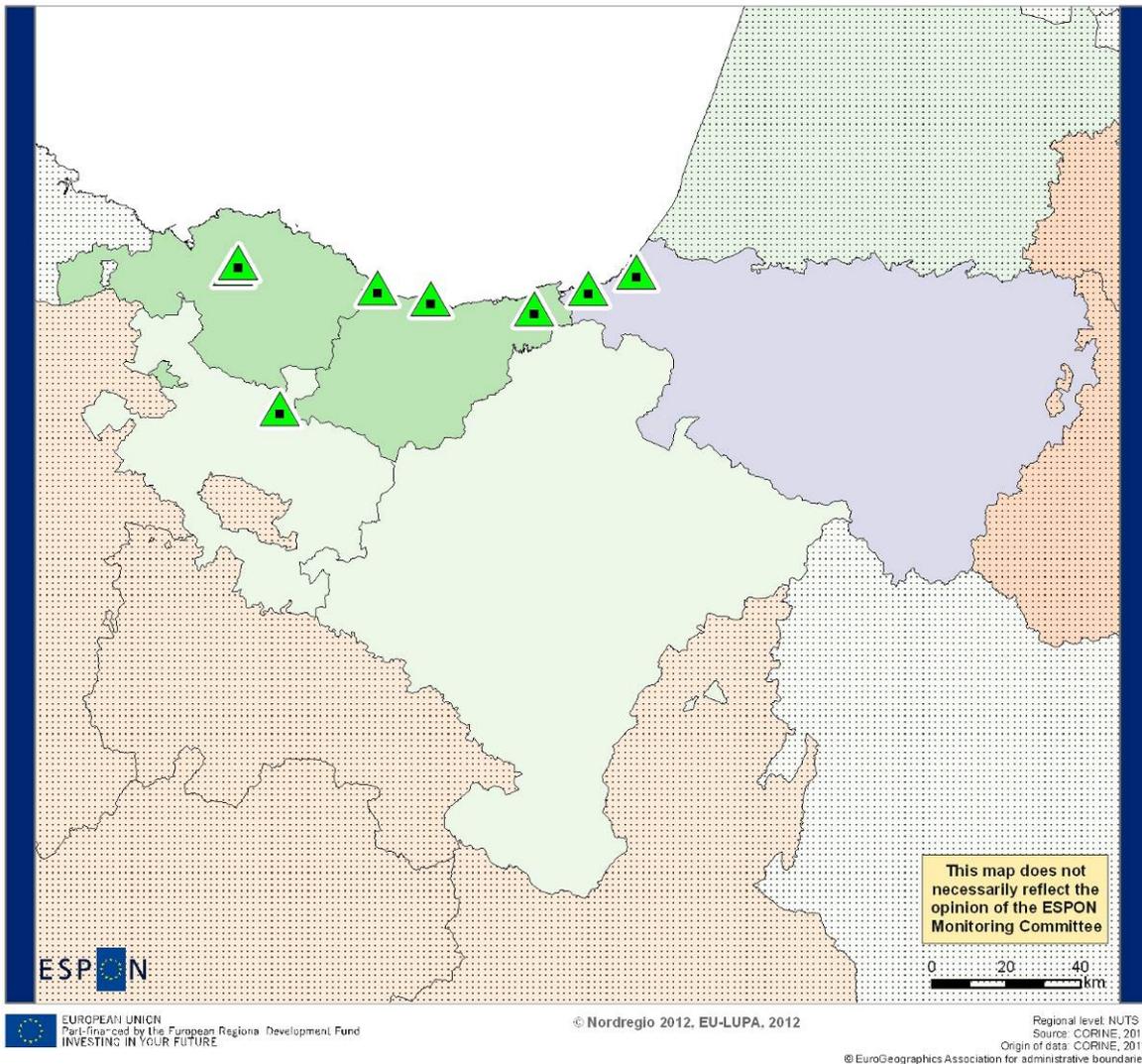
- lcf1 Urban land management
- lcf2 Urban residential sprawl
- lcf3 Sprawl of economic sites and infrastructures
- lcf4 Agriculture internal conversions
- lcf5 Conversion from forested & natural land to agriculture
- lcf6 Withdrawal of farming
- lcf7 Forests creation and management
- lcf8 Water bodies creation and management
- lcf9 Changes of Land Cover due to natural and multiple causes

Basically, the classification of land cover flows distinguishes change between broad land cover classes and changes that are internal to these classes.

As can be seen on the figures, changes in each part of the analysed region are different. On the French side, extensive or complex agricultural intensification took place. There was low intensity of changes. When analysing the land cover flows in this area, we can notice some urban sprawl or urban land management. The Navarra region was classified as agriculture extensification area, where the intensity of changes was low or with a leaning toward extensification. Araba was classified as region with agricultural internal changes or intensification. Regions of Bizkaia and Guipuzcoa were classified as the ones with internal changes of forest, when we descend to a lower level of regionalization.

1990 – 2006 Land Change Typology

Eurocity Basque Bayonne - San Sebastian



Land Change Typology

- Very high intensification with artificial surfaces replacing mainly natural areas
- Very high intensification due to specific areas of residential and economic sprawl
- High intensification due to residential and economic sprawl surrounding urban conversion
- Medium-high intensification due to diverse urban processes
- Medium-high intensification due to diverse urban processes
- Medium intensification due to some urban sprawl combined mainly with forest conversions
- Medium intensification - dynamic mix between agricultural/forest changes and urban sprawl
- Low intensification, dynamic mix between agricultural/forest changes and limited urban sprawl
- Low intensification mainly due to agriculture and forest changes
- High extensification due to forest and agricultural changes but specifically the withdrawal of farming

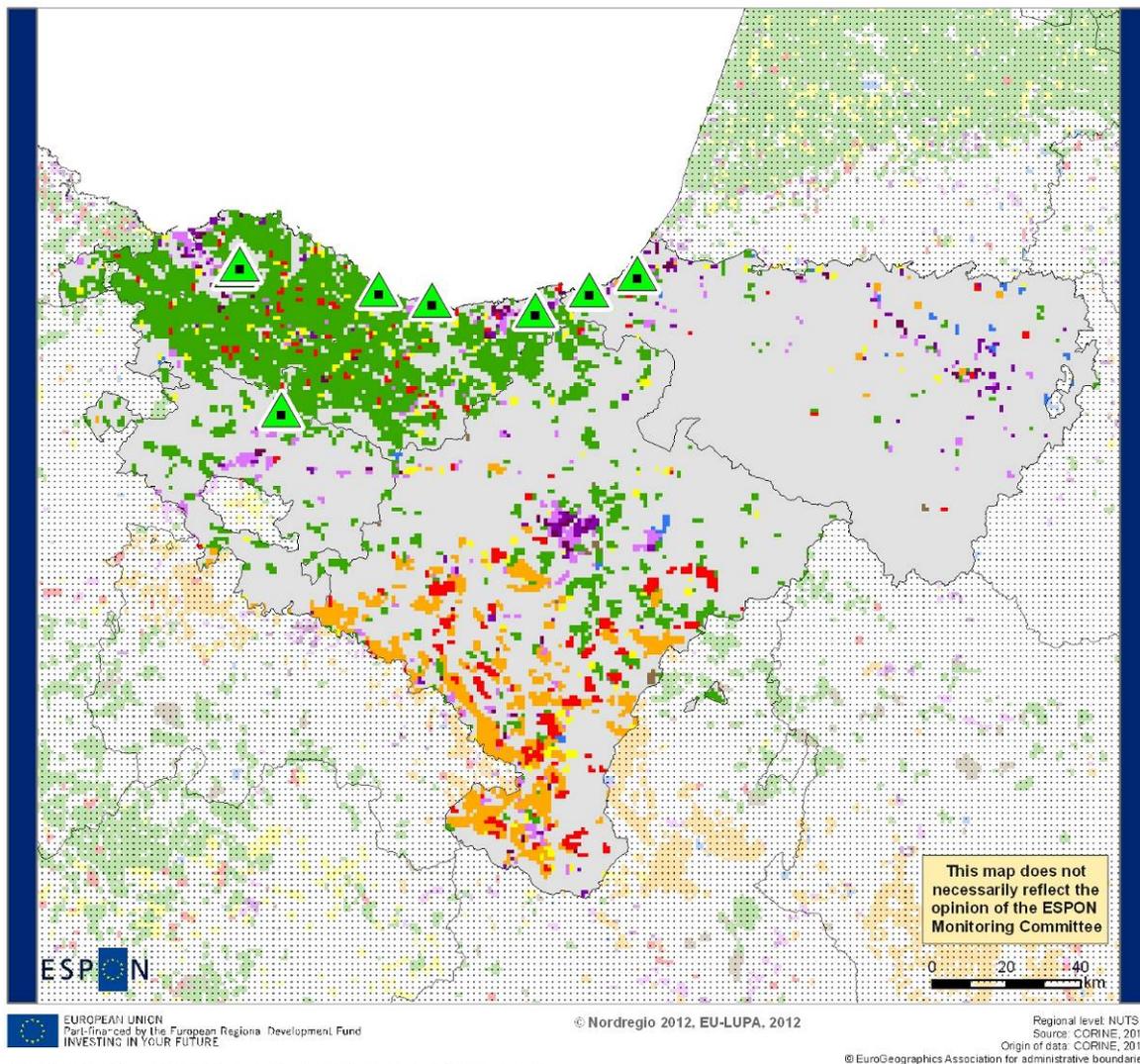
- Points of investigation
- Areas outside the case study region

Fig. 27. Land Change Typology (1990-2006)

Source: Nordregio, based on Corine Land Cover

Land Cover Flows 1990-2006

Eurocity Basque Bayonne - San Sebastian



Areas Subject to Land-Use Change

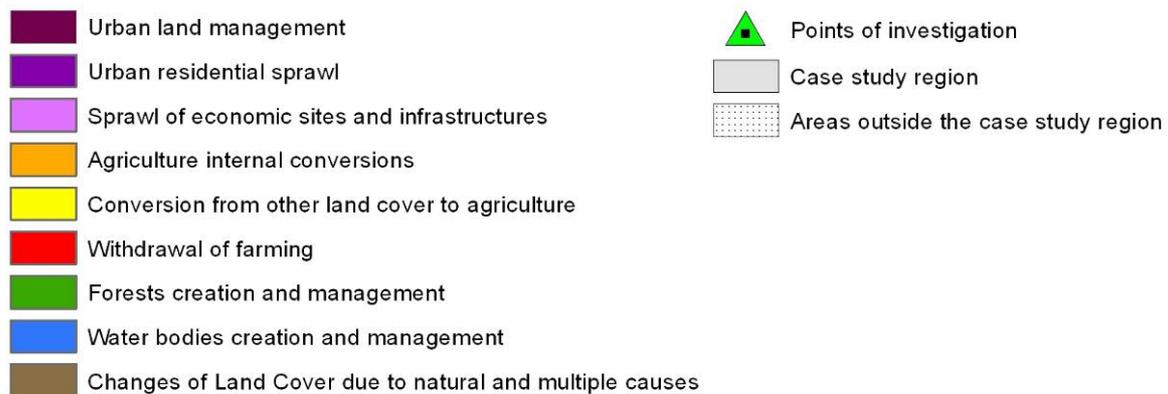


Fig. 28. Land Cover Flows (1990-2006)

Source: Nordregio, based on Corine Land Cover

Looking closer at the broader area that includes the Basque Country Region, Atlántiques Pyrénées and Navarre, it turns out that the land cover and land use is closely related to the terrain. A high proportion of hill and mountainous areas, large denivelations (height differences) of area or location on a rocky coast determine the type of vegetation and activity that can be seen in this region. More than 90% of land is covered by undeveloped land like forests, agriculture areas, special protection areas. The highest percentage of this type of land is common in the mountainous area of Araba. But differences in relative numbers are not markedly striking. On the whole, agriculture and forest areas are dominant; other types of lands constitute just barely 8%.

Three types of land use dominate in the analyzed area: forests, special protection area and agriculture with farmland. Forest dominates in Araba: this form of land use covers 31.5% of the region’s surface and, at the same time, constitutes 34% of green areas in the region.

We should notice that the quality of forest is not the same in each region of the Basque Country. Nowadays, there is barely 5% of good quality natural oak forest in the whole region, as compared to originally 80%. Most of the areas which in statistics are classified as forests in actual reality are plantations of trees. The quality of forest in Araba is very high as compared to other regions.

The highest percentage of agriculture area is in south part of the studied territory – in the Araba region. In the analysed period, the surface of agricultural area decreased from 255 290 ha in 2000 to 242 780 in 2007. The critical factors that influence this situation are urbanization processes and other ways of land use intensification.

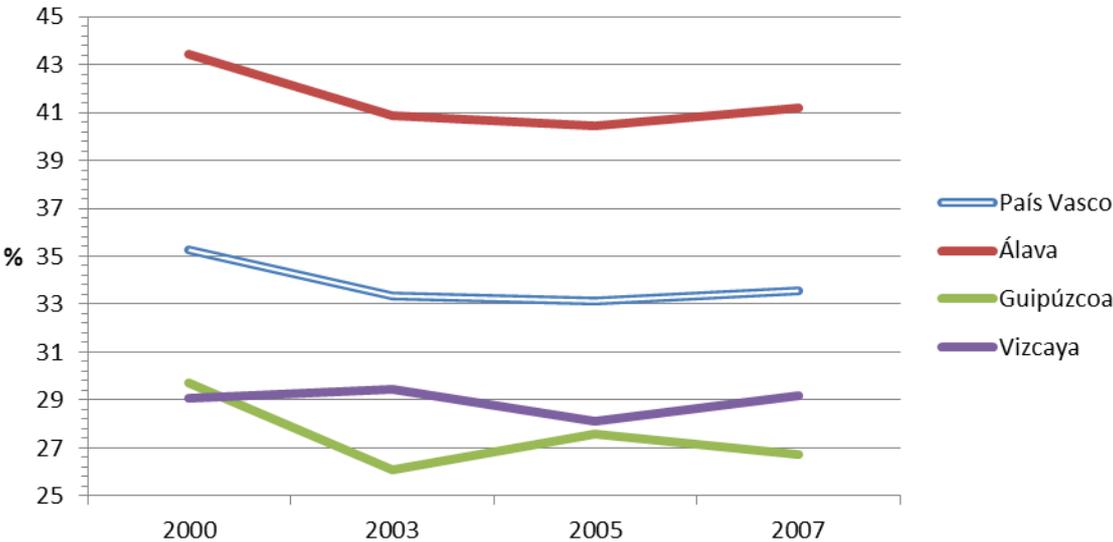


Fig. 29. Total agricultural area
Source: Eurostat 2012

Total area of arable land also decreased – in the 7-year period this area was reduced by about 8% (Figure 29). Most part of the arable land was occupied by cereal crops (primarily wheat, spelt and barley). Area of root crops, potatoes, sugar beets decreased in the period 2000-2007. Only area of fresh vegetables and industrial plants experienced an increase. Surface area of permanent pasture and meadows

decreased in all the regions (Figure 30). The most significant drop was observed in Araba.

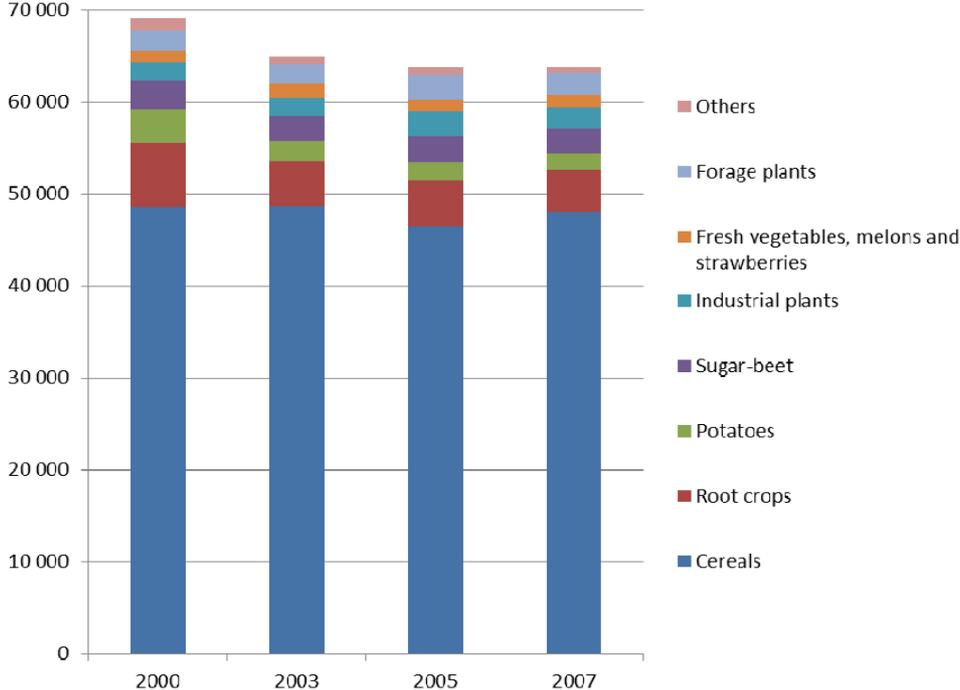


Fig. 30. Structure of arable land in Autonomous Basque Country (in ha)
Source: Eurostat 2012

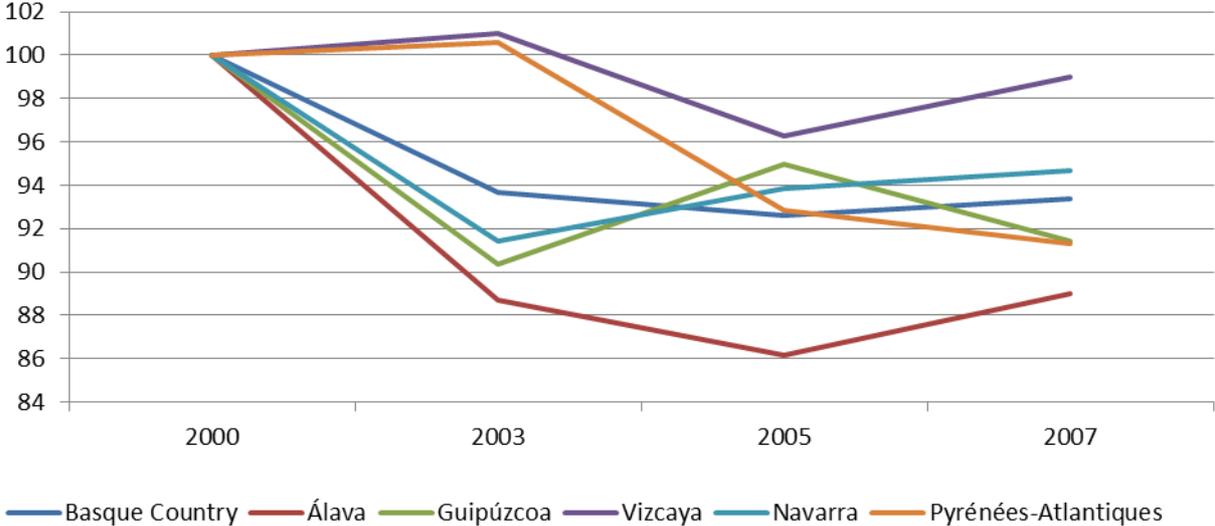


Fig. 31. Dynamic of changes permanent pasture and meadows (in %, date for 2000 - 100%)
Source: Eurostat 2012

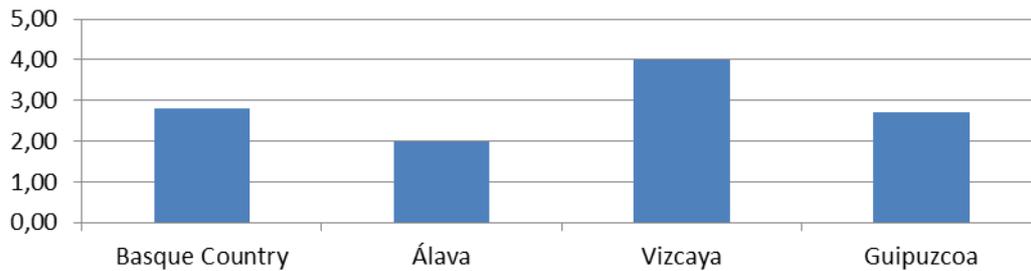


Fig. 32. Share of residential land in Basque Country and its districts in 2000

Source: Eurostat 2012

Coastal area in Eurocity Basque Bayonne- Donosti- San Sebastian Region is highly urbanized – it belongs to Spain’s industrial north. In this area, there exists a lot of forms of industry, tourism logistics and services centres. Towns (Bayonne-Anglet-Biarritz Conurbation community on the French side and San Sebastián on the Spanish side) in this coastal cross-border conurbation have 600,000 inhabitants. Also, other two big cities – Bilbao and Vitoria – Gasteiz, which are the capitals of provinces, have a highly urbanized area. Bilbao have 354,145 inhabitants, but the Greater Bilbao – the one of the biggest Spanish metropolitan areas has almost 1 million inhabitants. The agglomeration of Bilbao includes city and surrounding municipalities of Derio, Etxebarri, Galdakao, Loiu, Sondika, and Zamudio to the north; Arrigorriaga and Basauri to the west; Alonsotegi to the south; and Barakaldo and Erandio to the east.

The second biggest town – Vitoria-Gasteiz is the capital of the autonomous community of the Basque Country. City has a population of 235,661 people.

The Basque Country in its structure is similar to other urban complexes in the world: it has a similar size and population. Many residents live in San Sebastian and works in Vitoria, companies from the region use the port of Bilbao. Daily operations makes cities closer together, creating a consistent market. There are some characteristic features which characterize a city region, like the Basque country. First, urban sprawl and new forms of land occupation have a huge impact. In the Basque country, we can notice the transformation of villages’ residential centres, the rise of new communities, the rise of new centres in areas that before have been of peripheral character, which are now being linked to the major shopping and leisure centres. Second, the new transportation systems link distant spaces, channelling growing demands for mobility. We can also mention global connection elements associated with ports and airports, high-speed trains, new logistics platforms, public transport systems, like metro, tram, improved intermodal connectivity between different systems, high-level telecommunications infrastructure. The last one is sophisticated and increasingly complex system of high level services and facilities. In the new economy, operating globally requires an extraordinary level of complexity. For businesses in order to operate globally, it is needed a support of a wide range of highly complex and specialized services (intellectual capital, consulting, legal, marketing, new technologies, transportation, financial, etc.), that can only be located in urban nodes of a certain size, that is, e.g., in cities and territories of a certain critical mass. Availability of specialized support services to companies is for cities a key precondition to attract competitive and innovative businesses that operate globally.

4.2. Trends, actors and drivers of the changes (micro and macro scale)

Population of the Basque Country have been increasing during the last 20 years by about 20,000 people. There is a high internal migration: people living in the peripheral, forested and mountain areas are moving to cities and to the coastal area. This phenomenon is caused by labour market in the north of the region. San Sebastian was previously a health resort with mild climate. As time went by, the aristocracy began to build houses and city became popular and expensive. Bilbao in 1960s was an industrial city, but after outbreak of the oil crisis in the beginning of the 1970s local authorities had to change strategy of development. They opted for a high-tech industry and tourism, with a particular focus on modern art. There were some changes in the landscape of the region: heavy industry was replaced by modern technology, based on the rapid development of transport accessibility.

In the Basque Country, the urbanization process is highly visible. Urban municipalities between 40,000 and 100,000 inhabitants have been losing their population by about 0.4% per year. On the other hand, in rural municipalities that are located close to the big city, the number of population has been on the increase (by about 15% in the last decade). A lot of new houses in the rural areas are holiday cottage houses (second homes for people from cities) (*EuskalHiria_Net...*, 2007). A number of functions are concentrated in the capitals of provinces, where there are infrastructure growth and better job opportunities - as a result, the brain drain occurs. Parallel to the development of the cities' centres, an expansion of metropolitan areas took place. There was a significant change in performance space: old industrial and port buildings disappeared – instead high-tech companies turned up. In Vitoria-Gasteiz, local community has addressed urgent problems and actively started works to restore the historical centre. In San Sebastian, various initiative have been launched, such as; the network of museums, concentration on the proposed widening of tourism, knowledge-intensive activities, or the renewal of the Pasaia Bay.

Coastal areas are becoming increasingly popular. However, the trend is different than in the south and west of Spain, which is dominated by sandy beaches. In other coastal regions in Spain, tourism approach plays a dominant role. Hotel complexes, restaurants are being built and services for tourists are being developed. In the area of the Basque Country, coastal tourism is focused mainly on the domestic tourists, who in this area are building their second, cottage houses. Most of them are people from the same region. In rural areas of the Basque Country rural tourism is rapidly developing (largely due to the fact that it is a more profitable form of tourism), which is geared toward foreign tourists from Scandinavia, Britain or Germany. With the development of rural tourism, agrotourism farms and organic farms proliferate. Also, they are equipped with sports infrastructure: golf courses, horse stables. In the farms orchards and gardens are cultivated, which use only environmentally-friendly methods. The quality of agricultural products is increasingly improving.

Nowadays, lack of biodiversity presents the most severe problem for environment. Forest areas cover 54% of the Basque Country, which is of a high value, but one should bear in mind that these forests are mainly composed of two species of trees: eucalyptus and pine. In the area of the Basque Country there are virtually no natural forests; most of these are plantings and plantations of trees. In recent years, organic farms are growingly gaining in popularity. Traditional agriculture is becoming less and less important, because of ageing of people working in agriculture.. There is a fashion for healthy foods, thus organic and ecological farming is highly popular.

In Spain, the responsibilities of housing policy rest on three different governmental levels: central, autonomous and local ones. As regards central level of government, it has to coordinate housing as an economic sector, together with general planning of economic activity. It is responsible for planning and distribution of credits, applying housing taxation through income tax. The central government has to prepare and approve the financial framework for housing policies. The autonomous government exercise control over regional planning, as well as pursues housing policy. In addition, this kind of government is obliged to provide a set of rules and regulations at the regional level, and to control accomplishment of basic regulations on the central and regional level. The autonomous government is responsible for management of housing policy programmes. That level of authority has to facilitate development of public housing, as well as acquisition and management of public land. Representatives of autonomous government have powers to sign agreements with local corporations in order to develop public housing.

Third level of government has responsibilities concerning land planning, issuing building permissions, managing and controlling of municipal inheritance taxes with regards to housing and land. The local government is obliged to develop local housing (Eastaway et. al, 2004).

One of important driving forces of change in land use are prices of land and houses. In recent years prices have increased enormously. This is important problem for affordability of households. Cheaper land and houses are located in the greater distance from a city or in less friendly landscapes. Second significant driving force is changes in property of houses: on the Spanish housing market there are a lot of private investors and almost no whatsoever public owners.

Despite the fact that since the 1980s, the central policy concerned with housing is trying to improve the availability of private flats, still the housing market has not yet been provide with significant stimulus. In the same period, other policies and laws were implemented, introducing, for example, rented laws or fiscal benefits for owners. Additional factor that facilitate the development of housing estates is a state subsidy for developers and households for the construction or purchase of freehold flats (Eastaway et. al, 2004).

4.3. Contemporary and potential conflicts

In the Basque Country, fortunately, barely a small number of contemporary conflicts can be noticed. It is largely due to superior spatial planning.

There are some conflicts caused by lack of continuity in the positions of power. Various political parties want to pursue policies in different directions. A common nuisance is different interests of individuals and communities. The most common problem is the construction of shopping centers or a new infrastructure. In addition to a confluence of interests, there are also the coordinating mechanisms that enforce compliance with existing regulations. EU regulations state, that spatial planning is of great importance and cannot respect the rules of an open market. This is a new problem, since the government imposes more limits in the guidelines, regarding, for example, that reconstruction of old buildings in cities is rather more important than a new housing development in these.

The most important task is to maintain the environmental balance. Recently, most widely known issue is the building of the Port of Pasaia. It raises problems, owing to its hugely negative impact on the environment, as well as for economic reasons. One might also ask whether the construction of the port will be profitable when operating in close proximity to the port of Bilbao. The construction of ports and harbours has always involved a conflict with the environment, protection of biodiversity and tourism. Also, the urbanization and depopulation of peripheral areas with low accessibility are also matters of great concern.

4.4. Scenarios

First, the Basque polycentric system is a key factor to the consolidation of the City-Region. The availability of three major urban areas is an important advantage. These are characterized by an exemplary territorial arrangement, and little distances between them. Bilbao, San Sebastian and Vitoria-Gasteiz are three cities that are full of attractive, increasing complementarities between them, and also they all experience, according to their own idiosyncrasies, exciting development processes and urban improvement. The future challenge is to continue betterment of quality and consistency of internal nodes for each of these cities, fostering a development of close relationship between them and agreeing on strategic complementarities of urban profiles between each of them.

The Basque Country has an attractive network of medium-sized cities that are key areas for integration of urban and rural landscapes, in which built-up and natural areas may coexist, preserving a characteristic landscape of their territory. These medium-sized cities are urban centres of great importance to the overall balance of the territorial structure, and to maintaining the social balance by developing the strong sense of belonging of its citizens, as well as to maintaining the balance between places of residence, work and leisure that should determine the future model. Here, the challenge is to improve an urban quality and integration with the environment, factors being of key significance to widening its appeal and potential development, which may halt its deterioration and strengthen the economy and diversification of production in this model of the Basque system of cities.

In the Basque Country, three principal objectives of “The cross-border cooperation project (II)” are realized: rooting the Basque culture in common identity, opening to and preparing to contributing to construction of Europe and creating new metropolises in the European urban system.

It is too early to say whether the review of planning, which is now taking place in the context of the current housing and construction crisis, will see the land occupation as envisaged in the current urban development plans, i.e. as a point phenomenon triggered under the new technical, social and economic circumstances, so the question remains open whether the current approach will be continued in the future.

According to Alfonso Sanz Araujo, the future of the Basque Country lies in an idea of Euskal city – i.e., the link between three biggest cities in the Basque Country. If you think about the Basque Country in terms of a big city, the cohesion in spatial planning will be very easy. The Basque government should think about airports, universities and university campuses. Also, an important problem that is going to be faced in the following years is the necessity of development of another big seaport in Pasaia.

5. MULTIFUNCTIONALITY OF LAND USE

5.1. Functional differentiations

The Basque Country is characterized by a relatively big differentiation of the relief. That differentiation affects the possibilities of development of specific functions in particular areas. The most characteristic feature of functional differentiation is the fact, that due to traditional division into three provinces, there are three equal (in the administrative understanding) cities – Bilbao, San Sebastian and Vitoria-Gasteiz. Each of these cities has a relatively different economic specialization, but all of them attempt to be a compact urban settlement – with all possible services of general interests, development of R&D centres, development of tourism and modern transport infrastructure. From the economic point of view the most important town in the region is Bilbao and its agglomeration. It can be noticed that inside of these towns there is an ongoing process of revitalization – the old industrial districts are transformed into the public spaces (parks, museums, etc.) and housing or industry functions take the place of the old functions. Thus the functional differentiations of the cities are decreasing, and, nowadays, the domination of the housing and service functions can be noticed.

Around the three major cities (especially Bilbao and San Sebastian) we can observe the fast development of the neighbourhood towns. It is all possible, because there is a very well developed transport infrastructure, with huge possibilities of travel offered by public transport. The very good connections (via motorways or fast double lines roads and railway system) provide the possibility for efficient travel time to the main cores of development in the region from many locations. The development of the settlements is especially evident on the west-east axis via motorway E5. In that area, there are not only settlements with developed housing functions, but there is also a fast development of logistics, industry, manufacturing, transport, shipping, technological parks, harbours (in Bilbao and Pasaia) as well as other functions (it is well exemplified by Irun town close to the French border). Due to a privilege of having a very good spatial location (motorway, airport and two important harbours), a belt of over 150 km around motorway E5 is not only the most densely populated but also the fast developing zone in the Basque Country, being one of the most developed areas in Spain as well as in Europe.

Next, there is the belt of towns that are located mostly in the estuaries of the rivers by the ocean. These towns are relatively small – the largest one is (except for San Sebastian agglomeration) Bermeo with around 17 thousand inhabitants (and what can be of interest, it has had a stable population since the 1970s). The development of these settlements is limited by the relief – In most cases, they are located in the bays which are surrounded by the rocky cliffs. That is why they cannot develop and spread its size in an unlimited way and all directions. Also, an important factor in the development of these towns is the way and philosophy behind development of tourism. These settlements have not developed the massive tourism functions as is observed in the Mediterranean coast. Due to colder summers, the development of tourism functions is less intensive and rather more selective and exclusive. The best example provides San Sebastian – the Cultural Capital of Europe in 2016 (together with Polish city Wrocław) and also the host of the famous film festival – has the highest flat prices in the whole Spain. Apart from that, the development of tourism is much more selective, depending, to a larger degree, on the domestic market than

international. Some of these towns are carrying out not only services functions (settlements, tourism, commercial activities) but also industrial ones – being largely dependent on fishery (best examples are Bermeo and Getaria).



Photo 6. Example of one of the Spanish towns located in the bays and estuaries – Bakio.

Source: own materials.

The rest of the region is sparsely populated – especially, in the southern part of the region (mainly Araba district). The biggest land surfaces of the regions are covered by forest (pine and eucalyptus). There are also rocky hills in the central part of the region (especially, Sierra de Gorbea). Also, some parts of the region (in particular, southern part of Araba) are utilized as agricultural land. Detailed description of the agricultural areas was given in the previous parts of the report.

5.2. Current multiple uses of land

Multifunctionality can be analysed at least on two different spatial levels – i.e., local and regional. When analysing that topic on the regional level, it can be noticed that the Basque Country as a whole can be called a multifunctional territory. As was described detailedly in the previous chapters, there are functions of great importance such as: housing, services, industry, transport, research, educational, tourism, forest, agriculture, marine, ecological, settlement and others. Intensification of each of these functions varies in accordance with each given area. Similarly, the importance of each function is varied, when looked at from different perspectives – economical or land use. While taking into account economical perspective, functions of major importance are transport and services, and conversely, from the land use perspective, forestry and agriculture are of greater importance. Also, we can notice general differences in the importance attached to these functions by comparing the Spanish and French side of Eurocity. As was already mentioned, the French conurbation is a low-density area (with 200 inh./ha) devoted mostly to tourism (leisure activities on the coast, health tourism, green tourism and cultural tourism), while the Spanish part (with 400 inh./ha) belongs to Spain's industrial north (food processing – mostly fish, construction and the manufacture of electric equipment). There is also a big contrast in the land usage – the French area has small houses set in large, green

gardens, the Spanish part is made up of high-rise housing blocks, industrial buildings and high-density old towns (Dubois-Taine, 2004).



Photo 7. Differences in the land use in Spanish (Bermeo – above) and French (Bidart – below) coastal area.

Source: own materials.

Analysing multifunctionality from the local perspective it can be stressed that there are a lot of changes in land use – especially in the cities and their surroundings. Many sites that were previously industrial nowadays are residential. According to the opinion of prof. Urrestarazu, nowadays there is a trend to create towns a little bit multifunctional. Previously urban development has been very sectorial, in one aspect, residential, in another one commercial (malls), in other industrial and so on. Nowadays, there are some ideas about multifunctional use of the urban space to reduce environmental impact. Certainly, some of the functions have to be located outside the cities, however, the development of big cities is, nowadays, and should be, in the future, much more compact and complex. The urban growth must take place within the cities' limits, with the existing areas having to undergo restructuring, for example, old industrial areas.

It has to be also mentioned that in the cities and their suburbs, the process of intensification of functions can be observed – it means that less intensive functions are being replaced by more intensive ones even if that means that one monofunctionality is replaced by another monofunctionality. Intensification of functions can be measured again from the economic and land use perspective. The most common changes are as follows: transformation of arable land into the industrial, transport, technological, logistic or services functions. One of the best examples are the technological parks located outside of San Sebastian, Bilbao and especially Vitoria.

At the end it has to be underlined, that due to a very good spatial planning system in the Basque Country, the development of the area takes place under generally favourable legislative circumstances. That is way there are only rare cases of unplanned, rapid and chaotic development of certain areas, which can lead to conflict of some functions. That is why, rather a complementarity and co-existence of functions is prevailing.

5.3. Potentiality of multiple uses of land

In the future, we can observe further concentration of population in the major cities of the region and depopulation of the small towns or peripherally located settlements. Owing to this, the stronger development of the main cities should be noticed – accompanied with more intensive usage of the land around them and further revitalisation processes of the ex-industrial districts. According to prof. Urrestarazu, in the peripheral settlements one monofunctionality connected with agriculture will be replaced by another connected with a specific development of tourism (summer residences, selective tourism). General future trend will be then associated with intensive development of many co-existing functions in the centres and transport corridors, and extensification of human activity in the less populated areas. Again, in the future, spatial and sectorial planning will be rapidly gaining in importance, in the Basque Country. Due to natural conditions, the planning should be carried out in a proper way, because of lack of alternatives to location of some activities.

Also, in the future, the closer cooperation between three main Basque cities (Bilbao, San Sebastian and Vitoria) can be predicted – under the Euskal city concept (the Basque Y transport system) and also cooperation with Bayonne agglomeration in France – under the Eurocity concept. These stronger ties will also influence, to a certain extent, the multifunctionality of the particular areas. Thanks to a cooperation, some higher functions will be distributed to particular places (some cities), and others, instead of building and developing the same institutions and functions on their territories, will be using them in the neighbourhood cities. Thanks to such cooperation and increased specialization of the towns, the process of development of many functions will be somehow a little bit reduced.

6. POLICY CONTEXT OF LAND MANAGEMENT

6.1. Land use in the regional/local documents

In late 1970s Spain moved from a highly centralised system, where there were two levels of government (central and local), to a three-tier system. Nowadays, there are local, regional and central governments. In 1978, the regional government was established in the Constitutional Chart. The regional government consists of 17 self-governing Autonomous Communities or regions. The local level of management in Spain is sub-divided into two levels: provinces (52) and municipalities (about 1000).

The central government exercises very wide powers. In the context of land management, this level of government has powers in areas such as: setting the basic framework for and coordination of the general planning of economic activity, merchant shipping, ports and airports of general interest, air traffic control, air transportation, railways and inland transportation - when it takes place in the territory of more than one region, basic legislation on environmental protection and on woodlands and forestry. The regional government has different responsibilities primarily in the areas such as: regional and spatial planning, land use planning and housing, also railways and roads that are entirely within a given region's boundaries. Its other tasks are connected with ports of refuge, recreational ports, airports and also agriculture, forestry and woodlands. In addition, regions admit liability for implementation of environmental protection in matters relating to building and operating hydraulic infrastructures and resources of regional interest (e.g. channels and irrigation projects). On the lowest level of administration, local responsibilities are concerned with urbanism and housing, roads, ports and airports, hydraulic exploitation, channels and environmental pollutions.

Besides three levels of government (regional, provincial and local), since 1986, the European Union policy has played an important role in spatial planning. Spain have taken part in several projects that have been financed by the Cohesion Fund or European Fund of Regional Development.

The major document for land management is Land Planning Law (LOT) of 1990. Number of broader policies was being reduced in favour of sectoral decisions concerning land management. The next level of land use management is general land plan (in the Basque Country, it was in existence for 16 years). The second level is territorial planning. In this case you have, e.g. a defined number of houses, which can be built in this area. The last one is sector land planning. More about local and regional document was in chapter 3.3.

6.2. Influences of regional/local planning

The recent housing programme from the period 2002-2005 supports people with low income in the acquisition of a house and also simulates the rental sector in order to improve labour mobility. This kind of policy influences land use: investors need more and more land for infrastructure and housing estates.

Process of renewal have generated opportunities for the creation of attractive spaces that have allowed, particularly in Bilbao, to recover the dynamism population in central areas, forming a more vital space and diverse city in its overall image and

functions. The achievements of these projects, which have been highlighted in recent years, are an excellent indicator of the actions that can still be undertaken in the coming years: the completion of the Estuary Project, the renovation of the Bay of Pasaia, the new landscape linked to major logistic platforms of Araba, renovation of obsolete space, defining a future land use in the three cities, opportunities associated with construction of new stations of high speed train, etc.

One of the above-mentioned examples is the revitalization of the Bay of Pasaia. It used to be a harbour and industrial area. The project drawn up by the winning architecture company from the Netherlands (KCAP Architects&Planners) proposes that within the next 10 years the 70 ha of industrial area will be transformed into an open recreational and residential area. The visualization of the project can be found on the figures below.





Fig. 33. Location and visualization of the project of revitalization of the harbour in the Bay of Pasaia

Source: <http://www.sztuka-architektury.pl/>

7. CHALLENGES AND POLICY RECOMMENDATIONS (2020 PERSPECTIVE)

In the article, *Biarritz – Anglet – Bayonne – San Sebastian: How to organize and territory town?* (Dubois-Taine, 2004), the French author proposed three possible concepts of development of the Eurocity. The main aim of the development should be promotion of polycentric system with an extensive system of links. The first concept we can call “core model” – where the development is based mainly on two big conurbations – Bayonne and San Sebastian. Second model we can call “polycentric”, where Bayonne and San Sebastian function as a bi-pole structuring the whole area, and the other towns (eg. Irun, Saint Jean de Luz) have the complementary functions. The public policies implemented are oriented toward setting up an equilibrium and complementarity between all these centres, not essentially, in terms of population but rather of a distribution of functions. And the third model can be called “territory town” - each of the towns tries to maintain its own identity, but there is a division of the main functions among them (eg. production, R&D, commercial, leisure activities, industrial, cultural activities) (Dubois-Taine, 2004).

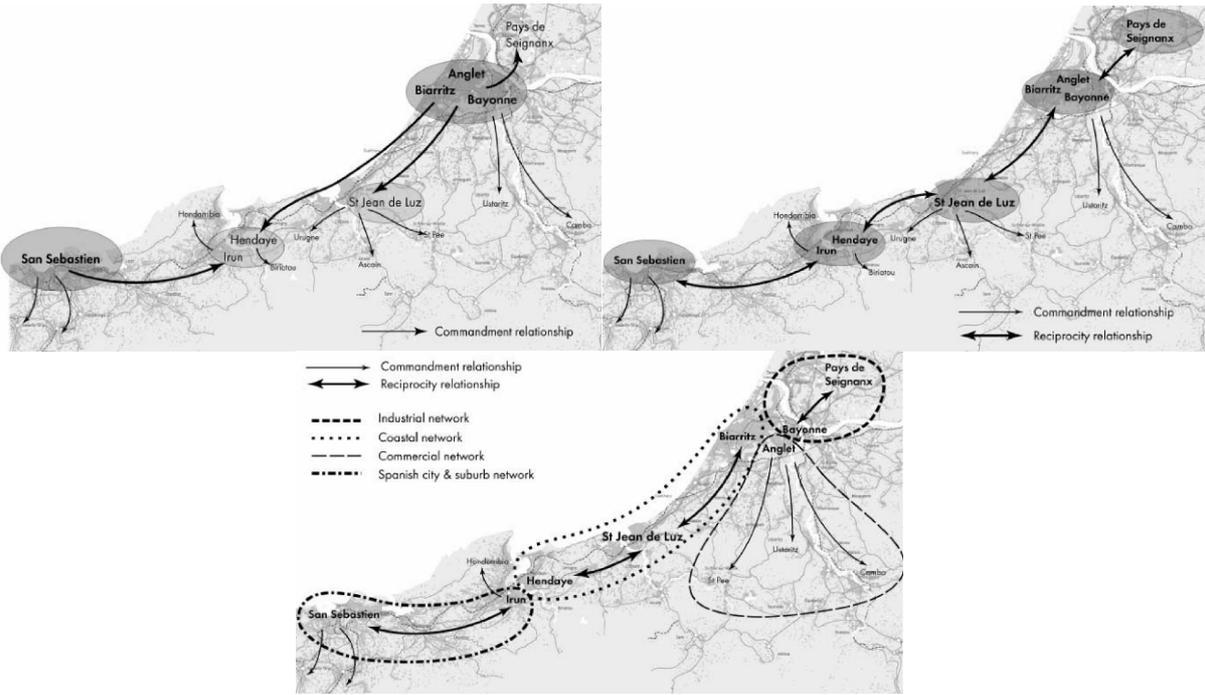


Fig. 34. Visualization of three possible models of spatial development and cooperation within Eurocity Bayonne – San Sebastian

Source: Dubois-Taine (2004)

This example is a good introduction for the identification of challenges and possible recommendations for the policy. The challenges for the Basque Country lie in its division into three provinces and the level of responsibilities that each of these has, and the responsibilities that are exercised by regional government, as was said by one of the interviewed persons: “there are four points of view in the Basque government: Vizcaya, Guipuzcoa, Araba and the Basque point of views. The parties are also different in each region”. There is a possibility that each of the main cities (Bilbao, San Sebastian and Vitoria-Gasteiz) will create its own policy, influence, in

According to the interviewed persons, the Basque Country in the future will:

- be more urbanized in the valleys' bottoms and more forested in the rest of the territory;
- have better connection between capital cities and the rest of medium cities;
- have better public transport, with more people making use of it;
- not develop more transport infrastructure elements;
- decrease the balance of the urban system;
- have better knowledge, better instruments and tools for property managing in the coastal area, where marine coastal planning is an important issue;
- increase the importance of tourism and marine energy, but decrease the significance of fishery;
- have very well developed links between three biggest cities;
- establish much stronger cooperation between different provinces and cities;
- have even better spatial planning.

Taking into account all of the mentioned circumstances, we can give three very simple and also very important recommendations for the proper land use policy management in the Basque Country - since all of these recommendations have a much broader character, their applicability extends also to other territories:

- holistic development of the region requires a very good planning system which is complex on the horizontal and vertical level – this means that sectoral plans should be created in cooperation with territorial ones (cohesion in spatial planning);
- very detailed planning on the municipality level – thanks to that there will not be many conflicts of functions;
- cooperation between different parts of the regions and division of functions within the territory – development of stronger functions of some particular towns has an important influence on the whole region. There should be a regional competitiveness and not competitiveness within region.

8. CONCLUSION

The Basque Country is characterized by a polycentric urban system: there are three cities (Bilbao, San-Sebastian and Vitoria-Gasteiz), which play the major role in this structure. When we analyze this region in a broader context, we should add also the Bayonne-Anglet-Biarritz Conurbation as one of the major system's cell. Those major cities with villages of subsequent rows are connected by transport system but also crisscrossed by social, functional networks. Land use is highly dependent on terrain and location relative to major urban units.

Urbanization is highly concentrated: the cities are surrounded by suburbs, housing expansion in settlements is concentrated along major transportation routes.

Urbanization in the Basque Country is closely related to a lifestyle. Young people in the first place are looking for a job and usually stay at parents' houses because they cannot afford their own apartment. When at the age of about 30, they start their own families and want to buy own houses or apartments. But then they rarely decide to change jobs and for a drastic change of place of living. Therefore, the city is overgrown with housing estates. Only a thoughtful planning process can effectively control and restrict the chaotic urban sprawl. Another limiting factor for moving to other cities and therefore causing pressure on the development of suburban areas is the specific modus operandi of the Spanish, whose working day exceeds 12 hours, with long, about 2 hour break for lunch in the afternoon. This operation mode is an impediment to people who live in a considerable distance from the workplace. To facilitate commuting, the Spaniards planned their network infrastructure in a very careful way.

Major changes that have occurred in land use and land cover are associated with urban sprawl and new forms of occupation of territory such as: transformation of villages residential centers, development of new communities (especially located near transportation corridors and big cities), shopping and leisure centers. In particular, the new and modernized network infrastructure was of key significance. One of the most considerable changes in land use are related to the migration from peripheral areas to the coastal and urban areas. People living in rural areas resign from cultivation of land, moving to towns and changing the way of production to organic. In this region of Spain rural tourism is more popular (to foreign visitors) than classical coastal tourism.

The highest pressure on land can be noticed in the coastal and urban areas. It is so because a lot of functions are concentrated there: settlement, industry, harbors, wind energy plants, logistic centers, touristic zone. Idea of multifunctionality is connected with mobility of people to reduce an environmental impact.

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EU-LUPA

European Land Use Patterns

Appendix 1

Verification of land use changes typology in practice



Land use changes discovered by Corine Land Cover pictures analysis were verified in practice by field study of eight cases in the Basque Country. Verification were carried out by the sample of 8 squares 1 km x 1 km, where the changes were in different intensity and were processing in different directions. Process of verification consisted of several elements: analysis of the typology maps and satellite imagery, observation of points, perform photographic documentation and talking to local people about factors of changes.

Point No.	Intensity	CORINE Land Cover Flow	Coordinates
1	2	3 - Sprawl of Economic Sites and Infrastructures	N 43° 19.148' W 1° 51.180'
2	3	2 - Urban Residential Sprawl	N 43° 23.206' W 1° 41.664'
3	-1	3 - Sprawl of Economic Sites and Infrastructures	N 43° 26.770' W 1° 32.759'
4	N/A,0	No Visible CORINE Change	N 43° 18.541' W 2° 23.108'
5	N/A,0	4 - Agricultural Internal Conversions	N 43° 18.161' W 2° 12.372'
6	N/A,0	3 - Sprawl of Economic Sites and Infrastructures	N 43° 17.797' W 2° 52.234'
7	N/A,0	No Visible CORINE Change	N 43° 18.753' W 2° 51.426'
8	N/A,0	No Visible CORINE Change	N 42° 58.740' W 2° 38.623'

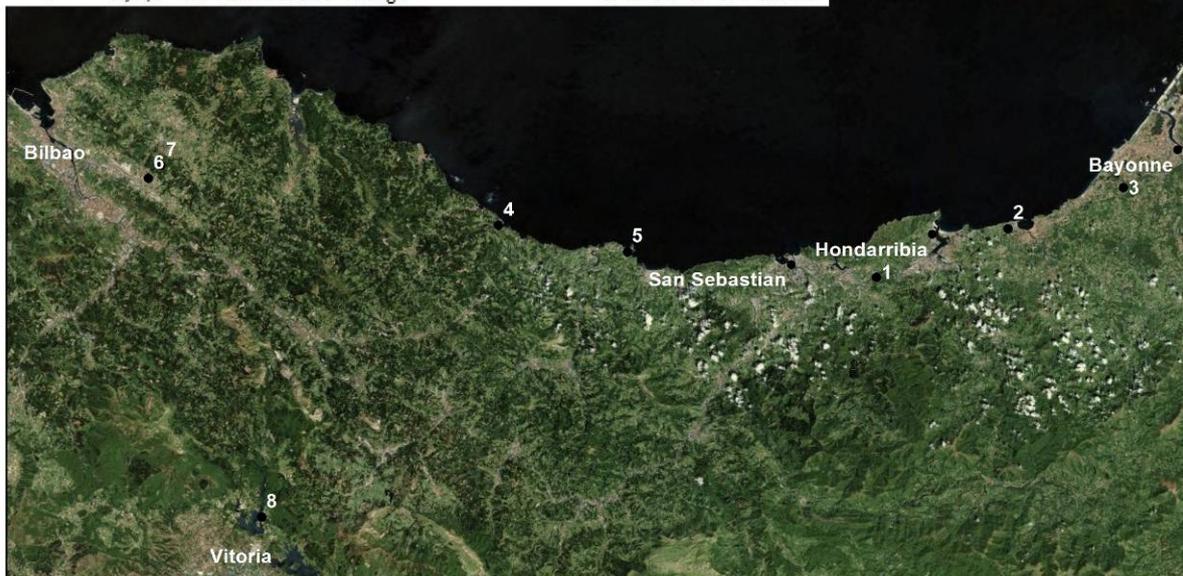


Figure A – Points of investigation

Source: Nordregio

Square 1

The geographical coordinates

N 43° 19.148'

W 1° 51.180'

Square 1 is situated between San Sebastian and Irun (about 10 km to the east of San Sebastian and 6 km to the west of Irun) in the town of Oiartzun. It's Lanbarren Industrial Zone. The square distinguishes sprawl of economic sites and infrastructures; the intensity level is 2.

Like we can see on the figure 1a, changes were very rapid in this area. In 2001 there was forest and just a year later first works were made. Logistic park was made by Construcciones Amenabar SA. The opening took place in 2005. It's largest industrial area in Guipuzcoa, the estate covers an area of approximately 450,000 m² divided into 15 plots of 30,000 m² each, and for enterprises engaged in the transport and logistics.⁸ The main factor, which decide of the localization of the industrial area was good transport accessibility. Lanbarren Zone is

⁸ <http://www.grundfos.es/web/homees.nsf/webPrintView/8C06DEA24B3AAB4FC12570B4003D4374> (access 22.02.2012)

located near motorway E5, which connected Iberian Peninsula with rest of the Europe and between two big cities – Irun and San Sebastian.

During the building of industrial zone have moved more than three million cubic meters of lands, strengthened the slope of the highway and was buried along over 300 meters electric line. Also, construction and driving of a tunnel under artificial Euskotren and RENFE lines to form a roundabout in two levels of access to the polygon.⁹

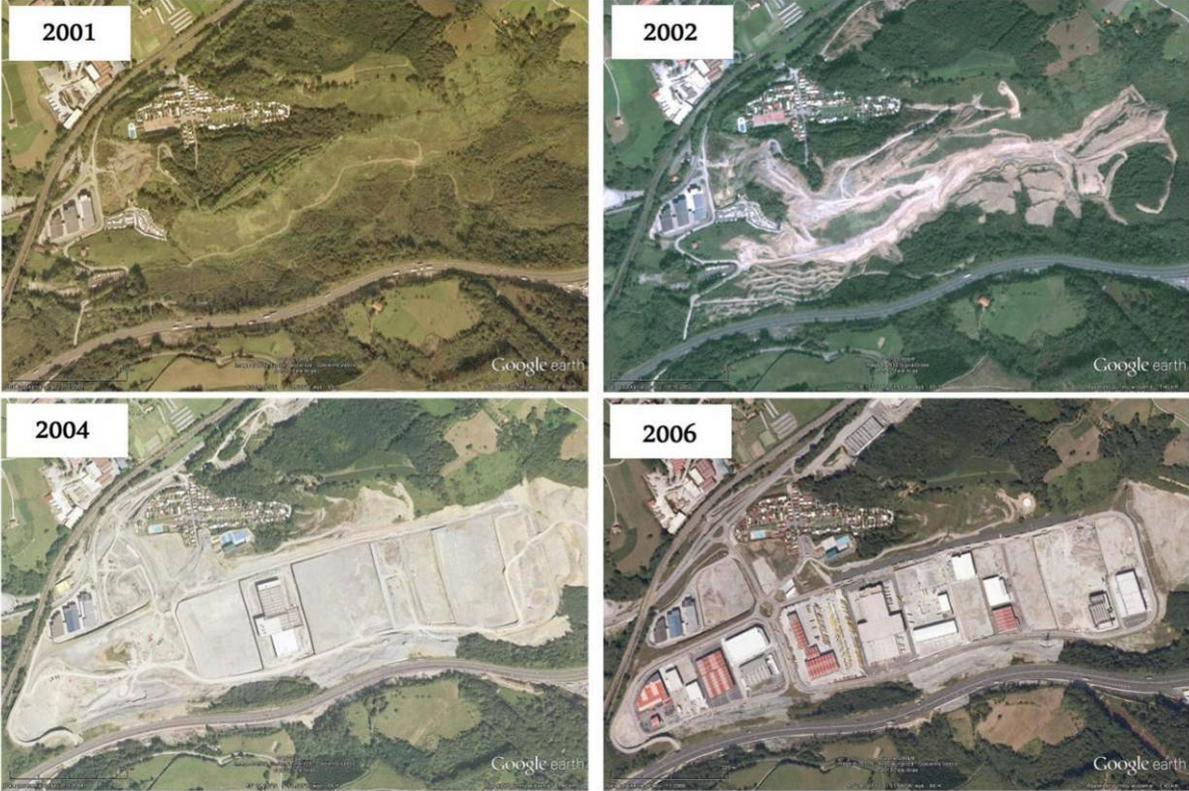


Figure 1a – Square 1 – Lanbarren Industrial Zone
Source: Google Earth (2012)



Photo 1a – Square 1 – Lanbarren Industrial Zone
Source: own materials.

⁹ http://www.camaragipuzkoa.com/publicaciones/economia_guipuzcoana/12/pdf/boletin122005.pdf (access 22.02.2012)

Square 2

The geographical coordinates

N 43° 19.148'

W 1° 51.180'

Square 2 is located in French part of region, about 2 km to the east of Saint-Jean-de-Luz in town Kalitxo. In land cover typology it's urban residential sprawl in the highest (3) level of intensity. Estate is located in the suburbs of Saint-Juan-de-Luz, less than 1km from coast of Ocean. Former agricultural land was transform into estate of houses. From the south of estate is located service zone with supermarket, bakery, car services.

The estate consists of a series of detached houses, which vary in size, but they are in a similar style, referring to the local architecture.

Localization of Kalitxo is very important factor. Good accessibility to town and services, nice landscape meant that live here is at a high level.



Figure 2a – Square 2 – Urban sprawl In Kalitxo.

Source: Google Earth (2012)



Photo 2a – Square 2 – Urban sprawl In Kalitxo.

Source: own materials.

Square 3

The geographical coordinates

N 43° 26.770'

W 1° 32.759'

Square 3 is located in commune Bidart, between Biarritz the Negress and the small village of Arbonne. It's situated just to the south of A63/E5/E80 road, and to the east of D255. To the east the Izarbel's Technopolis is located. The land cover flow distinguishes sprawl of economic sites and infrastructure. The level of intensity is -1.

In our opinion typology is incorrect. In this area had place urban residential sprawl. There are some block of flats and detached houses.

The most important factor is good accessibility to town and other part of region (by motorway). Estate is located near to highway, but it isn't nuisance because of trees area separating houses from noise. Estate has also public transport connection with Bayonne and other cities.



Figure 3a – Square 3 – Bidart

Source: Google Earth (2012)



Photo 3a – Square 3 – Bidart.

Source: own materials.

Square 4

The geographical coordinates

N 43° 18.541'

W 2° 23.108'

Square 4 is located in Mutriku, a town located in the province of Guipuzcoa. Town was located in first half of XII century on the rocky coast of Atlantic Ocean. Nowadays there live 5 thousand inhabitants. Localization a far away from main routes of communication makes it relatively isolated.

The main factor of development was fishing, but nowadays is crisis time for fishers. A huge impact have industry (canning, medical devices). Service sector focus on tourism.

As a result of low accessibility and rocky location, Mutriku's spatial develop isn't intensive in last years. In the beginning of the city areas in the valley and near to bay was housed in. With time more inaccessible areas have been built (the slope of the hills). In last we can see just a few new buildings, which were constructing on the slopes (Figure 4a) and in place of old buildings.

According to Corin Land Cover typology there are no visible changes. The team agree with this, because the final spatial structure of city was formed in medieval and after buildings just were reconstructed. The changes on the slop, which we can see on figure 4a are on the too small area to be included in the typology.



Figure 4a – Mutriku
Source: Google Earth (2012)



Photo 4a – Square 4 – Mutriku.
Source: own materials.

Square 5

The geographical coordinates

N 43° 18.161'

W 2° 12.372'

Fifth point of investigation is localized in Getaria, small coastal town with 2666 inhabitants. It was located in XIII century as fishing port. Originally the city and the island were not connected. Only later built harbor linking the two banks. In recent years city wasn't changed his spatial area a lot. Old buildings and space between them replace or fill new buildings.

In rural areas of Getaria municipality was located furniture company, in space between land and island was set fishery business. The main factor of low changes is weak accessibility to town.

Corine Land Cover Flows shows on this area Agricultural Internal Conversions.



Figure 5a – Getaria

Source: Google Earth (2012)



Photo 5a – Square 5 – Getaria – harbour and fishery company.

Source: own materials.

Square 6

The geographical coordinates

N 43° 17.797'

W 2° 52.234'

Sixth square is situated in Derio, the municipality located in the province of Bizkaia. Area is located on the north-west to Bilbao and on the west to the Bilbao Airport. There is good route and train connecting with Bilbao and other parts of the region. Derio is situated in nice landscape, between hills and forest.

Like we can see on figure nr 6a there is intensive expansion of economic sites and infrastructure. There was constructed a complex of buildings for research and development and technologic parks. On the picture from 2009 we can see (in left top corner) a new golf club and touristic area. According to CLC Flows the square distinguishes Sprawl of Economic Sites and Infrastructure, what is correct.

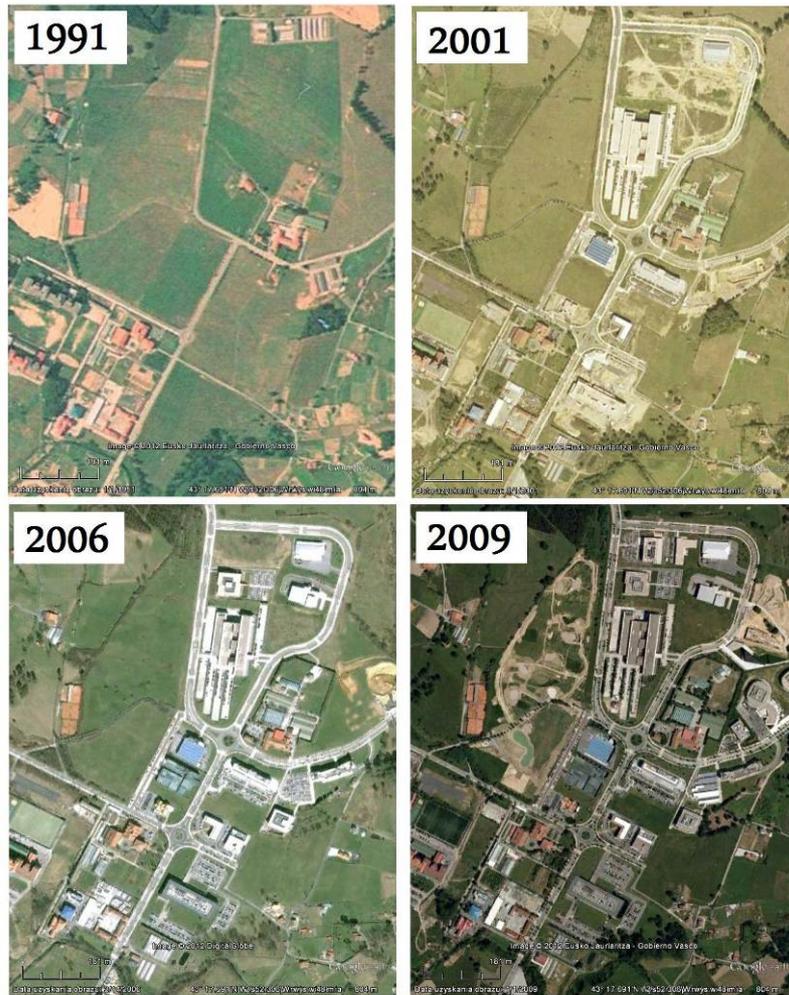


Figure 6a – Derio – technological park
 Source: Google Earth (2012)



Photo 6a – Square 6 – Derio – technological park.
 Source: own materials.

Square 7

The geographical coordinates

N 43° 18.753'

W 2° 51.426'

Corine Land Cover shows forests and tree plantations as one type of land use. One would think that in the Basque Country is a lot forests and government take cares for their biodiversity. But after talking with experts, it turned out that most of the forests in the Basque Country is a eucalyptus and pine plantations. To the north of Bilbao, near the town of Geldo

there are large tracts of trees. Like we can see on Figure 7a there are changes in agriculture type of uses of land and in wooded area. Arable land was changed into pastures area. In particular years different areas woodland were cut down. Private owners cut their own property, creating a network of roads in their area. Cut areas in subsequent years have been spent on another plantation.

Corine Land Cover Typology don't shows any visible changes on this area. Changes in forest plantations are not visible to tools such as CLC. It should also be noted that the intensity change is greater in recent years, after shooting images.

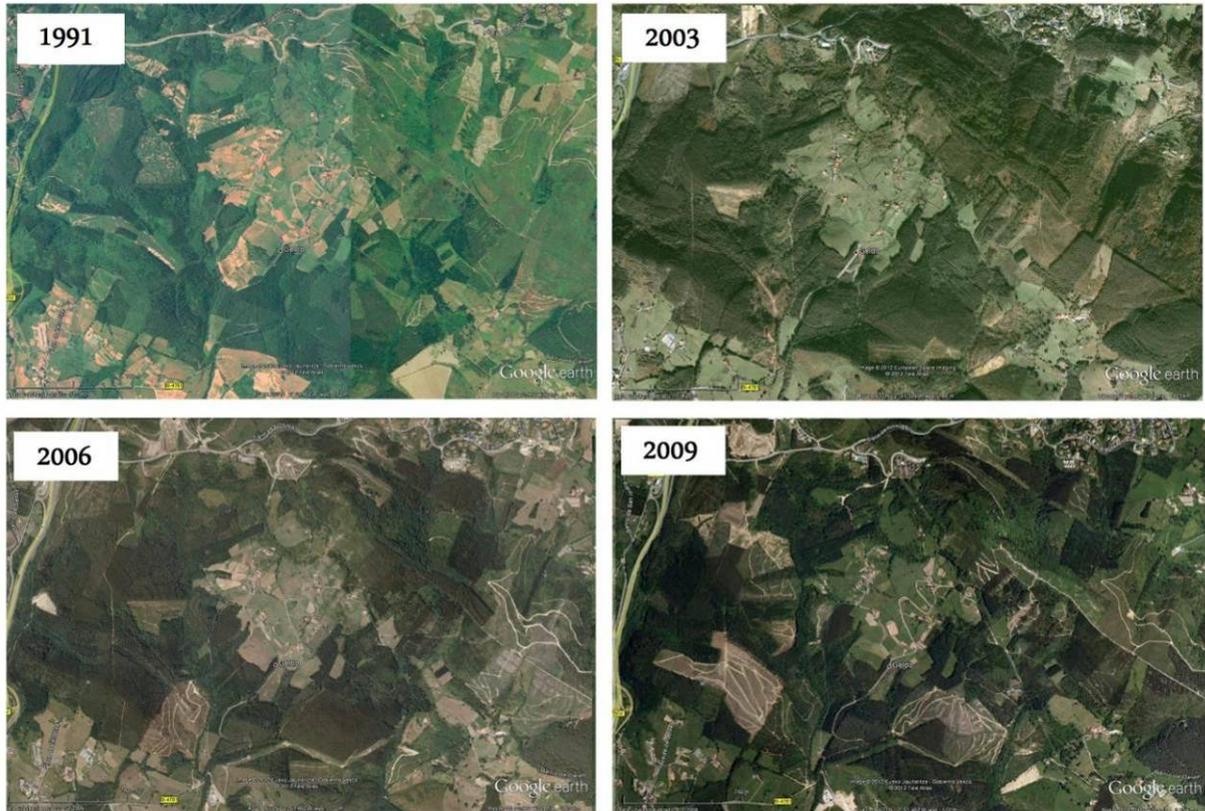


Figure 7a – Square 7 – Geldo – forest changes

Source: Google Earth (2012)



Photo 7a – Square 7 – Geldo – forest changes.

Source: own materials.

Square 8

The geographical coordinates

N 42° 58.740'

W 2° 38.623'

Legutio is a town and municipality located in the province of Araba. Town has 1.698 habitants (2011). In this area we can notice urban residential sprawl. Statistics shows that

the population of Legutio rise in last two decades from 1214 in 1990 to 1644 in 2010¹⁰. But on the Corine Land Cover Flows Maps there are no visible changes in this area.

There are two most important factors, which impact on that huge rise of population. First is good localization: there is less than 15 km to the centre of Vitoria-Gasteiz, the capital of Basque Country and few kilometres to technological park. The second one is nice landscape: Legutio is situated on the peninsula of Urrúnaga Reservoir. West side of town is old part of town. Investors known, that there is social infrastructure: schools, health care, kindergarten, shops.

On the basis of investigation with local entrepreneur it can be deduced, that in the new flats in Legutio lives mostly young couples without children or with small child. They usually works in Vitoria or in technological park near city. What is interesting, new residents do not integrate with the old inhabitants of the settlement. The new residents are young people who work a lot outside the home. They spend free time outside Legutio. Probably just when they have children they can use social infrastructure located in the city.

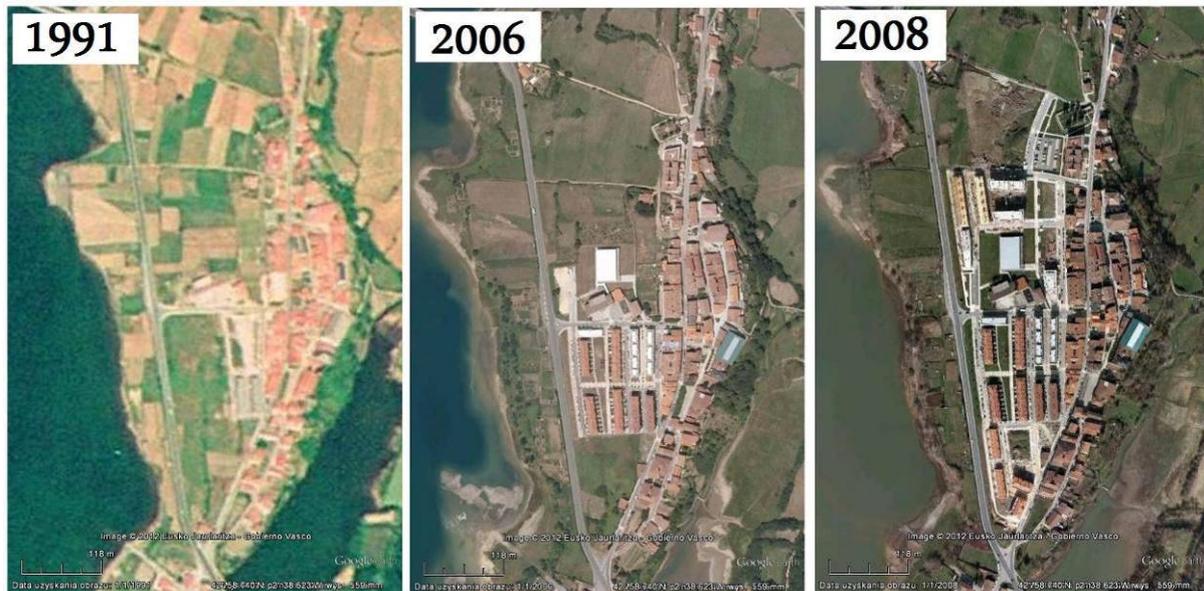


Figure 8a – Square 8 – Legutio

Source: Google Earth (2012)



Photo 8a – Square 8 – Legutio – old and new part of the town.

Source: own materials.

¹⁰ Instituto Nacional de Estadística de España (2012)

EU-LUPA

European Land Use Patterns

Appendix 2

Field study – interviews questionnaires



Region: BASQUE COUNTRY

Place: BILBAO

Person interviewed: MARÍA MONTSERRAT GARCÍA MERILLAS.

Representative of Association of Basque municipalities – EUDEL

Interviewers: Gemma Garcia Blanco, Konrad Ł. Czapiewski, Mariola Ferenc

Date: 09/01/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

The total population in the Basque country has increase slightly from 2003 to date, only 2.8% according to the National Institute of Statistics (www.ine.es). From 2003 to 2010 the population grew in 60.000 inhabitants.

In the province of Araba, the increase was 6.4%, while in Bizkaia was 1.6% and Guipuzcoa 3%.

This moderate population increase is connected to the phenomena of immigration. In the last 10 years until 2009 100.000 foreigners arrived to the Basque Country. However, the economic crisis has stopped the immigration.

In any case, the reality behind the increase in population from 1996 til 2009 is very different if we look at local scale, at municipality level. There are some municipalities where the population increase has been significant (such as Vitoria-Gasteiz for example) others with no changes at all, and even other that have lost population (Sestao municipality for instance)

With respect to the natural growth of population there has been a process of deceleration which started in the 90's. There have been negative rates from 1981 until 2008, showing nowadays positive values close to 0% due to the profile of the immigration (young people and families)

The impact of this statistical data automatically translates in changes in the use of land in the Basque Country. Firstly because there have been important movements of population within the Basque country. There have been important movements from big cities to the small municipalities, looking for an alternative style of life. This trend has force the revision of the urban planning in those small receptors municipalities that should offer new land for residential uses.

The last decades are not relevant in terms of Spanish migration. The immigrants have come from other countries (but not as much as elsewhere in Spain). In recent years, foreign immigration is decreasing.

I think that Spanish migration is not relevant in urban planning, but immigration from other countries, it is.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

Spain is different than Basque Country in term of land use. Urban planning is different. Basque Country has its peculiarities. It is high industrialized and this “pollutes” border regions such as Cantabria or Burgos. The town planning answers to the Basque Country peculiarities. The explanation is that we have own legislation that permits differences in urban planning, so we have focused to industrial land. For example, we have more similarities with Navarra than Cantabria or Burgos.

The more urban municipalities between 40.000 and 100.000 inhabitants are losing a average of 4.4 per thousand inhabitants a year. The Basque municipalities with less than 2.500 inhabitants show the most important population growth rates, reaching an annually rate of 3.5 per thousand inhabitants.

On the other hand the rural municipalities are the ones which show the most dynamic processes with respect to population. They have increased their population around 15% in the last decade. This is the case especially of the rural municipalities close to the bigger urban agglomerations, well connected and accessible to service. If we look at the urbanization process in this municipalities, it is particularly obvious the low density, in some cases secondary houses.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

Organic farming, rural tourism, and development of small towns have to develop. The last years' urbanization has been above rural and agriculture land. The fertile soils are lost. In recent years we have started with the promotion of organic agricultural value, economic-oriented agriculture... The problem is that agriculture has never been planned. Also, people working on agriculture are few and old. Law should discriminate agriculture positively because is critical to us, just to eat good quality food. Forestry is not as bad, but we must do better on agriculture.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

Generally speaking, the agriculture sector has been reduced considerably in the Basque Country, considering its weight in the region GDP.

The primary sector is systematically losing his weight in relation to other productive sectors. To the extent that even in the legal framework it is reflected the need to protect the rural space and food production in the region in order to strength the adaptation capacity of the sector and also its response to new challenges with regard to globalization and market liberalization.

Besides, at local level, society has lost interest in the productive sector, which currently relies on small farms and very aged population.

Nevertheless, the food sector in the Basque Country is trying to recover and advance towards competitiveness, is still in need of support.

The reality in the three provinces is totally different. The primary sector is still important in Araba while in Bizkaia is not relevant. Guipuzcoa still keeps a quite important forestry activity.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

Infrastructure is important in the Basque Country. Since DOT (territorial master plan in the Basque Country) in 1991, the connection from Lisbon to Paris through Basque Country was marked. The different plans are oriented to this connection. Highways and harbours are oriented to this. The high-speed train follows these plans. We must take advantage of the border. For many years, the aim is Europe.

It has been very important in the last decade in particular, the urban processes associated to industrial use, as well as infrastructures of transport & communication and energy.

It has not been an arbitrary process, since there are instruments of Spatial Planning at regional level, devoted to the planning of such uses in order to coordinate the development in the Basque Country.

The effect of such plans is also different at local level. The incidence of those plans is more relevant in the municipalities located in the communication axes and where the productive and economic activity of the Basque Country concentrates.

However, mostly all municipalities in the Basque Country, takes advantage somehow of such infrastructures, due to the reduce dimensions of this territory. The accessibility is somewhat guarantee to most of the municipalities.

The development of the infrastructures, at the same time, is influencing land use changes and the intensity in the use of the land: creation of industrial parks malls in peri-urban areas, etc. In many occasions they even provoke displacement of residence and work places, which frequently has negative effects because there is not a well-developed mobility model associated to this displacement.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

With respect to tourism and services, this has not such negative effect in intensity in the use of land. To date, tourism has not required a specific or complementary territorial infrastructure. The tourism in the Basque Country combines the strength of urban tourism with the nature enjoyment, in a well-connected territory, with adequate infrastructures of transport and communication so tourism has not generated mayor land use changes.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

Basque Country's coastal location in the North is relevant (it's an asset). After Civil War (1939), we had a big migration from Spain through the harbour and metal industries. This positioned us very well. After this, with autonomies (1980), industries are maintained and we improved infrastructures to support industrial uses. So we have a small territory with big population's density and big industry with large number of workers. After this, with the 80's crisis (industrial), all industrial areas were reconverted to keep workers. It was restructured to a big quality industry. In last years, territorial balance has grown with good infrastructures, industrial parks, research parks and above all better services. The small towns (<2500hab) have gained population due to the big cities. This has been achieved because urban planners have changed people's preferences. One good thing is that this change has not been in a very sparse way.

Looking at the future, and in terms of land use changes, it seems that industrial and residential use will be not as intense as in the last 2 decades. It is expected a biggest role of the tertiary sector particularly in relation not only the quantity of land needed but the characteristics of this land, the quality, the services provided by this land. In this relation are important the regeneration and the rehabilitation process in the urban fabric, in opposition to the consumption of new land.

In the report CONFEBASK "*Demografía, disponibilidad de trabajadores y crecimiento vasco 2008-2020*" (*Demography, labour force and development 2008-2020*) it is shown that, in terms of employment, the main problem of the industry in the Basque Country is the lack of qualified workers.

It is expected that in the next years more than two thirds of the employment generated by replacement will be of low qualification, whereas, almost 85% of the new demand of employment will be concentrated in media and high qualification. The estimations say that between 2009 and 2015 the Basque Country will need around 6800 qualified workers into its labour market and around 91.000 workers of low qualification.

II. Environmental issues

- 1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?**

In general is needed to say that during the last 50 years there has been a strong artificialization process in the Basque Country. The increase of urbanized areas has had an impact in nature, in biodiversity, in river basins. However is also important to point out that this process has been in line with a protection, research and management of natural areas particularly those areas with high ecological value.

The management of natural areas has been characterized by a passive conservation rather than an active conservation so this has allowed a coexistence of much transformed areas with protected ones. From a total of 251 municipalities in the Basque Countries, 148 are affected by Red Nature 2000

- 2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?**

Currently, natural areas, and specially protected ones, are well preserved in the classification of land uses through environmental legislation. This protection is shown in instruments of Spatial Planning, in the assessment of plans and programmes (Strategic Environmental Assessment).

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

At local level, specially flooding, decline in the quality of water, and heat island effect in urban agglomerations.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.
2. Multifunctional land use - which of the functions in your region co-exist?
3. Which of the functions are the most important in the context of land use?
4. Is the number of functions of land use increasing or decreasing?
5. To which extent is the land in your region used in multifunctional way?
6. What kind of functions co-existence is:
 - a) the most effective?
 - b) the most desirable?
 - c) the most common?
 - d) the most difficult?
7. Which of the functions of land use are the most important for the future regional development?

Answer for all question:

The multifunctionality of use understood as a guarantee that all possible uses of land are guaranteed through land management is a principle inherent in planning. In general, urban monopolies is a learned experience that are impoverishing to all the cities and towns (for example, have large areas of towns and cities that have opted for a monoculture urban "residential" which has been impoverishing because he has become in too specialized and uses exclusively and especially residential, have not made easy implementation of the service sector, trade-, small industry and services promoted by individuals and local authorities has cost them much effort once implemented to encourage the predominantly used to perform a required minimum diversification).

On another level of work and land management instruments, the multifunctionality is a working premise. Thus, management of the sector, which could tend to a monopoly in land use by sectoral policies should be integrated into the reflections that come from the supra-territorial and functional areas. Perhaps at this level of work is necessary to ensure that this multifunctionality makes it very difficult to reuse the land is used.

IV. Spatial conflicts

- 1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

There are many needs that want to be satisfied in the same soil. Bring these needs because of interest, all of them legitimate, it is necessary to assess the soil has one or the other predominant land use. However, the ultimate power to order the use is a public service and administration is proposing those uses. The municipal administration should respond to all needs in the urban scale of work, primarily to serve the population living in cities and towns. With a higher-level and supra-serving interests are the instruments of planning, linking the planning, which must weigh the interests that come together to give priority to infrastructures (socio-economic or environmental. That is the confluence of interests exists but also the mechanisms to coordinate and establish them forcing compliance.

- 2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

There have always been the same. Currently, with a transformation as profound as the experienced and in a moment of crisis like this, maybe have taken a back the residential and industrial interests are the interests of environmental protection, agricultural and infrastructure (roads and energy) those between competing interests today.

- 3. Which of the actors are the most dynamic and successful in obtaining new land?**

The most dynamic and successful was probably the road infrastructure and industry in recent history. The actor who has set up this collection of soil have been regional and provincial levels of decision. In the last decade and once satisfied the above and basically from a quantitative parameter and widespread in all municipalities should talk about the actor whose residential use have been the municipalities.

- 4. What are the most likely conflicts related to land use in future and what could be its impact on land use?**

Urban level is likely that all land uses are conditioned by a major reflection on noise pollution and recovery of watersheds under existing threats. You might think that future is not as extensive use of new land and a commitment should be to win urban intensity uses in areas already changed.

V. Government and policy

- 1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?**

Our urban culture is very important to us because our territory is limited. Land uses are controlled by urban planning, but land uses may change due to agents' interactions. But this is controlled by urban planning. Talking about spatial planning, the culture is less, but we

have consolidated the procedures. Spatial planning determines the town planning. Some procedures are good, some not, some are obeyed, some not. What controls land uses is town planning, orientated by spatial planning. They are different and we are on track to coordinate them.

Urban planning and spatial planning...we have to develop the fields corresponding to each one. There is a lack of coordination. The sectorial plans are not coordinated with the regional plans. For example in the metropolis of San Sebastian, there must be coordination between the various spatial plans and urban planning as well... I am town planner, so I am subjective about spatial planning. We have to improve too in the discussion about who has a higher rank and the work with urban planning, but we are in the good way.

It's a term of scale, town planning is municipally. The one who implements is the municipality. Spatial planning orientates the whole region and orientates the municipalities to implement some plans or not.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

Valuation is not negative. However, the model change essentially territorial and spatial planning culture that has developed only since the 1990s has required a cultural change and urban development operation that will gradually adapting. The legal provisions are becoming increasingly effective.

However, there are several activities that should ensure the effectiveness of the rules and roles are different, local authorities manage the urban development (local interests) and the regional authorities manage the supra-scale zoning, to accommodate the interests beyond the scope of purely local management.

An example of this confluence of interests and how to manage them is by example the Territorial Plan for Rivers and Streams. The level of autonomous decision which approves the instrument to protect the margins of the hydrological channels in the BAC. This requires you to prioritize environmental concerns over other such as the different uses that could occur on the banks of rivers and streams (leisure, entertainment, sports, etc). This protection extends to all the channels that run hydrological entirely in the territory of the BAC. However, in each municipality, through the General Urban Plan also addresses the management of the river that runs through the municipality and the minimum of protection is established by this Territorial Plan, but the City could increase the protection (never decrease)

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

There is no proper monitoring system but there is relevant information in databases and integrated information that brings UDALMAP relevant territorial scale work.

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?

Not asked – not respond.

2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?

Not asked – not respond

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.

Not asked – not respond.

2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.

Although the BAC has not been left out of the intensive process of urbanization that have known other postindustrial societies, in the BAC the process of occupation broadly characterized by low local authority and its high population density, a compartmentalized geography and an urban-industrial relatively continuous but adjoining rural areas. And, despite intense industrial stage, nuclei have survived traditional landscape and architectural forms individuals, environments highly valued, even idealized, which have served as territorial support for the realization of the economic development process of the BAC.

The spaces have been substantial net population and the consequent emergence of new primary residences are located primarily in rural areas nearby and accessible from the major urban centers of the BAC: in Araba, the eastern municipalities of the Plains of Araba, Foothills Gorbea and municipalities located in the axis of the N-1 between Vitoria and Miranda de Ebro in Biscay has been polarized on the right bank of the Nervion, basically Plentzia-Mungia region extending to the western municipalities of Gernika -Bermeo and secondarily in the eastern townships Encartaciones, Arratia-Nervi6n or Durango. In Gipuzkoa, in the light of statistical data the phenomenon has a lower intensity, but is evident in municipalities Donostialdea Goierri Tolosaldea and located on the margins of the N-1 and secondarily in some coastal towns.

Thus, well-connected rural municipalities with the densely urbanized areas have become more attractive for the establishment of new population. Many of these families, among which highlighted those which involve children and adults engaged in highly skilled professions-abandoned urban centers in search of privileged environments and less standardized forms of habitat. Consequently, employment in the BAC has been a territorially and socially selective, affecting primarily to rural settings and well linked to nearby urban areas and is played by social class socio-economic well defined.

However, it is too early to say whether the review of planning, which is taking place in the context of the current housing crisis and constructive, will see the occupation as envisaged in the current urban development plans as a point phenomenon triggered under the new technical, social and economic or otherwise, will continue in the future.

Region: BASQUE COUNTRY

Place: VITORIA- GASTEIZ

Person interviewed: PROF. EUGENIO RUIZ DE URRESTARAZU

Vice-Rector of the University of the Basque Country, geographer.

Interviewers: Gemma Garcia Blanco, Konrad Ł. Czapiewski, Mariola Ferenc

Date: 11/01/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

In last 20 years, the main demographic process has been a stop of the population growth. Before in the 50's, 60's and 70's, there was a big Spanish migration and industrialization process accelerated the growth, and the birth rate was really important. So that, important urban transformation happened in residential and industrial areas. The growth was compact, with development of infrastructures too. In 90's, birth rate fall, with negative natural growth, no exterior migration. But recently, 2000's it can be notice the migration from foreign countries: Eastern Europe, Northern Africa and Latin America.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

There is observed weak population growth, but big urban expansion. It seemed that with no more population growth, urban growth will not be remarkable, but nothing of that happened. It has been an extraordinary urban expansion in last 20 years, it has been done with low capacity urbanization in metropolitan areas. The compact urbanization disappeared and now urban sprawl is more common. Citizens with big economic capacity prefer less density areas. Furthermore a lot of new infrastructures with big capacity that have changed the people mobility, so that is very important.

Another demographic issue is the big cities importance to attract people (San Sebastian, Bilbao and Vitoria). This is dangerous, above all in the Atlantic part, because there are a lot of medium cities that make an interesting urban system balance. But with this big attraction, urban system is not as good as used to because this is a population, services and decision makers' concentration. So there is a growth of the coastal zones in detriment of the interior areas. This is dangerous because it could be lost this territorial balance as exists now with this dense urban area with medium cities.

In relation with euro city San Sebastian - Bayonne, there a lot of differences because of the border. You could think that there is a physical thing that separate people (rivers or mountains), but this case is an evident proof that what separates is human thought. This is a border between two big states (France and Spain) which have been fighting several times in their history. It separates different legal systems, languages and cultural systems. It has

been a different evolution. Spanish side, big industrialization. French side, traditional society. Spanish side, immigrant. French side, emigrant to Paris or big French cities, but they have old people immigration. There are different cities in each side. Spanish side, dense urbanization, more compact. French side, sprawl urbanization, relaxed, with individual houses that could collapse the territory, you should have to go to the interior to find no urbanized area.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

In the Atlantic part, the best agricultural soils are in the bottom of the valleys, but this land is in competition with other uses because is the best, not only for agricultural but for everything (infrastructures, urbanization, industry).

It has been lost the best agricultural soils and they will be losing the following years. In the last 10 years, 40% of exploitations have been lost. There are no people to work in the land. But the landscape still exists. The Atlantic countryside landscape still exists, why? I think there are different reasons. 1) Economic reason, farmers think that they have a potential treasure waiting for urbanization. They don't want to rent to other people. They are keeping the property of their land without impediments. They are making not legal treatments to keep the land in good state with other farmers (without weeds). They don't want to reforest. Some others are keeping the land like a spare time activity. 2) Another factor to keep this landscape is that some exploitations have been restructured to a luxury residence, good communicated, with good views...they doesn't want trees in their surroundings because they want good views... Forests should conquer all this Atlantic countryside landscape without this intervention. Territorial planning doesn't do anything to avoid this situation. 3) Offspring's don't want to continue with the exploitations.

One important factor which has to be mentioned at the end and is influencing the agricultural changes is Common Agricultural Policy and the payments to farmers. Also some certificates and programs can help with good quality oriented exploitations. For example, *Guarantee of Origin Queso Idiazabal*, they some good benefits but some are disappearing because the sons don't want to continue with the exploitations. The Txakoli or Rioja alavesa have good results. Rioja Alavesa is the richest rural area in Basque Country and Txakoli has good benefits but in a little number of exploitations. There are also Quality Labels which help to sell Basque meet in the market, but last years, exploitations are disappearing, the help is not enough to keep them. The future in agriculture is not good except Rioja Alavesa (wine) and some economic oriented exploitation related with ranching. The others will be disappearing except as a hobby and landscape keeping.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

Is territorial planning effective in the non-desirable changes of uses? I want to think that partly yes, but reality is that partly not. Territorial dynamics are much faster than territorial planning instruments. When the first plans were approved, lots of things were already done in the territory. And there is competition between different administrations. Municipalities are very jealous and everyone have economic objectives. Generally supported by the population of the municipality. The people don't want to hear that they cannot grow; they want to grow above everything, by the mountains, rivers with new industrial areas, services areas. In the future, this is not easy. Urbanization is not easy to stop. The new revision of the DOT

(territorial master plan in Basque Country) is talking about new urbanized areas named “innovation core”. Now not, because we are in crisis, but when the storm stops economic agents will act. They are not thinking about a system change, they are not thinking about changing economic paradigm. In the other side, rural areas as an economic spaces are very difficult to survive.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

Development of the roads is enough. Basque Country has enough roads and other elements of technical infrastructure. But of course there will be big pressures of the more intensive functions on the less intensive – so as it was described above agricultural land will lost the competition with the housing and construction.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

About the tourism – see below – point III.2.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

General assessment was already made above.

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

Environmental issues wasn't asked separately – answer on that questions can be found partly in other parts of the interview.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Environmental issues wasn't asked separately – answer on that questions can be found partly in other parts of the interview.

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

Environmental issues wasn't asked separately – answer on that questions can be found partly in other parts of the interview.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

Multi-functionality is possible but is not given. All urban development has been very sectorial, in one side, residential, in the other commercial (malls), in other industrial and so on. Nowadays there are some ideas about multifunctional use of the urban space, because of mobility, to reduce environmental impact. Some industrial areas must be in the surroundings (pollutant ones), but others, like technological centers, could be in the city; but in Basque Country are in the surroundings. In Bilbao and San Sebastian this is happening. Especially in Vitoria Gasteiz, the technological center is surrounded by crops. Acting with intelligence, the urban growth must be in the interior of the cities, existing areas must be restructured, for example, old industrial areas. Planning must actuate here. There is a way to actuate, future must be here.

2. Multifunctional land use - which of the functions in your region co-exist?

In the rural world, rural tourism has been successful. In the Basque Country, Atlantic areas, the rural and the urban is near, but in Araba, rural areas are very rural. The tourism in Basque Country is regulated by some rules, previously must be an agricultural exploitation and if it wants to be restructured to a tourism house and it wants help by the administrations, it must be kept for several years. This is going really good in coastal zones and near urban zones, several times is used by businessman because is near big cities. But at the end, this change is between two mono - functionalities, from rural to tourist. A lot of rural villages have high levels of studies because high socioeconomic levels use them as a place to sleep, but this is not really multifunctionality. There is a lot to do for multifunctionality, above all in urban areas, too in rural but urban planners are more complex than rural.

3. Which of the functions are the most important in the context of land use?

Development of tourism in Basque Country was very selective. It wasn't on such a scale as on Mediterranean Coast. The weather conditions are not very well for massive tourist, so the development is much more selective. That is why settlements are develop only in the coastal bay. Much more important are settlement functions and intensive development of three big agglomerations (Bilbao, San Sebastian and Vitoria); development of industries areas and technological parks; and transport infrastructure.

4. Is the number of functions of land use increasing or decreasing?

Rather is stable – as it was mentioned one monofunctionalities is transferred into other monofunctionalities.

5. To which extent is the land in your region used in multifunctional way?

Not asked.

6. What kind of functions co-existence is:

Not asked.

- a)the most effective?
- b)the most desirable?
- c)the most common?
- d)the most difficult?

7. Which of the functions of land use are the most important for the future regional development?

Not asked.

IV. Spatial conflicts

1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).

There are example of conflicts in the rural areas and little villages, related with governance. New people coming from cities want in the little villages more services, better infrastructures. They want to be in the government bodies too. This is a conflict that should be resolved by passing time, it is not really serious. Other problem is that the new people who live in these villages don't want more people there; there are important conflicts about this.

Related with environment and territorial planning, for example, out of Basque Country, in the Pyrenees, all the valleys want to have a ski station. Economic agents build residences to the ski station and win lots of money, when they win the money; the money only comes from the skiing station but is not rentable so they need the help of public administration to keep it. Here, in Basque Country, we don't have ski station but there are projects related with golf courses in which economic agents want to build residences to earn money. Now, because of the crisis, is not a good moment, but the agents are waiting for a better moment.

2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?

There are problems related with environmental protection. This enters in conflict with the population living there; they don't have the power to build other type of developments. With new natural parks, there are always people who live there and don't want the natural park because the rules don't leave them to do anything. The problem comes when the land is private (Bizkaia, Gipuzkoa), but it is easier in Araba, where the land is mainly public.

3. Which of the actors are the most dynamic and successful in obtaining new land?

Not asked directly – the indirect answer can be find in other questions.

4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

There is not used to be a lot of problem about conflict between rural and industrial because everybody generally wants these areas. But can be conflict between big malls and

competition with traditional markets, which have the risk to close and it is reflected in territory because it changes the mobility.

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

Territorial planning is much important here than in other places because is very difficult and the alternatives are few, one worse than the other. An intelligent politic is that urban growth must be inside the city and not out, restructuring areas and changing uses in the cities.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

The experts and leaders have problems with the comprehension of the territory, it is improving but it's not good. For example, the typical experts in this field are architects, who sometimes have expressions to describe a rural place as "a lack of opportunity", but this is not true, that space has a function in the ecosystem because a system is related with everything. A simple affectation in one place, can affect other places, but the experts don't use to think about this. This is related to floods, because here the mayor natural risks are floods. We have to think about politics related with a good planning about all the territory. As an example, in the *Zaragoza Expo* about the water, they built the space in a river meandrous, and within the rains the people say that the river has invaded the Expo, but that is not true, the expo invaded the river, the location of the Expo was not good thought.

Here we have damages and loss of biodiversity lives because urbanization is on valley's bottom, this is an example of how important is planning here. There is not enough formation of experts and politic leaders. It's necessary a new culture about territory. The territory is not a scenario of activities. It has values above this. These values don't belong to the people who live there. Everybody has to say something about an affectation to the territory, what is made in one located place affects everything. A good example is the Harbor of Pasaia, which affects all Basque society.

It is important that the decision has to be related with the local people, but not only local people but all society too. For example, in France, related with skiing stations, talking with French people they say that as the decision of the National park of Pyrenees is coming from Paris (France is very centralist) they have built just the necessary skiing stations, but every valley would have wanted a skiing station.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

Not asked.

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)

I am not an expert in the Euro City Bayonne – San Sebastian, but in my impression there are certain characteristics that could say there is an euro city. For example, the trade, the tourism... but much more is needed.

One of the most difficult things is to take out the mental border. For example, the lunch hour is different. There are certain things that are really different in each side. To reach to an euro city, more cooperation is needed between administrations. Some things have been done, above all in the Txingudi Bay (Irun, Hondarribia, Hendaya), but there is no cooperation between Bayona and San Sebastian. A territorial planning cooperation must exist. For example, the high-speed train will be constructed in Basque Country to the border, but we still don't know if it will be constructed in the French side. This example is good to other things, like infrastructures, land law... There is not a real feeling about an euro city, people doesn't have a feeling of becoming an euro city.

There is an obvious change of function in the place where the infrastructure is constructed, but there are also changes in the mobility of the people. One can be working in San Sebastian and living in San Juan de Luz. There are lots of changes in residential functions, more urbanization has been caused by mobility increase.

An euro city must be good connected, infrastructures are already done, more infrastructures are not necessary, we don't want more because we don't want more cars, we need more effective public transport, effective to connect different cities. People must be convinced that public transport is better than private. If you can go from Bayonne to San Sebastian to watch a football match in public transport, like moving between different neighborhoods, you are starting to become an euro city.

2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?

Answer on that question can be find in the whole interview.

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.

Here, it is different to other territories in Europe that there is a feeling about the historical territory (Bizkaia, Araba, Guipuzcoa). They are almost a federal country. Each territory is jealous about the other. The three want what the other have, but the true is that if something is good for a territory is good to the other. This is a problem in terms of cooperation between administrations.

I think that the identification with the conservation of landscapes and environments is very different between different persons, is different between urban, farmers.

A farmer appreciates the crops, but urban people prefer mountain landscapes. There is a general appreciation of natural environment, people usually go to the mountains, but in general it doesn't relate to a common sense that influences in the politic decisions, because

people don't make pressure on the politics. There is not a common sense related to the protection of environment.

For example, related with eolic energy, some people don't mind about wind turbines being in the top of the mountains, but others are really concerned.

Sometimes the relation is folkloric, as the feeling that the *caserio* (farmhouse) is the essence of the Basque. But nowadays doesn't really exist because the majority of them are not *caserios*, they are just residence.

Nowadays there is a feeling that keeping a good environment landscape with traditional activities is an economic treasure related essentially with tourism, but with industrial zones or residences too.

But in my opinion, I don't think that the feeling is traduced on a real territorial planning to protect it.

In the future Basque Country is going to continue with a growing urbanization. Now the urbanization is "sleeping" because of the crisis, but bottom of the valleys will be urbanized. This is evitable but there are not factors against it. If this happens, the urbanization will be lineal in the bottom of the valleys. This has problems with the urban life, because here, in Basque Country, the cities are places of social relation. It is Mediterranean urban relation, but with the lineal urbanization this relation will be disappearing and furthermore there will be more problems of mobility.

The time of big infrastructures is over. With the end of the high-speed train there is no necessity of big infrastructures. A rail connection between the medium and small cities is needed. We have to recover small trains to communicate the bottom of the valley. We have to quit the highway's traffic and introduce it in public transport, including railway.

It is difficult to fight against emigration of population to coastal zones. I think that is difficult to maintain the attraction of medium cities because of the big cities attraction. The balance in the urban system will disappear.

Three big capitals will be connected but not the medium cities, so the system equilibrium will be lost. The concentration of population, services, and powers of governance will be in the capitals.

I think we are going to a higher forestation because of the lost of people working in the farms. No one wants to work there except immigrants, but the land owners don't want them working their lands, so these opened spaces will be forested.

The territory will be more urbanized in the valleys' bottoms, more forested in the rest of the territory and with a better connection between capital cities and the lost of medium cities. The people in the medium cities now are going to the capital ones to buy things and this will be increasing. The improvements in the public transport will increase the dependence to the big cities too. The balance of the urban system will decrease.

2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.

Not asked.

Region: BASQUE COUNTRY

Place: BILBAO

Person interviewed: JAVIER FRANCO

AZTI Tecnalia researcher in Coastal Zone Management

Interviewers: Gemma Garcia Blanco, Konrad Ł. Czapiewski, Mariola Ferenc

Date: 11/01/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

The population in small villages along the coast is decreasing in last years. Immigrants are the only reason for increasing, what stabilized the number of population in this region. The internal migrations are based on movement from small villages to bigger city. The small villages along the coast are very traditional, which means that people lives mostly from the fishing. If you compare the number of boats and changes of people, who working in fishing in last 40 or 50 years, the fishing activities is going down very quickly. Nowadays in Bermeo is ¼ of boats, which were in use a few years ago. Nowadays boats are more efficient.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

You can noticed, than the core of coastal cities are near the bay, and together with height on slopes there are more new settlements. The newest settlement is located in places, which are not very friendly for building.

Most of villages are located in the mouth of rivers - estuaries. We have 12 estuaries in Basque country and in every of them you can find a settlement in the mouth. The rest of the coastal territory has very disperse settlement. There are a kind of harmony between settlement and environment in the Basque country.

The typology of Spanish and French coast is completely different. In Spain is rocky coast and in Aquitaine is sandy coast. So there are some important villages: Biarritz, Bayonne and Saint Jean de Luz and other parts are very long sandy beaches, very good for holidays and vacations. There are not a lot of small villages. The each available part of the coast was settled in previous centuries. The sandy bay and the settlement was establish and the village was growing up, also on the slopes and there are any places, where the new settlements can appear, because there are only rocks, and each possible bay is already settled.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

The main process is changing agricultural and forest area into trees plantations, especially two kind of species: eucalyptus and pines. The quality of forest in Vizcaya and Araba is completely different. On the Comprehensive Land Cover Typology (2000-2006) map you can see that all Vizcaya and Guipuzcoa had a lot of forest area and in Araba is just a few places, where Corine identified forest. In fact the quality of forests in whole north regions is poor, because there are mostly forest plantations with just one or two species. And on the south there are some natural forests. In the Basque country there is not any good oak forest. It's not good situation that almost 80% of forested areas is occupied by two species of trees. Originally oak forest cover 90% of surface of Vizcaya province, nowadays it covers less than 5%. Some of the areas are cover by shrubs. Every five years the government publish document, which is analyzed of the forest in community. They put in the same category the broadleaves trees: eucalyptus and oak which are completely different. So in the statistic broadleaves forests are increasing.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

In Corine Land Cover you can identify some grid, cells telling you that some piece of land is agriculture. In reality the land will be occupied by house, which is only use for family for resident. You are not making any economic profit of that. Corine tells that is agriculture area and from economic point of view it isn't true. The cover is good, but the land use functions are different. Also with forest area can be the same: on the map it can be forest, but in reality functions of this land can be different.

The ecological and economic functions is different when you compare the plantation and natural forest. People living from forestry or agriculture will see landscape from different way than tourist. Maybe from people living in agriculture land the plantation of trees is not so bad, because there are living from the profits of this land. The sensibility is also different. People living in the north coast of Spain get used with plantation of trees. Close to Vitoria is located forest of natural species.

The management has responsibility analyzing all goods, services, which land can provide. And they can put it into balance. They have to promote the best practices and give some money for promoting programs of good management of land.

Concept of ecosystem services is a relatively new, it's important for management of land. Not just of way of thinking how to get founding but also in order to good management.

Non-government organizations try to manage some parts of land; especially they promote natural forest on private lands. Normally it look that owners cut all eucalyptus and pines and put there oak and another natural species. The non-government organizations try to make these areas open for public. We are trying to make that situation heritage.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

In coastal area are not any important roads between Bilbao and San Sebastian. The most expensive and important are highways. Expensive project is the railway "The Basque Y" between three main cities in the Basque country.

The Eurocity San Sebastian- Bayonne is similar like Bilbao, the only differences is that in San Sebastian properly is no commercial port. There is just one fishing port, but very close to city. 5-6 km to the east from San Sebastian is located industrialized area – port of Pasaia. The Basque country has a very strong tradition of industries, especially with iron, steel. Port of Pasaia is a place to exchange materials, dealing with industries. The Bilbao area is one of the most industrialized area in the Spain.

Now in Pasaia there are considering in project for constructing a new harbour. Nowadays the harbour is inside the mouth of river, plans are talking about port outside, in the coastal area. This is very important project with a lot of controversy, from the environmental and economic point of view it's not a good project. This harbour will have a big impact on environment. They want to build this, because they want to increase transport, trade.

Bermeo has a strong character, because of marine, so the local government want to create there some commercial in connect with marine transport. There are thinking about a new road going from Bilbao to Bermeo with a big tunnel, which should reduce travelling time. But it is unusual road project in coastal area.

In Basque country is one place to experiments with wave energy. But there are some projects for wind energy.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Normally in Basque the model is different than in Mediterranean coastal area. In Atlantic coast (Galicia, Asturias, Cantabria) and in Andalusia is different because new buildings are for hotels and services. To some extent in Basque coast you can see some of this type of buildings, but absolutely different in dimension. In Basque coast are a lot of second houses. For instance many people live in Bilbao and go for holiday to their second resident house, 40 km away. Also block of flats are summer apartments. The reason is because of relief. Some of natural area are naturally protected, because of a long distance to sandy beach and rocky typologies.

There no many hotels in the Basque coastal area. And also not so much very high buildings in the coastal villages and towns, which damage landscape.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

No response

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

During the last 20 years the local government is doing a monitoring of water quality. Fortunately many important things connecting with water quality has change in better way. There were introduction security skills. In last five years ships movements in coastal area were increase, but fortunately the water quality also.

The problem is also trees plantations: people are thinking that Basque country has a good land use structure, because of a lot of land with trees. But in reality “forests” haven’t got a high nature value, because mostly there are a tree plantations, which consist of eucalyptus and pines.

It’s also problem for Corine Land Cover, because the satellite view couldn’t recognize a different between forest and plantation of trees. On one area in 1990 it could be forest, but 10 or 16 years later it could be a plantation. It’s deforestation and changing land use to agriculture area.

With lack of several of trees, the biodiversity is loosening. People from Vizcaya need to go to other provinces to see birds, flowers or animals in natural environment.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Scenarios say that risk of flooding has increased. All plantations of trees increase the risk of flooding. The land is significantly threatened by alien species occupied

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

In general speaking most land are cover by forest, by we should notice, that there aren’t natural forests but plantations mostly of pines and eucalyptus.

The most important are changes in landscape and land use, when the investors after a few years decide to cut down the plantation. For eucalyptus it is about 12-15 years, for pines 25-30 years. The problem for them now is that prices are very low because of two reasons. First of all there are a lot of opportunities for taking wood from many parts of the world: it is possible to take a big boat with wood from every place in the world, that you can imagine. It’s because prices can be much better somewhere else. And the second question is that three years ago there was a very important storm in the Basque country, something like twister. In French part of region there was a lot of plantation of pines and the storm fall dawn a many of these trees and the French people had a lot of wood, which put to the market and the prices fall down. The planters are waiting for the better price.

This is more important than natural disasters because of lack of biodiversity. For natural point of view this is problem, but most of people don’t realize, that most of green areas aren’t forest but plantations.

Most of fire are not natural, there are because of human action.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

We can separated environment and rural with industrial areas. Energy producers, industry, logistic centres mainly concentrated in urbanized areas. In the Basque country tourists are concentrated in three major cities and in the coastal zone. In internal land it is some tourist place, but it isn't very intense.

The coastal area is more multifunctional. Good example is Mundaka, where there are some functions. These are natural reserve, but also its tourist place, settlement, people make fishing activities and some small business are located there.

2. Multifunctional land use - which of the functions in your region co-exist?

Settlement, second houses, tourist place. Also fishing activities, recreation areas and small business.

3. Which of the functions are the most important in the context of land use?

4. Is the number of functions of land use increasing or decreasing?

5. To which extent is the land in your region used in multifunctional way?

6. What kind of functions co-existence is:

- a) the most effective?
- b) the most desirable?
- c) the most common?
- d) the most difficult?

Not asked – not respond.

7. Which of the functions of land use are the most important for the future regional development?

Not asked – not respond.

IV. Spatial conflicts

1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).

In the coastal areas are some spatial conflicts like using previous forest land for agricultural purposes. Also there are conflicts between fishers and energy, gas production companies.

Because of industries investment at this moment marine area are not very well develop; the conflict is not very high. In next years the conflicts will be higher if we do not get any tools or rules for manage this conflict.

Other conflict is natural protection and fishing. Fishing is potential conflict everywhere in the marine environment, because it's the most traditional activities in coastal area. Any other activities, which are located there are in conflict with fisheries.

2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?

Fishers, energy producers, investors.

3. Which of the actors are the most dynamic and successful in obtaining new land?

The most important players, who changes land, are mostly owners of trees plantations.

4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

The more close to the coast the land is located the probably that is private land is higher. When you go to the south, to Araba, there are much more public land than in Vizcaya and Guipuzcoa. This is reason why most of the land in these two last regions is occupied by plantations, because owners want to take as much economic benefit from land as they can.

The owners of land decide what they want to do with their territory. It exists 'Sector plan for forestry', which gives some general guidelines, descriptions, rules.

The model of exploitation of forest area isn't good, because of management of forest land. When trees have 25-30 years, the investors cut down all of them, so a huge area is deforested. The area is in one moment without trees, herbs, it is just land. When it's raining there is big erosion, so a lot of soil just lost. Natural capital of this land is lost. There is a very big problem with a lost of quality of land. There is most important impact of this kind of management.

The spices, which investor was putting there is not a big problem, because ones are better, others not so much. But the biggest problem is management, very aggressive on the land. That's much cheaper than making biodiversity on land. Another question is that in order to explore you should construct a lot of small roads, which will be used by trucks.

The government should make rules for management. It because this action has big impact for soils, rivers and biodiversity. It's not just the problem with the small land, where owner cut all trees, but it has an impact on the other parts of region.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

Not asked – not respond.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

There is a SIGPAC program, which include GIS for agriculture land.

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?

Not asked – not respond.

2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?

Like I said before, lands located near to the coast are probably in private hands. They usually want to have benefits from land, so they changing agriculture or forest area to plantation of trees. Also on the coast density is higher, because of labour market, climate, landscape.

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.

The future is very difficult to predict. Everything is changing very quickly, so it's more difficult for me to predict next years than to somebody who lived 30 years ago. The matter of land use (especially forested area) can change because of changes of global market (the more and more impact of China). I can imagine more occupation of coastal area by marine project.

I hope in next year's we will have better knowledge and better instruments and tools for property managing the coastal area. Marine coastal planning will be an important issue for management. The evaluation of coastal activities will be important issue also, as an instrument for managing.

Fishery will be going downer, but others activities in coastal area will be increase (tourism, marine energy).

2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.

In Corine Land Cover we can see that whole the Basque country is very well forested. But in fact just south of the country has a good quality forest. 80% of forested area in north part of region is plantation of trees.

Region: BASQUE COUNTRY

Place: VITORIA-GASTEIZ

Person interviewed: ALFONSO SANZ ARAUJO

Director of Spatial Planning - Department of Environment, Spatial Planning, Agriculture and Fisheries. Basque Government.

Interviewers: Gemma Garcia Blanco, Konrad Ł. Czapiewski, Mariola Ferenc

Date: 12/01/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

The Basque country has got 2 million people. The density is about 300 people/ km², so it's about triple for average of Spain. The planning of land use, the governance is very important for so density area. Most of the population is going to main cities: Vitoria, San Sebastian, and Bilbao.

Cities located on the coast have also increase of population. Cities located in internal, 20-30 years ago had 40 000 people, nowadays there are 25 000 e.g. Éibar. The reason is movement from these cities to big towns and to the coast zone (Deba, Mutriko).

The Basque country has different than mediterranean areas dynamic and patterns of settlement, demographic processes.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

In the Basque country is trend to concentrate settlement and revitalize old buildings for apartments, business centers.

In framework we have a territorial planning (PTP) for each functional area. In PTP for each town we have a number of houses, which can be constructed.

The mayor of cities have some statistic about population, settlement, economic situation. We can say that city could have some number of houses. The mayor knows, that city has services, good infrastructure and can have more inhabitants, because then the economic situation of town increase.

Sometimes the government could change the number of houses in plan. When mayor needs to increase the number of houses he can go to commission of spatial planning in regional government. But he gets only small flexibility – the number of houses can increase just about 10%.

The private investors, constructors never speak with regional government. Investors are talking with local government before changing in spatial plan for municipality or city. In first time it's checking with all frameworks if the new investment is compatible with law.

Mostly, the cities want a high level of new houses in territorial plan, because they want have flexibility. But in Guipuzcoa are a lot of municipalities, cities, which didn't want a high number of possible houses; it's because local government thinks that actual number of houses is enough.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

In the Basque country they take into consideration the quality of agriculture. They also make protect the tradition. They have a number of the plantation of forest – especially in Guipuzcoa and Vizcaya. In the south of Araba there are processes of concentration of the land to bigger parcel.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

Not asked – not respond.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

Not asked – not respond.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Not asked – not respond.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

Not asked – not respond.

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

Not asked – not respond.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Not asked – not respond.

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

Not asked – not respond.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

The Basque country is the industrial area. There are a lot of changes in land use, because many sites, that were industrial nowadays, are residential. Also in some places like Éibar, which are depopulated.

2. Multifunctional land use - which of the functions in your region co-exist?

Not asked – not respond.

3. Which of the functions are the most important in the context of land use?

Not asked – not respond.

4. Is the number of functions of land use increasing or decreasing?

Not asked – not respond.

5. To which extent is the land in your region used in multifunctional way?

Not asked – not respond.

6. What kind of functions co-existence is:

a) the most effective?

Not asked – not respond.

b) the most desirable?

Not asked – not respond.

c) the most common?

Not asked – not respond.

d) the most difficult?

They put in balance a rise of big shopping centers and small shops. The PTS of activities try to put in balance this issue.

7. Which of the functions of land use are the most important for the future regional development?

Not asked – not respond.

IV. Spatial conflicts

1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).

There are conflicts between public interest and private investors, for example shopping centers. In the Basque country is trend to concentrate settlement and revitalize old buildings for apartments, business centers. But investors want to build new centers at the suburbs.

2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?

Not asked – not respond.

3. Which of the actors are the most dynamic and successful in obtaining new land?

Not asked – not respond.

4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

Not asked – not respond.

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

Land planning in the Basque country.

We have land planning law (LOT) from 1990. We have different tools for respect this law:

- DOT – guidelines for whole Basque Country,

- PTP – territorial planning in functional areas. The Basque country is divided into 15 functional areas. The one area has 12-15 municipalities.
- PTS – sector land planning (houses, flooding, energy and rail infrastructure, etc).

The general land planning law can be changed, also major tools, e.g. classification of land use. Nowadays the government is working for law of landscape. It's new interesting tool. In this month it will going to government council and after to parliament. It's new legislation. Not many regions have own aw of landscape: only Catalonia, Galicia and Valencia. It will regulate impact of the landscape and every activities; it will preserve and manage the landscape in terms of perception of people, identity. All intervention in landscape will have to make report of assessment. Different departments have responsibilities and knowledge of landscape, so they want to cope with it together.

Landscape is possibility to see the land use; it's another tool for work, e.g. in processes of degradation of certain areas.

In next three months the government want to approve the sector plan for agro-forest activities for whole Basque country. This is very important, because only 1% of GDP in Basque country came from the first sector. It's probably because the Basque country doesn't have very strong tools connecting with the agro-forestall problematic.

Nowadays we are changing the guidelines for the Basque country to put limit to develop the cities, the urban plan land limits. Establish the limitation for urban growth. The guidelines will regulate market processes. The law sometimes have some flexibility. The mayor of the city has possibility to interpret what to do.

We have LOT and tools. We have to respect the law and guidelines. We are changing just one part of the tools, but model still works.

In last 10 years a lot of things appear in framework, e.g. environment, which is very young discipline. We don't have many tools to govern this. Also with the climate change – we have an idea to put some indicators that we should respect.

The hierarchy of government in Basque country:

- The Basque general government,
- Three provincials councils,
- The municipalities and cities.

Those different levels have different competencies, possibilities. There are very complex, but in the same time the results of this is grid. In all PTP's we have consensus with all provincials' councils. When you want consensus sometimes you have obligated to complain this.

The land use planning is going well.

We have very big commission, about 25 people from local councils, provincial's councils and the Basque government. This commission has all rules to prepare public administration. In commission of spatial planning there are representative of national government.

The framework is good. The responsibilities for each level are suitable. It's good balance of responsibilities.

In the Spanish framework the spatial planning is located on regional level. All country works like federal state. But some of competencies are responsibilities of national government, like sector of energy. This model works very well in last 12 years. We are changing the rules, because the external factors are different nowadays.

For example the city of Bilbao want to make 25 000 houses, and the commission of land planning make the limit on 20 000. The city has to change own documents. The Basque country has a limit of new settlements, so we don't have problems like the Mediterranean regions.

The stronger problem with settlement has only Vitoria-Gasteiz region. There are massive of residential area.

The changes of framework is for reduce houses problem in different municipalities in the next 20 years. Other limit is the parameter of the cities. In the beginning of this process we put limits. We think that all the construction in Basque country had to be making into cities: reconstruction, renovation etc.

It's no easy because municipalities have autonomy, competencies and own plans. But with the law we have possibilities to limit this. Land planning is very special, also because of Consumer Law (Open Market) Directive from Europe, which is talking about the commune open, liberty of competency.

The spatial conflict is because of limits in land planning in European directive and big shopping centers. The directive said that everybody have to respect of liberty economy, but estate land planning, because it's in public interest. Companies like IKEA make pressure on the regional governance because they want build wherever they want. They went to the court, but the government won – spatial planning couldn't be changed for market.

EU said that land planning have this own responsibility, it do not respect the open market. This is a new problem; there was also dilemma in San Sebastian, in some small cities in all country.

The guidelines are changing for put more limits because the government thinks that it should be process of reconstruction of old buildings in cities rather than a new settlement in cities.

Some of the issues, like transport are regulated by national law, guidelines. For example speed train, which are under construction in the Basque country, and nowadays there are some agreements with France. In big constructions the papers from national governments are very important: for speed trains and seaports. We have two big, important ports: in Bilbao and in Pasaia Bay. The Spanish government has strong competencies in sector aspect.

We have knowledge what happen in neighborhoods' regions and they know very well what we are doing. We are doing now the PTP for Donostia-San Sebastian and we send them this document for comments, opinion from their side.

The bigger problem is that Navarre wants that the higher speed train connect also Navarre with the Basque country and France.

The Urdaibai estuary is a natural region and a Biosphere Reserve of Biscay, where the double framework exists. First from government, second for environmental protection.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

Generally regional administration is effective the most important element is a good and sufficient system o tools in planning described above.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

Yes – each year the regional authorities of Basque Country publish the “Udalplan – Sistema de Informacion Geographica y Banco de Datos Territoriales de la CAPV” which is a very good and detailed tool for monitoring the changes of land use. In that document it is described in a detailed way the actual coverage but also the plans for possible changes.

VI. Localization (depending on the region)

1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?

Cooperation with France is working especially during the projects.

There is an agreement between Aquitaine and the Basque country to collaborate with main matters. It's not a long border, but is a very important for transport to Europe.

There are different regions, but also different countries. The result is that is also different language, legal and administrative system. France is much more centralized than Spain, but regions, also Aquitaine have the figure to manage space. They don't have as much responsibility like the Basque country does, but they still have the figure.

There are people, who live in France and go to work or school to the Basque country or conversely. They often are going to double-language schools.

2. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?

Not asked – not respond.

VII. Land use in general

1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.

There is four points of view in the Basque government: Vizcaya, Guipuzcoa, Araba and the Basque point of view. The parties are also different in each region.

For land planning it is big challenge. Nowadays problems will be actually in the future also. Maybe it will be with the stronger view on landscape and climate changes. We have small function in climate changes, but we do our best to improve the situation.

I'm thinking about an idea of Euskal city – the link between three biggest cities in the Basque country. If you think about the Basque country like a big city the cohesion in spatial planning will be very easy. We should think about airports, universities and student's campus.

Connection and cooperation between that three main cities is important, because problematic is that each of that town want to have their own facilities – universities congress centers, airports, seaports and other things. Such investments are expensive, and if there will be cooperation within the network of that towns, it would be easier to create the development of the region.

2. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by..... Is it a proper type for your region? Please explain.

Not asked – not respond.

EU-LUPA
European Land Use Patterns

Chełmsko-Zamojski Region Report
Case Study Report
Appendix 6

Applied Research 2013/1/8

Marcin Mazur



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1. INTRODUCTION TO THE REGION

Chełmsko-Zamojski region is located in the south-eastern borderland of Poland in Lubelskie voivodeship by the Ukrainian border (fig 1). The region consists of 6 rural districts (*powiats*) and two urban districts (*powiats*) – Chełm and Zamość. Analysed area occupies 9291 km² with 644 000 inhabitants (2010). Geographically, it is mostly a hilly region in eastern part of the Polish upland belt, with apart from south-western outskirts of San valley (Biłgorajska Flatland) (fig. 2), extraordinary agricultural conditions, e.g. soil fertility (fig. 3). The only part relatively inconvenient for agriculture is the Roztocze Hills, at southern edge of the upland. The region extends from San valley in the South-West to Bug river valley (Polish-Ukrainian borderline) in the East. Favourable environmental conditions for agriculture had an impact upon current character of the region, which is the most rural and agricultural in Poland as a whole. It is distinct for its significant share of agricultural land (69.7%, 2005) and arable land (56.1% of agricultural land, 2005), high input of labour into agriculture, (49.1% employed in agriculture and forestry, 2010, second place among 66 NUTS 3 regions in Poland), high share of small farms and marginality of other functions. The farming plant production includes wheat and other cereals, sugar beet, maize and rapeseed mostly, with local importance of vegetables, hop and tobacco. In the industry structure, small entrepreneurships dominates with a decreasing domination of food processing industry (fig. 4) and characteristic small furniture factories. The only relatively important mineral industry is located in Chełm and its surroundings (northern part of the region) (fig. 5). Total share of employment in industry in Chełmsko-Zamojski region reached 14.1% (2009).

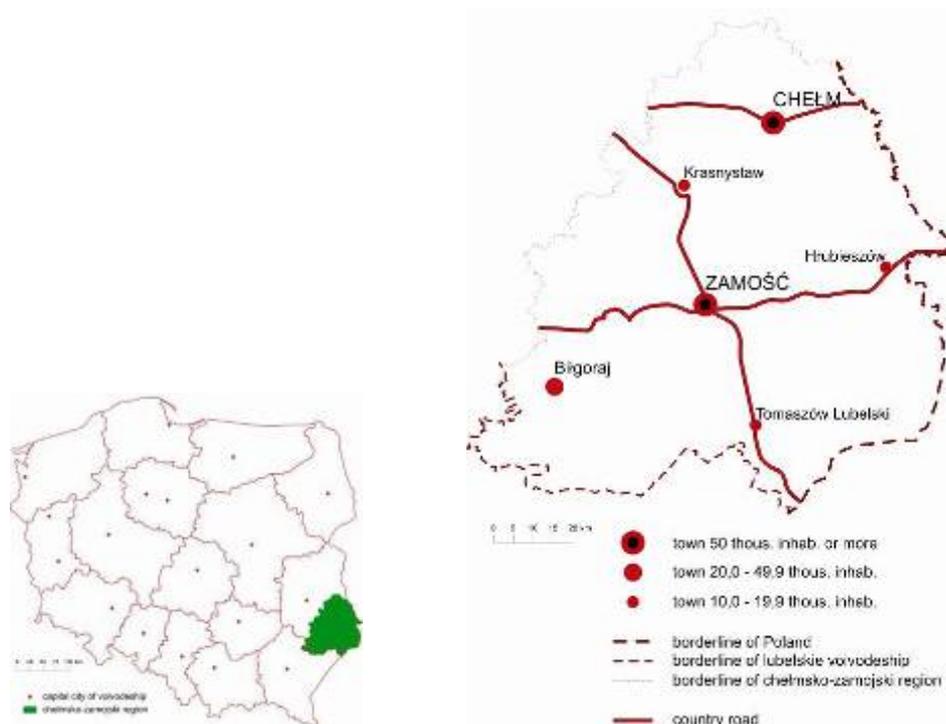


Fig. 1. Location of Chełmsko-Zamojski region

Source: own elaboration.

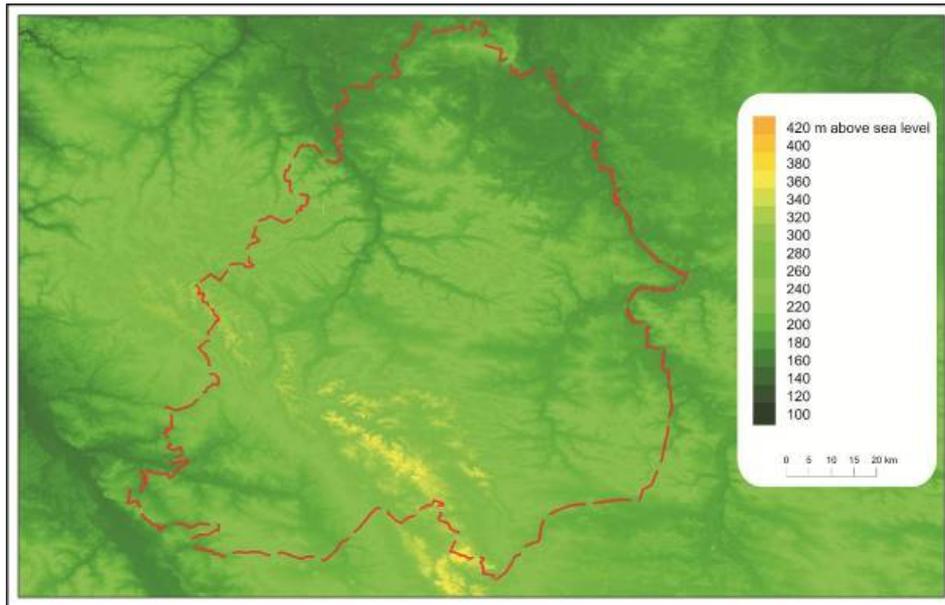


Fig. 2. Hypsometry of the region

Source: own elaboration.

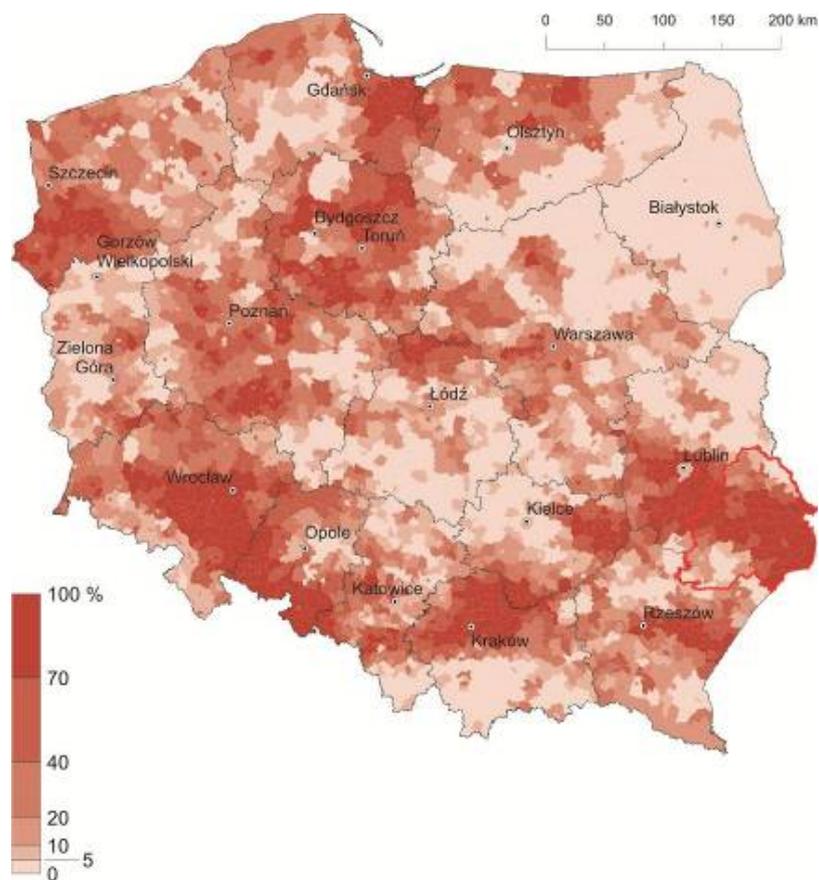


Fig. 3. Percentage of farms with the highest agricultural quality of soil index values on the Polish background

Source: own elaboration based on Polish Agricultural Census data, 2002, *Charakterystyka Rolniczej Przestrzeni...*



Fig. 4. Sugar refinery in Werbkowice (Eastern Lubelska Upland), J. Bański



Fig. 5. Cement mill in Chełm, J. Bański

Both, geographical and historical context have a significant impact on the current economic structure. For most of the time, Chełmsko-Zamojski has been a peripheral region, with a relatively low level of industrialisation occurring, within impermeable boundaries, which inhibited innovative processes. In the majority of 19th and at the beginning of 20th century, the region was the western outskirts of the Russian Empire. After II World War the region became peripheral on Polish background. In the period 1975-1999 the administrative division supported the development of medium sized towns in Poland by creating 49 smaller voivodeships substituting the earlier partition of 17 regions. Chełm and Zamość in that period used to be the capital cities of the two voivodeships, what resulted in a period of their dynamic development and food processing industry inclusive. Industrial plants cultivation developed and hence agriculture became more market oriented.

The region is distinct for a very low urbanization coefficient (38.2%, 2010). Population density was at the level of only 69.3 inhab./km² (2010), almost twice less than the Polish average. Two the biggest towns, Chełm and Zamość, have over 65 000 inhabitants each. Zamość is located in the central part of the region and Chełm is

situated in the North-East. Apart from them, only the city of Biłgoraj (south-western part of the region) has over 20 000 inhabitants.

Permanent outflow of young people, from both rural areas and towns, is a very strong determinant of regional population ageing. The destination of migrants are external labour markets, both domestic and foreign, and centres of higher education. Demographic situation on the rural areas shows a negative tendency, due to a significant majority of males, especially in younger age groups, which is a result of rural services sector weakness and mono-functionality of rural areas.

Lack of successors of less specialized farms on the one hand and volition to be owner of cultivated agricultural land and benefit from direct EU payments on the other decided, that process of enlarging the most specialized farms by leasing the land appeared last years. Land concentration is taking place in land users structure aspect much more than in land ownership.

The region is typically agricultural, with traditional, scattered farms. New industrial and transport investments are relatively rare and insignificant in economic and territorial meaning. Former industrial areas, mainly associated with food and furniture production, were gradually transforming into services sector from the beginning of 1990s. Less favourable macroeconomic conditions for agriculture influencing inefficiency of agriculture in contributing to the Polish GDP and abandoning food industry processing in the region observed last years all committed to Chełmsko-Zamojski 63rd position out of 66 Polish NUTS 3 regions concerning the GDP per capita index, which in 2008 was at the level of 4494 € (Polish Central Statistical Office). The value of this index makes 85.9% of the GDP level for Lubelskie voivodeship and only 59.6% of the mean value for Poland. Chełmsko-Zamojski is one of the poorest regions of the EU.

Agriculture is a sector of economy changing the most dynamically last years. The region is an appropriate case to analyse the impact of economic circumstances resulting from the EU policy on agricultural land use changes for the new member states.

2. CHARACTERIZATION OF LAND USE AND LAND COVER

2.1. Definitions of land use

Land use is defined in a corresponding way to the agriculture dominating in the region's functional structure as well as in land cover. That is why in the case of Chełmsko-Zamojski region land use can be referred to a significant extent by the land cover definition and structure of the sown areas. In description of land use in the region, most commonly used categories include: agricultural land, forests and others. At least equally important in this case is the description of agricultural land structure and the types of agriculture. Agricultural land refers to grounds, which are used by a farmer in agricultural production process. In agricultural land description there are such categories distinguished as: arable land, meadows, pastures and permanent crops. Each of them has a different function. Arable land mostly supplies with cereals, vegetables, fodders and industrial plants. In permanent crops category production of fruits takes place, e.g. in orchards. Meadows and pastures supply with fodders in a more extensive way compared to arable land. Moreover, in description of functional changes of agricultural land use very useful are such terms as intensive or extensive, industrial, market oriented, self supplying, animal or plant production dominance.

2.2. Surface and structure of land use

In Chełmsko-Zamojski region agricultural land dominates (69.7% of total area, 2005) (fig. 6). In the spatial pattern, there is an improvement of natural conditions for agriculture, in particular from North and South towards the middle of the region and to the East. Therefore, the highest share of agricultural land is observed in the East of the region (79.4% in hrubieszowski *powiat*), and the lowest in the South-West (56.1% in biłgorajski *powiat*). Arable lands are dominating among them (80.5%, 2005) (fig. 7). The orchards area is rather low (1.2% of agricultural land area, 2005) and shows a significant share only in krasnostawski *powiat* (2.2%, 2005). Meadows and pastures occupy the remaining 18.6 % of agricultural land area (2005). These are concentrated along river valleys, hence the highest share is observed in Chełm surroundings, near to Bug river, where in addition agricultural quality of land is slightly lower.



Fig. 6. Typical landscape of Chełmsko-Zamojski region (view from the hill in Szczepieszyn to Central Rostocze Hills), M. Mazur

Forestation index is relatively low (22%, 2005). Relatively high share of forest area is observed only in biłgorajski *powiat* (38.7%, 2005), where infertile sandy soils are dominating. In this region and in Roztocze Hills only a small furniture industry has developed.

Internal water surface takes very little share, mainly due to several artificial water reservoirs with combined functions. The biggest one is situated approximately 20 km heading West from Zamość and has about 950 ha.

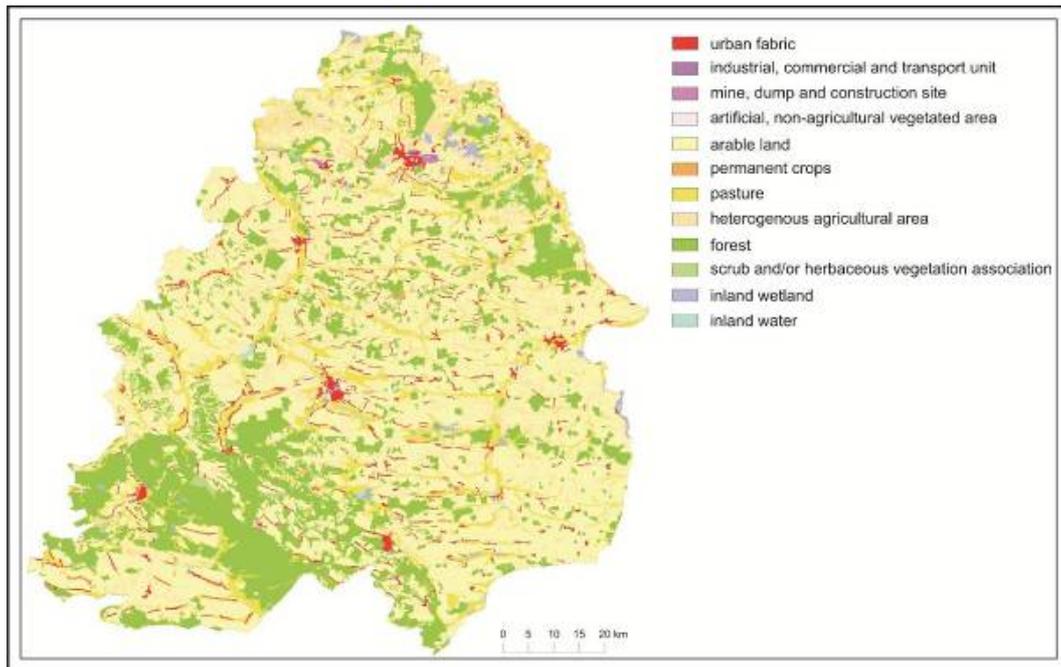


Fig. 7. Land cover, 2006

Source: Corine Land Cover Image, 2006

2.3. Land cover specificity

Environmental conditions influence the land cover spatial pattern to the greatest extent; other key factors contributing are: soils fertility, water balance and relief. Most of the area is occupied by arable land. Its spatial distribution depends very strictly on favourable natural conditions for agriculture influenced mostly by soil quality. Meadows and pastures have a significant share in slightly less favourable area in Chełm surroundings and in river valleys. Agricultural conditions are less suitable there, and these areas are excluded from crop cultivation at first. The regional urbanisation index is low and the artificial surface takes a little share of total area. Housing area is particularly prevailing. There is no extensive industrial or transport areas in the region. Forests dominate in South-West and South, where infertile soils on sands or steep slopes in Roztocze Hills make the agricultural activities difficult. The forested areas are partly protected within the Roztocze National Park. In eastern part of the region there are several unique habitats with natural steppe flora and fauna. These are protected areas within wildlife reserves.

2.4. Protected areas (from environment, military, etc. points of view)

In Chełmsko-Zamojski region 22.7% of the total area is protected by law (2010). The largest share is observed in Chełm surroundings (42.1%, 2010). Only 1% of total area of the region is occupied by two national parks. In the central part of Roztocze Hills there is Roztocze National Park preserving the unique primeval forest ecosystem of 8483 hectares, which used to be a protected area since 16th century as abundant hunting grounds, used by famous aristocratic family – Zamoyski. In the northern outskirts of Chełmsko-Zamojski region there is Poleski National Park's area (of which 9,7% is situated within the analysed region), where swamps and lakes with their flora and fauna are protected. The biggest share of total protected area of the region (56.4%, 2010) is taken by the seven landscape parks. Four of them are situated in Roztocze Hills: Szczepczyński (estern part), Krasnobrodzki (central part), Puszczy Solskiej (southern edge) and Południoworoztoczański (southern-east). Apart from those, in Chełmsko-Zamojski region there are: Chełmski (northern-east edge), Skierbieszowski (central part) and Strzelecki (eastern edge). Landscape parks have the most significant impact on the land use, because their network creates a form of preserving agricultural and environmental dual land-use function on the predominant surface. This form of active environmental protection based on supporting good agricultural practice contributes in avoiding harmful human activities in the most environmentally valuable parts of the region.

Protected areas in general, in spite of their high share, do not have a significant influence on land use changes due to domination of traditional agriculture in the region. Although the protected areas show some impact on land use in the current structure, being the barrier for intensification of agricultural production, which started taking place outside of them. Nevertheless, it should be admitted that there is no notable pressure on the investments harmful to natural ecosystems.

2.5. Technical management of the land use (infrastructure, drainage systems, etc.)

Technical infrastructure does not take a large part of the land use. There are three national roads within the region, but lack of expressways (limited-access highway) and motorways. There are two railway axis with passenger-trains and one broad-gauge railway for international freight transport. Apart from the connection from Chełm heading West direction, the railway traffic is not very common nor frequent.

Drainage system was formed in the North-East, along the Bug valley, but it does not function currently. Generally, technical infrastructure does not have a significant influence on the land use as the agricultural function dominance in the region does not require a particularly developed technical management.

2.6. Major trends in historical context

The major trends of land use changing depend on economic and to a lesser extent, demographic processes, which are strictly related. Their impact reflects especially in agricultural economic situation and land structure changes. For centuries, this region used to be covered mostly by arable land. Generally, in the last decades forest invasion on meadows and pastures is observed and therefore resulting in reduction

of their area (fig. 8). This process is strongly linked with concentration and intensification of cattle breeding in the region, abandoning meadows and pastures as a fodder source. Small farms do not uphold animal production due to macroeconomic changes in agriculture and their meadows and pastures areas are often under renaturalisation. Most farmers of the region sustained animal production on a small scale up to beginning of 1990s for self-supplying.

Transforming meadows for willow cultivation is the process occurring in the last years (fig. 9). This positive tendency contributes to a greater use of renewable energy in Chełmsko-Zamojski region.



Fig. 8. Forest overgrowing on pasture in Radechnica (Western Roztocze Hills), M. Mazur



Fig. 9. Energy willow cultivation on former meadow in Sułów (southern Lubelska Upland, Por valley), M. Mazur

Impact of economic situation within the region is also observed in case of shifting of the sowing area. Chełmsko-Zamojski was famous for cultivation of such industrial

plants like sugar beetroots (fig. 11), flax, tobacco (fig. 10) and hop (fig. 12). The cultivation of listed plants including the potatoes, due to various economic circumstances, shifted to cereals nowadays. Cultivation of mentioned plants that once were characteristic for the region became rare as these are upheld at a small scale only. On the other hand, best prospering, food industry in particular fat processing factory in Bodaczów (15 km to West from Zamość), caused introduction of rape cultivation in the region. The economic difficulties that have arisen last years however, contributed to a decrease of rape cultivation in the region.



Fig. 10. Little scattered areas of sugar beetroot cultivation, former very common plant in the region (Gaj Czernięciński, Western Rostocze Hills), M. Mazur



Fig. 11. One of the last examples of traditional tobacco drying in the region (Gaj Czernięciński, Western Rostocze Hills), M. Mazur



Fig. 12. Hop plantation in Lubelska Upland, J. Bański

While the intensity of plant cultivation in the region declined, the breeding industry and the agricultural production related is currently developing. Although the number of cattle and pigs was decreasing, production was concentrating in less number of specialised, larger farms. This results in abandoning of mowing the meadows, and introducing of fodder maize cultivation.

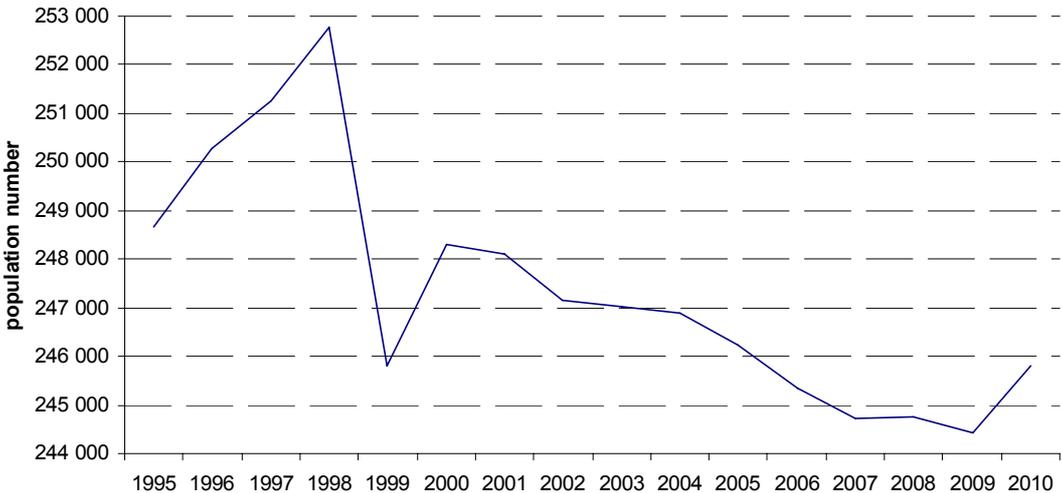
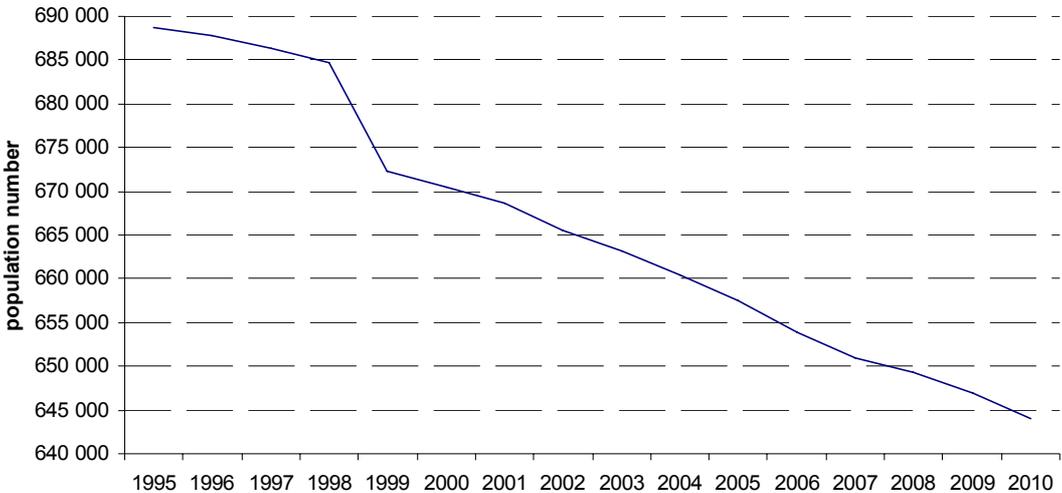
Forested area slightly increased, because cattle breeding is in collapse and meadows are no longer mowed on the one hand, and the furniture industry is not developed enough to exploit the forests and significantly reduce their area on the other. The economic condition of agriculture does not put pressure to reduce forested area on the weaker soils.

In the last years an increase of land use for touristic purposes is observed. There are new investments in the region, such as: the ski lift, artificial water reservoir and a stud farm. This process is observed especially in Roztocze Hills region (southern part), where the entire territory of national park is located. In the 1990s, the largest artificial water reservoir in the Chełmsko-Zamojski was built on Wieprz river, in western part of the region. This influenced significantly the raising of recreational function in the surroundings since then. Another sub-region of leisure activities and agritourism function development since the 1990s is Central Roztocze Hills, within the landscape parks nearby the Roztoczański National Park border.

3. NARRATIVE OF CHANGE IN RELATION TO LAND USE

3.1. Socio-economic (demography, employment, ... etc.)

Chelmsko-Zamojski region registers a permanent young people outflow in particular from rural areas, and to a lesser extent from towns as well. Migration from urbanised zones is mainly due to difficulties on local labour markets caused, among the others, by collapse of numerous workshops of food processing industry in the region dating from the 1990s. Additional impact on population number decrease has also negative natural movement (fig. 13).



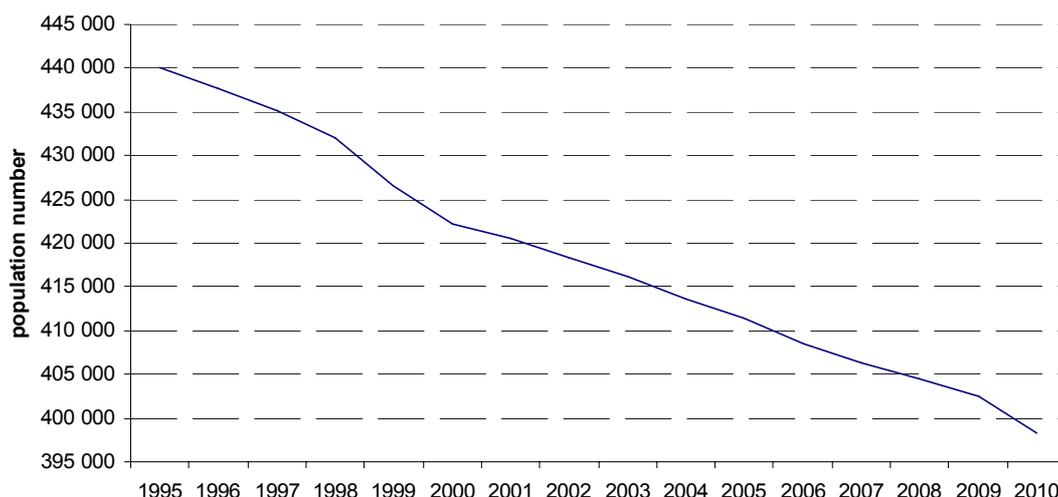


Fig. 13. Change of population number in the region: total (top), in towns (centre) and in rural areas (bottom)

Source: Source: Bank of Local Data, Central Statistical Office

Another negative tendency observed in regional demography is unbalanced feminisation index, especially in marital age groups. As can be expected, far lower values of feminisation index are noticed when analysing the feminization index for population aged 20 to 29 years old in comparison to total index rate (tab. 1, fig. 14), and marital age is the most influential on natural movement rate. Index for this age group is also a more applicable indicator of a real demographic situation because it is more influenced by migrations intensity and structure and reflects the impact of economic situation more fully. In Chełmsko-Zamojski, the value of feminisation index in marital age is significantly lower than in Poland as a whole, and even comparing to Lubelskie voivodeship, although it is generally raising. There are significant differences between the values between urban and rural areas, but a trend of gradual equalising is observed as the disparities are diminished. However, an increase of index value on rural areas can be explained not only by the effect of positive economic transformation, but in majority as a result of raising percentage of population in a post-productive age, where the excess in number of females is significant. Although a general raising of feminisation index value is noticeable in the region, it still remains at a lower level than it was for Poland in 1995.

Groups of population in marital age in different communes are more diverse regarding the feminisation index values. The communes of lowest values are in the eastern outskirts of the region, and generally in peripheral, rural areas like Jarczów commune in Southern-East (75.7) and in Horodło commune in the East (76.3).

Tab. 1. Feminisation index in marital age group

	1995	2010	Dynamics (1995=100)

Poland	Total	96.0	96.6	100.6
	Urban areas	100.3	98.7	98.4
	Rural areas	89.7	93.6	104.4
Lubelskie, Podkarpackie, Podlaskie and Świętokrzyskie voivodeship		93.2	94.6	101.5
Lubelskie voivodeship	Total	93.1	94.4	101.4
	Urban areas	103.2	97.9	94.9
	Rural areas	84.6	91.3	107.9
Chełmsko-Zamojski		90.1	91.7	101.8

Source: Bank of Local Data. Central Statistical Office

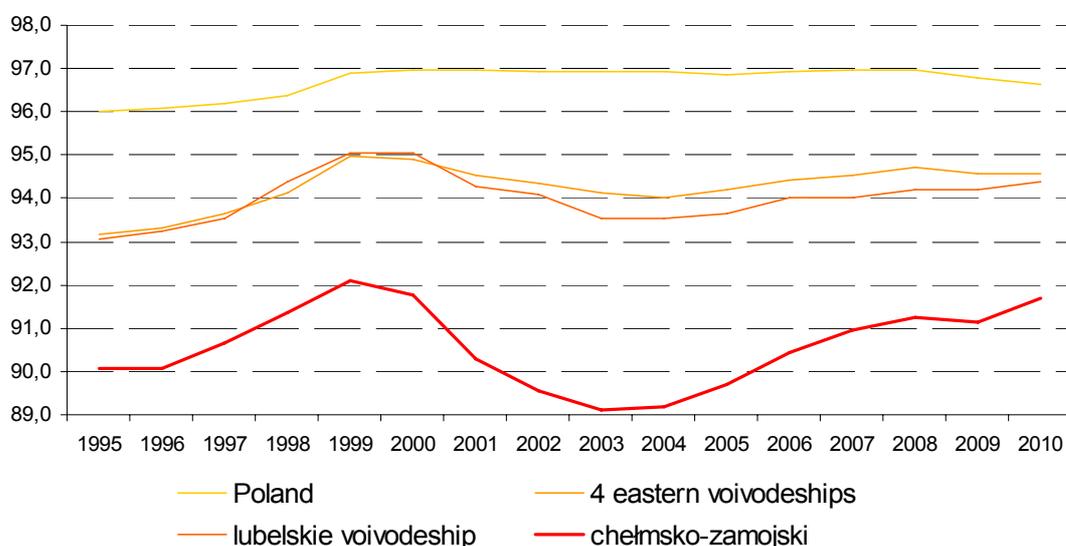


Fig. 14. Feminisation index in marital age group change

Source: Bank of Local Data. Central Statistical Office

Unbalanced feminisation index in most of Chełmsko-Zamojski area has a negative impact on general demographic situation within the region, what can be observed for instance in a low natural movement *per saldo* and the ageing of society. An increase in feminisation index values is observed, what can be linked with a gradual tertiarisation of rural economy.

However, the age structure of regional population as a consequence of permanent young people outflow is unfavourable and this negative tendency is deepening. This phenomenon is also strictly related with disadvantageous sex structure. It can be seen on the sample of rapid share of population under 14, as a change and gradual raise of population in post-productive age increase (tab. 2. tab. 3. fig. 15).

Tab. 2. Percentage of population under 14

	1995	2010	Dynamics (1995=100)

Poland	Total	22.5	15.1	67.1
	Urban areas	21.0	13.9	65.9
	Rural areas	24.8	17.0	68.4
Lubelskie, Podkarpackie, Podlaskie and Świętokrzyskie voivodeship		23.8	15.2	63.9
Lubelskie voivodeship	Total	23.3	15.3	65.6
	Urban areas	22.8	14.1	61.9
	Rural areas	23.8	16.4	68.7
Chełmsko-Zamojski		23.9	15.0	63.0

Source: Bank of Local Data. Central Statistical Office

Tab. 3. Percentage of population in post-productive age (females over 59, males over 64)

		1995	2010	Dynamics (1995=100)
Poland	Total	13.8	16.9	122.5
	Urban areas	12.8	17.7	138.4
	Rural areas	15.4	15.6	101.4
Lubelskie, Podkarpackie, Podlaskie and Świętokrzyskie voivodeship		14.7	17.3	117.1
Lubelskie voivodeship	Total	15.4	17.7	114.7
	Urban areas	10.9	16.7	152.6
	Rural areas	19.2	18.6	96.5
Chełmsko-Zamojski		16.4	18.1	110.3

Source: Bank of Local Data. Central Statistical Office

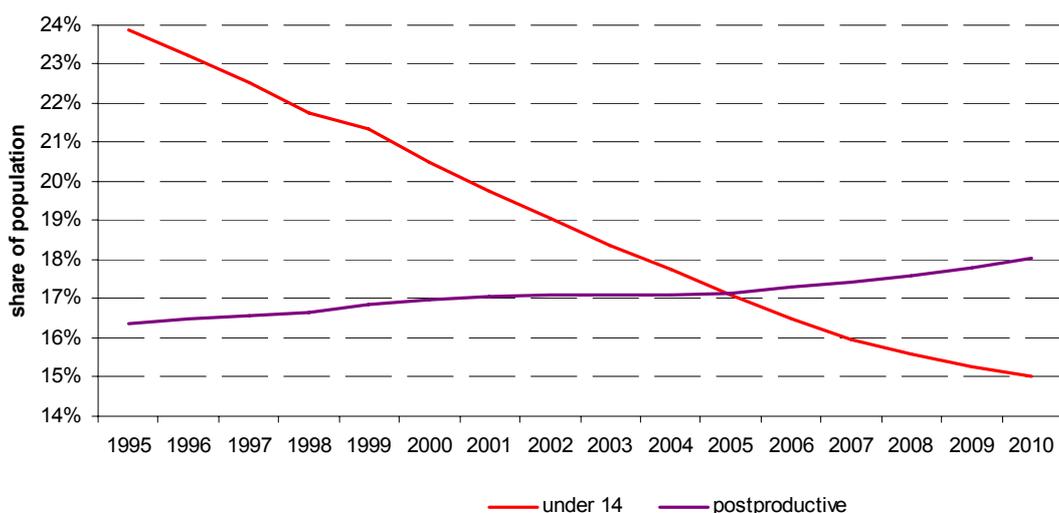


Fig. 15. Percentage of under 14 and post-productive (females over 59, males over 64) population change

Source: Bank of Local Data. Central Statistical Office

Demographic process of population ageing is the major reason, that lack of successors of the small farms leads to the leasing of land to the larger competitors, which are more economically effective. This also has an impact on agrarian structure. As a result, the number of small farms is decreasing rapidly, which is a common process in the Polish agricultural regions. In the years 2005 to 2009 number of farms under 1 ha in Lubelskie voivodeship declined from 75.1 to 54.5 thousand (27.4% decrease). During this period share of the farms above 2 ha increased from 59.1 to 65.4%. It highly contributes to the abandoning of breeding in small farms and intensification of animal production, but at the same time reinforces the changing of cultivation structure for a more extensive one.

Due to the limitations on the labour market, a permanent outflow has been occurring since the 1990s. Mainly the active and the enterprising young people migrate outside of the region to big cities as well as abroad. This process accelerated in the recent years due to new opportunities of earning money abroad or studying. It brings a harmful impact on the economic activation of the region. Rural population, relatively less educated had limited possibilities of finding the job other than agriculture sector.

As a consequence, the level of entrepreneurship in Chełmsko-Zamojski region is very low (69.3 enterprises per 1000 inhabitants) and it increases relatively slowly (by 78.1% between 1995 and 2010). Registered unemployment in the region is rather moderate (14.6% in 2011). A phenomenon occurring in the rural areas of south-eastern Poland called - hidden unemployment in agriculture is worth attention; there is too much labour force used in small farms and this is not registered as unemployed.

Main industrial activity concerns the cement mill in Chełm, some remaining food processing industry and small furniture factories in Zamość and in Roztocze Hills region. The one in Zwierzyniec is prospering the best. Changing of land use in rural areas into multifunctional is a rather slow process. It appears mainly in introducing tourism in traditional rural areas with unfavourable environmental conditions for agricultural activities (fig. 16). Heritage of landscape of the region determines significant tourist potential. Old Town in Zamość (fig. 17) was placed on the World Cultural Heritage List in 1992. The cultural heritage includes also old spatial patterns of villages and traditional countryside architecture. Diversified relief, small patches of cultivated fields, a significant share of forests and attractive mosaic landscape are contributing in creation of this potential as well. However, it still remains a marginal form of land use. The most rapidly developing kind of services in towns is trade in stores and supermarkets. The main reasons for failure of large enterprises in second and third economic sector are: the peripheral location of the region, its weak human potential and lack of industrial tradition.



Fig. 16. Advertisement for accommodation opportunity in “Oasis of Peace” (left) and modern hotel in rural area (right) (Kawęczynek, a village in Western Roztocze Hills), M. Mazur

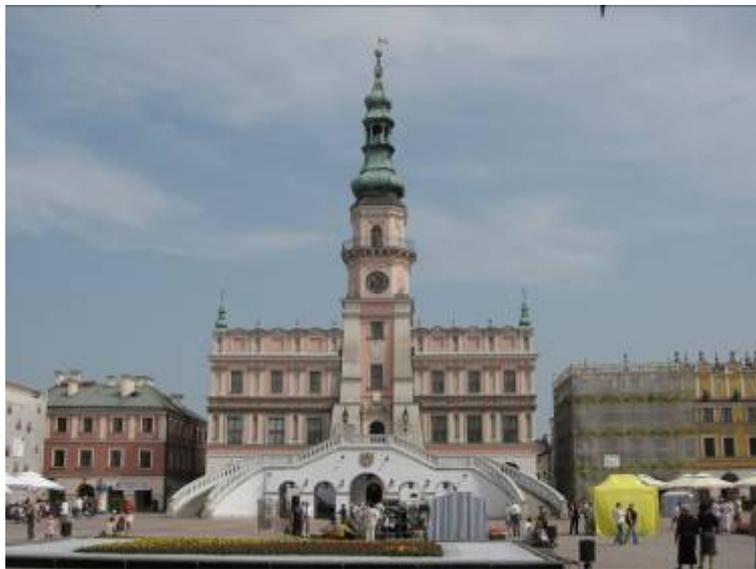


Fig. 17. Town hall in the old town of Zamość, J. Bański

Demographic adversity of Chełmsko-Zamojski is reflected also in the diminished expansion of housing area. This is a common trend observed in the region at a relatively significant scale. Expansion of housing area can be seen to a meaningful extent only in Chełm and Zamość suburbs along the main routes with sufficient infrastructure and in the areas of most attractive landscape, especially in Roztocze Hills.

3.2. Environment (Landscape. soils. climate change... etc.)

Despite good soil quality, most favourable areas for agriculture are on the loess background, which at the same time is a vulnerable soil-bedding for water erosion, especially in case of steep slopes of Roztocze Hills area (fig. 18) with high density of gorges in western part. Relief conditions and scattered farms contribute in making agriculture of this area more self-supplying oriented.



Fig. 18. Example of water erosion in Sasiadka village (Western Roztocze)

Protected areas show no pressure from the new investments and agriculture.

Changes of nature life in the region are in general positive, especially in the last two decades. This is caused by the decreasing of market oriented agriculture, the use of fertilisers and reinforced sewage networks investments with sewage treatment plants building as well. For instance, a sewage treatment plant in Zamość built in the 1990s is currently exploited to a minimum extent because of the collapse of industry in the town.

Number of species, especially the migratory birds is increasing as a result of building the biggest artificial water reservoir occupying 950 ha in Nielisz (southern Lubelska Upland). Population of some rare species in the region is increasing as well. Water quality in region's rivers is still improving.

The only negative environmental process is the lowering of ground waters level and springs efficiency.

There are two main threats concerning the environmental state of the region. The first one being the intensification of animal production in the future under the economic pressure of large farms. The second one is related to the potential energy produced from renewable sources, like wind power plants (main threat to natural landscape) and the possibility for future slate gas exploiting in the region.

3.3. Government and policy

There is no complaining for the administrative and legal system related to spatial planning. There are only a few examples of controversial spatial decisions, which are mostly related to lack of spatial organisation planning for the municipality and the necessity of individual decision making regarding building conditions given by municipal officials.

Lack of realistic perspectives for the development of other branches caused special concern among regional and local authorities on tourism development in the region, and especially agritourism. Zones for the development of tourism in the spatial

development plan of Lubelskie voivodeship were confirmed, agritourism financial and training programs with preferential credits were started and these encouraged many agritourism farms. The estimations of real potential were however exaggerated, mainly due to low level of facilitating, lack of tourist tradition and poor promotion. Stimulation in the tourist branch in some particular parts of the region was observed mostly in Roztocze Hills.

Direct payments had an influence on breaking the process of land selling and made land leasing more common. This makes restructurisation of the agriculture in the region slower and preserves traditional landscape as well as farms structure.

In the spatial development plans the areas attractive in terms of nature are usually protected against construction sites. The authorities of the municipalities try to resolve the dilemma between nature protection and profitable investments, which are addressed to the zones intended for housing or commercial enterprises harmful to natural environment (Wesołowska 2006).

3.4. Localization (accessibility. core-periphery. urban-rural continuum)

Localization of the region is one of the most important factors of its economic structure. From one side it used to be a peripheral region for over two centuries, among the others, in the industrialisation period in 19th century it was a borderland of the Russian Empire. From the other side, there are very favourable conditions for the development of agriculture in the region.

Currently the region remains fully peripheral in the European and country scale as it is located relatively far from Lublin, the core of Lubelskie voivodeship. On the other hand, there are three Polish-Ukrainian border crossing points and three main routes are passing across the region. They are attained mainly by vehicular traffic and are forming the main axis of development in the region. The local cores of development are Chełm and Zamość. However, their influence on the surrounding rural areas is rather weak and of a narrow range.

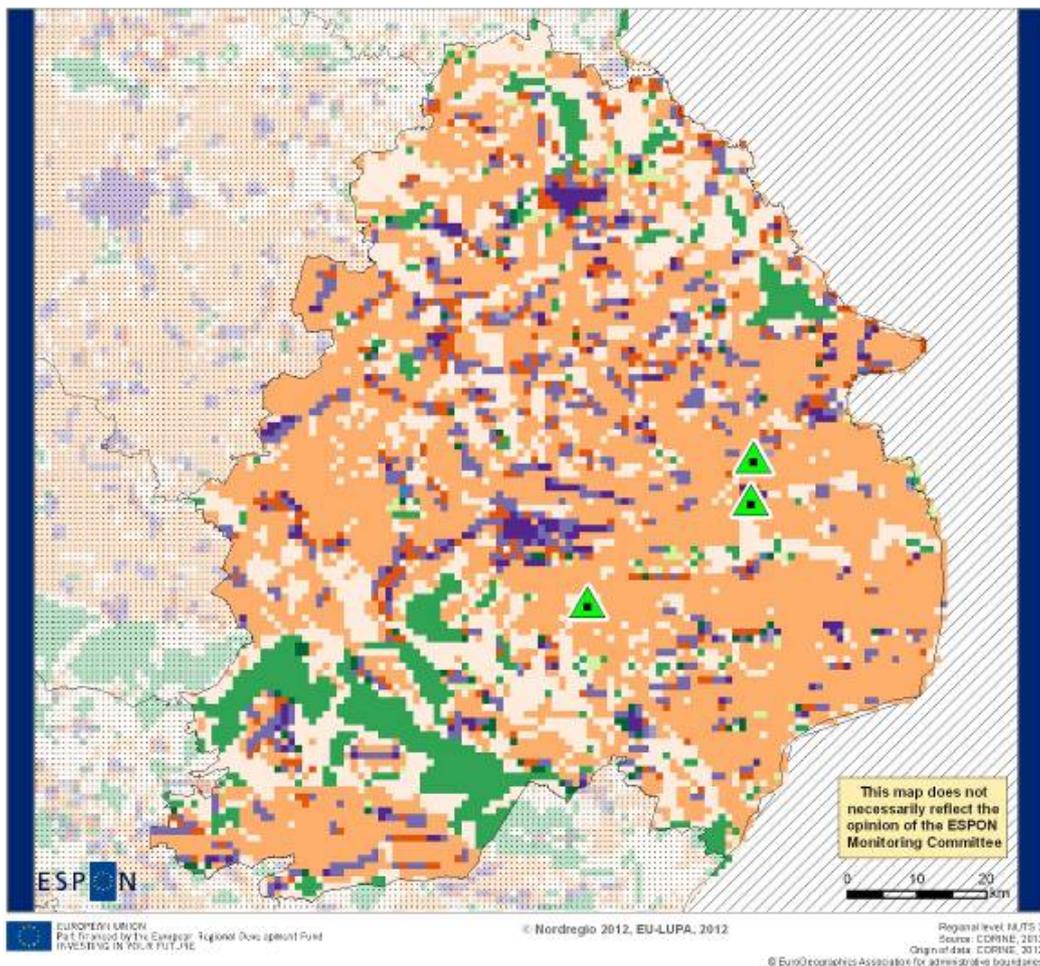
Considering the economic activation of the region issue, its localisation is a strong barrier for further development. This is reflected by an insignificant foreign investment dynamics, tourism development etc.

3.5. Conclusions in the context of land use

In this peripheral region traditional agriculture dominates (fig. 19). In the last years food industry workshops collapse is observed as well as crisis on local labour markets and young people outflow. In agriculture the process of extensification of plant cultivation is particularly significant, especially the shifting of sowing area from industrial plants into cereals as well as the intensification of animals production. Young people outflow contributed to the lack of small farm successors, leasing the land to large, more competitive farms and increasing the average farm size. Environmental changes, apart from ground water level decrease are generally positive.

Stable Elements of Land Cover 1990 - 2006

Chełmsko-Zamojski



Stable Land Types

- Urban cores and metropolitan areas
 - Suburban residential and economic areas
 - Special urban areas with relation relationships to the marine environment
 - Arable land in predominantly rural areas
 - Pastures and agricultural mosaics in peri-urban or rural community areas
 - Forested areas and agricultural mosaics in peri-urban areas
 - Rural forest
 - Pastures, agricultural mosaics and mixed forest in predominantly rural areas
 - Transitional woodland or sparsely vegetated areas
 - Lands primarily associated with water courses
 - Sparse vegetation, wetlands, water bodies and snow or arctic conditions
- Points of investigation
 - Areas outside the case study region
 - No data

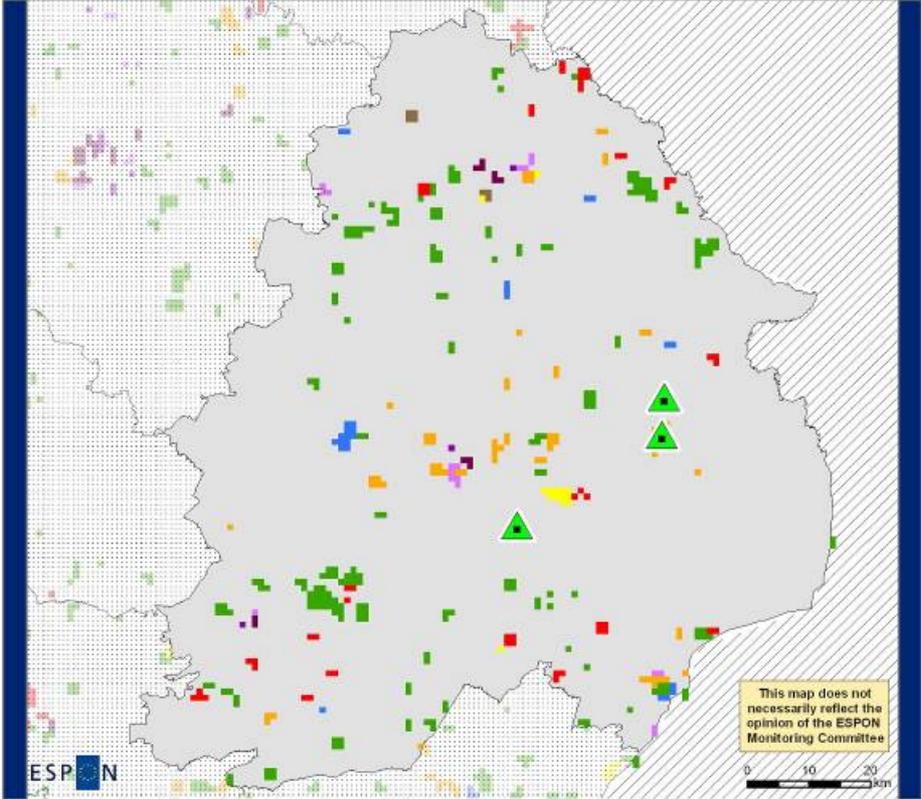
Fig. 19. Stable elements of land use between 1990 and 2006

Source: Corine Land Cover

Changes of land cover in the region are relatively slow, what is the effect of low investment pressure of both, housing areas and industrial zones. The most interesting changes are taking place among the agricultural land use categories and between agricultural land and forests (fig. 20. fig. 21). The major factor of these land

cover flows results from macroeconomic circumstances concerning agriculture and demographic crisis.

Land Change Typology 1990 – 2006 Chełmsko-Zamojski



ESPON
 EUROPEAN UNION
 Part financed by the European Regional Development Fund
 INVESTING IN POLSKA FUTURE
 © Nordregio 2012, EU-LUPA, 2012
 Regional level: NUTS 3
 Source: CORINE, 2012
 Original data: CORINE, 2012
 © EuroGeographics Association for administrative boundaries

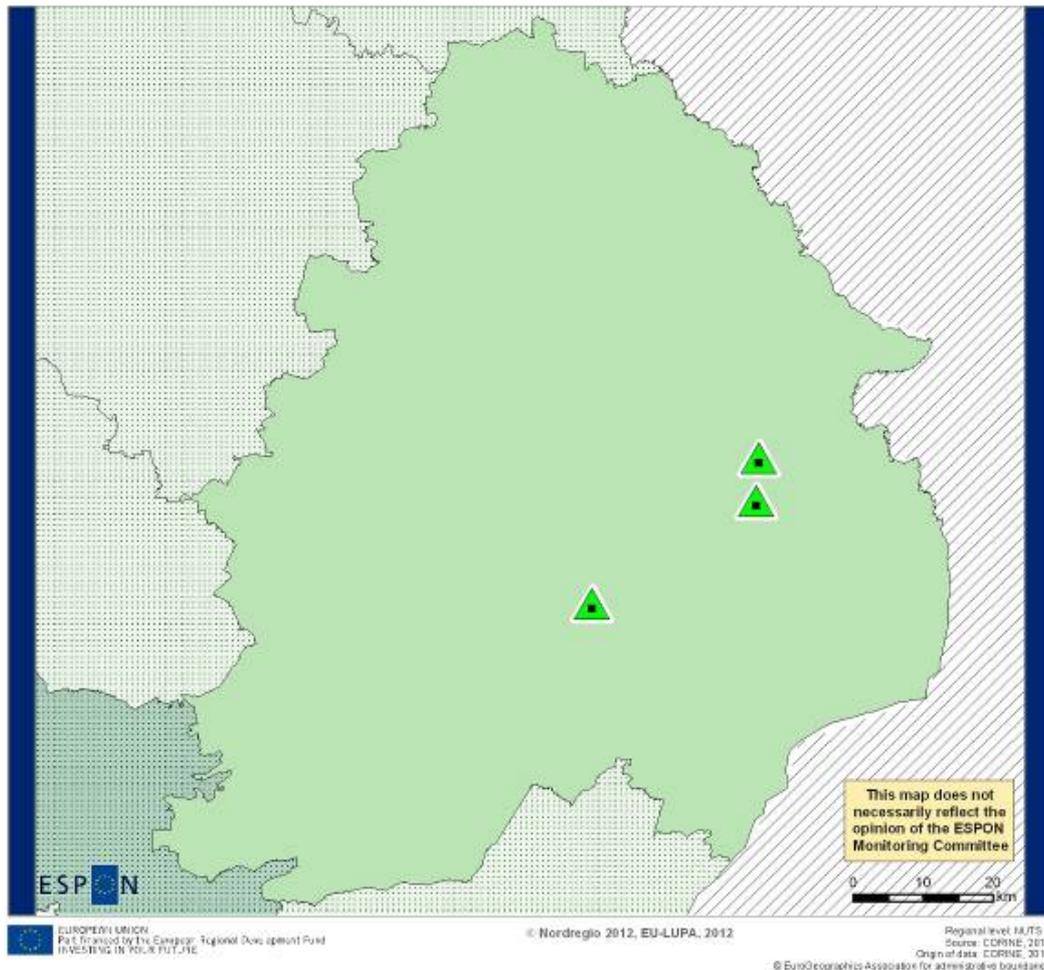
Areas Subject to Land-Use Change

- | | |
|--|--|
| <ul style="list-style-type: none"> Urban land management Urban residential sprawl Sprawl of economic sites and infrastructures Agriculture internal conversions Conversion from other land cover to agriculture Withdrawal of farming Forests creation and management Water bodies creation and management Changes of Land Cover due to natural and multiple causes | <ul style="list-style-type: none"> Points of investigation Case study region Areas outside the case study region No data |
|--|--|

Fig. 20. Land cover flows between 1990 and 2006

Source: Corine Land Cover

Land Change Typology 1990 – 2006 Chełmsko-Zamojski



Land Change Typology

- Very high intensification with artificial surfaces replacing mainly natural areas
- Very high intensification due to specific areas of residential and economic sprawl
- High intensification due to residential and economic sprawl surrounding urban conversion
- Medium-high intensification due to diverse urban processes
- Medium-high intensification due to diverse urban processes
- Medium intensification due to some urban sprawl combined mainly with forest conversions
- Medium intensification - dynamic mix between agricultural/forest changes and urban sprawl
- Low intensification, dynamic mix between agricultural/forest changes and limited urban sprawl
- Low intensification mainly due to agriculture and forest changes
- High extensification due to forest and agricultural changes but specifically the withdrawal of farming

- Points of investigation
- Areas outside the case study region
- No data

Fig. 21. Land cover flow type of the region

Source: Corine Land Cover

4. ANALYSIS OF LAND USE CHANGES

4.1. Dynamics and directions of land use and land cover changes

Dynamics of land use changes was rather slow. Domination of the agricultural land since the 1990s was gradually decreasing (fig. 22) due to afforestation of the weaker soils and steep slopes process (fig. 23). This trend changed after Poland's EU accession in 2004 due to direct payments for agricultural land of good practice. In Chełmsko-Zamojski region it is still more profitable to have such agricultural land, because the pressure of agricultural function change results from land prices increase and with the exception of Chełm and Zamość suburbs and along the main roads it remains low. Nevertheless, the EU accession turned back the trend in afforestation *per saldo* within the region for two years only.

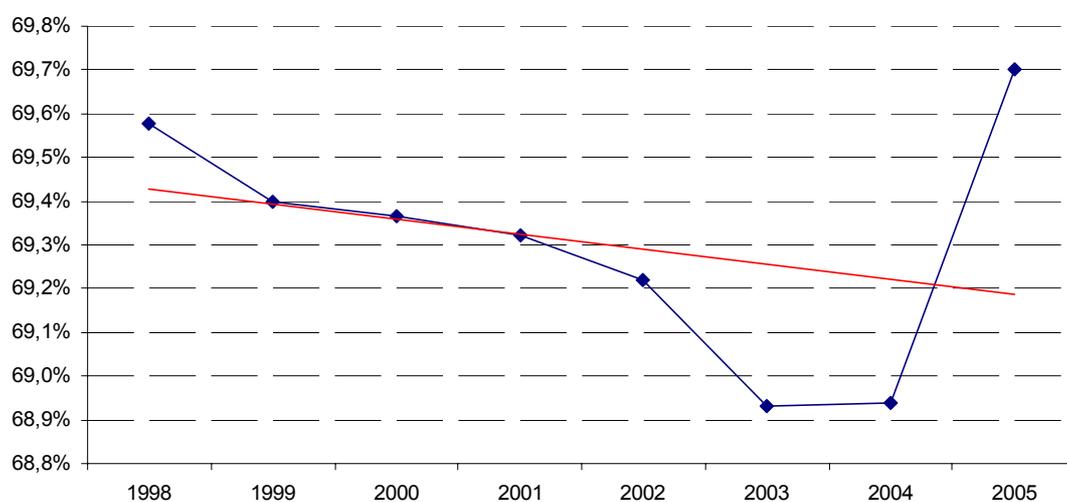


Fig. 22. Agricultural land area share change

Source: Bank of Local Data. Central Statistical Office

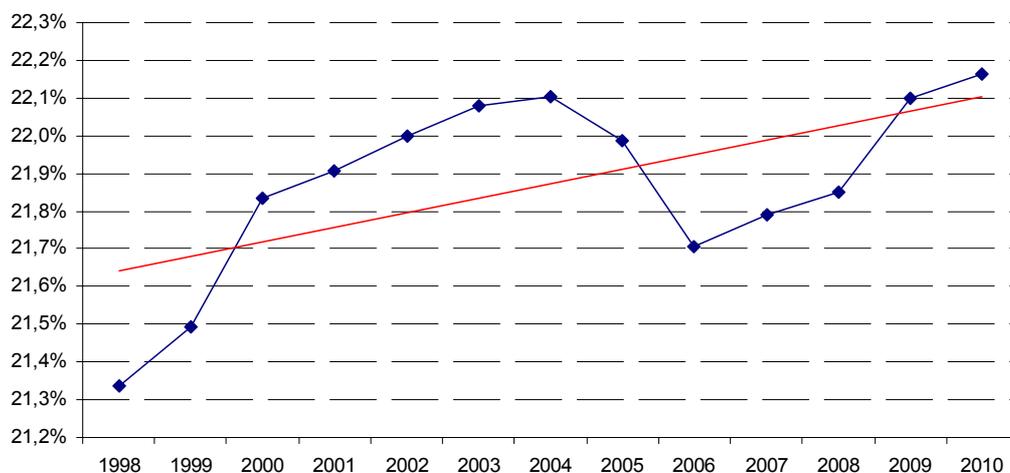


Fig. 23. Forests area share change

Source: Bank of Local Data. Central Statistical Office

Area of arable land is gradually increasing due to a greater demand for land by large farm owners and extensification of agricultural plant production (fig. 24). However, changes of the agricultural land use structure generally depend on the decreasing of meadows and pastures share (fig. 25, fig. 26). Reduction of their area is noticed most clearly and it is related to the animal production intensification, greater specialisation and concentration of cattle stock. This general trend concerning agricultural land structure change turned dramatically after the year 2004, similarly as the total agricultural land area trend. Such impact of general economic conditions is not clearly observed only regarding the permanent crops area changes (fig. 27). However, orchards have a rather insignificant role in agriculture of the region.

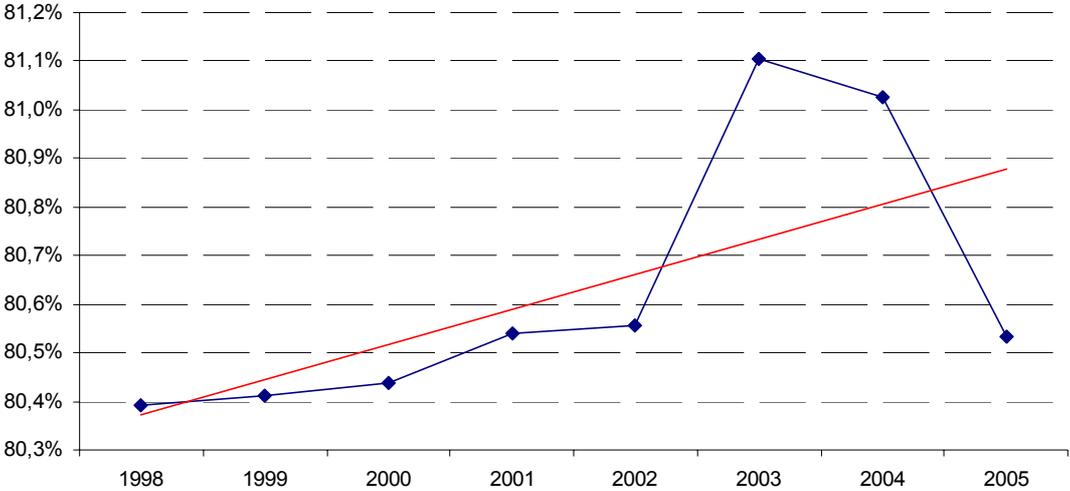


Fig. 24. Share of arable land in agricultural land area change
 Source: Bank of Local Data. Central Statistical Office

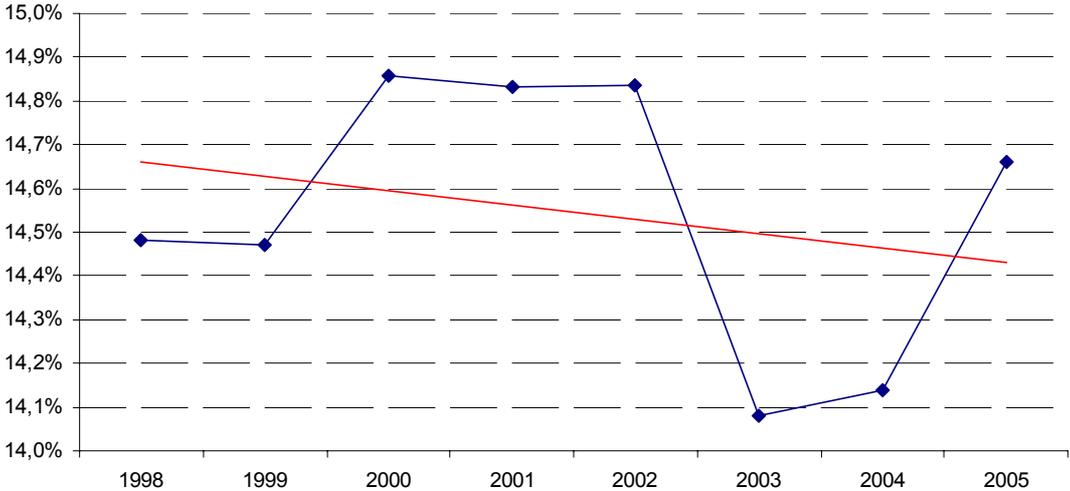


Fig. 25. Share of meadows in agricultural land area change
 Source: Bank of Local Data. Central Statistical Office

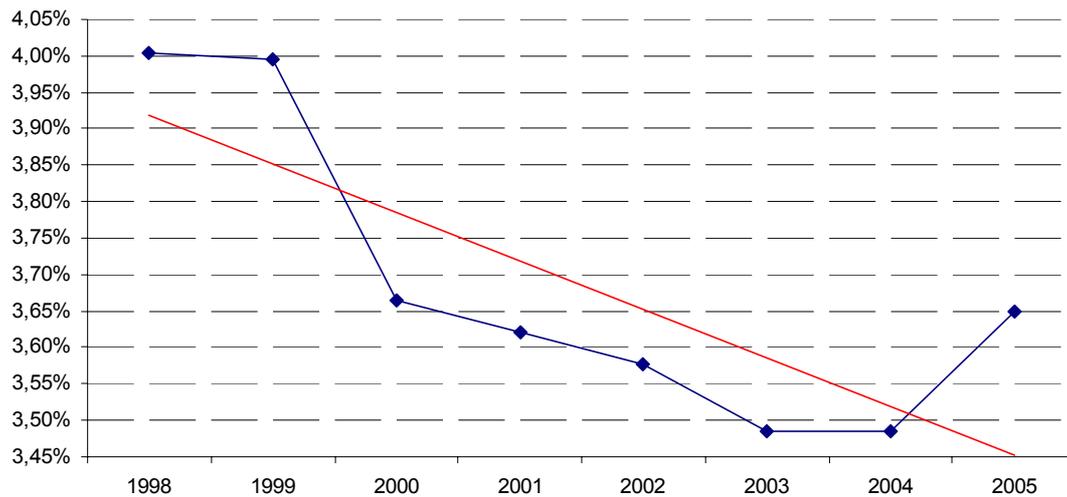


Fig. 26. Share of pastures in agricultural land area change

Source: Bank of Local Data. Central Statistical Office

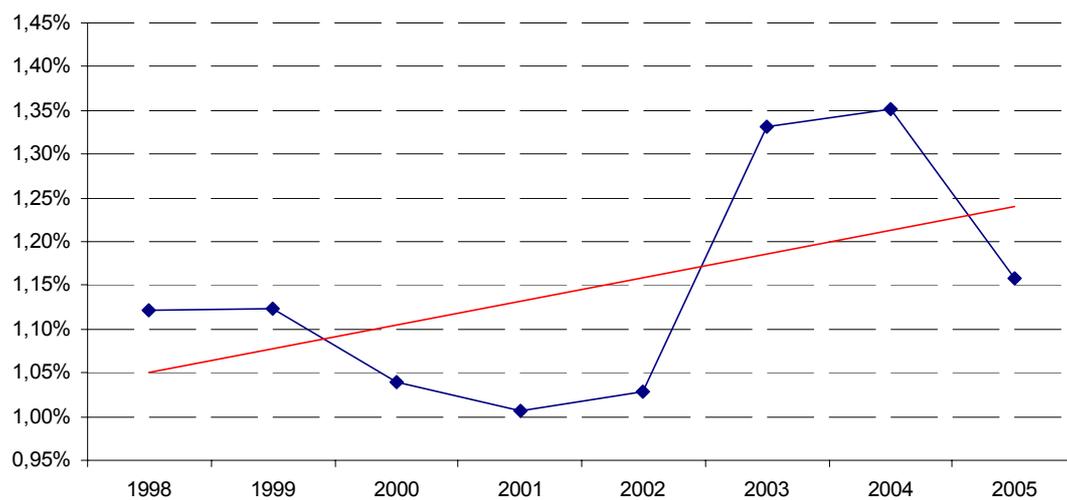


Fig. 27. Permanent crops area change

Source: Bank of Local Data. Central Statistical Office

4.2. Trends. actors and drivers of the changes (micro and macro scale)

The main actors of land use changes in rural areas are farmers contributing to afforestation and new activities related to recreation. Changes are observed both, inside the agricultural land, even in plant production on arable land itself and between agricultural land and forests or multifunctional land use. A new actor of agricultural land use changes are the investors interested in implementing the wind power stations on rural areas.

The major actors causing land use changes in towns are entrepreneurs who are investing on former industrial areas by building stores and supermarkets or

developers transforming them into new estates. There are still some post-industrial sites that require organisation and adaptation for new land use functions.

The major actors of land use changes in the suburbs are their new inhabitants. New investments in the suburbs of Chełm and Zamość are taking place along major routes as a principle but in more peripheral sites there are cases of individual forcing to obtain permission for house building in some distance from the infrastructure but of a more natural neighbourhood.

4.3. Contemporary and potential conflicts

The only important contemporary spatial conflict concerns social protests related to the investing in new mobile telephony base stations. There are also potential threats of future spatial conflicts. These may originate from possessing the energy from new sources such as wind power plants or shale gas exploiting nearby settlements or environmentally valuable areas. There is also a threat for the environment protection in the light of further intensification of animal production.

In a very local scale there were cases of forcing house building in a distance from infrastructure and among natural environment on the areas without any spatial planning. There is such risk to be observed in Roztocze Hills especially.

Significant potential conflicts concerning functional spatial structure of the regional development come from the discovery of rich shale gas resources. This energetic potential needs to be used for regional economy activation but maintaining the awareness of local landscape preserving at least in case of the most valuable areas. It will probably become a common dilemma between the two ways of thinking about regional development: dynamic investments with concentration on the exploiting of the most economically profitable regional resources in short terms or multifunctional and sustainable development with preserving the regional character based on broad spectrum of regional strengths. The second way, although more time demanding, guarantees a longer perspective. The choice among these two, will have a great impact on the future land cover and land use changes direction.

4.4. Scenarios

The next 10-15 years will bring a further decrease in the rural population and most probably in the total population of Chełmsko-Zamojski region. The only areas of population increase are most likely to be observed in the vicinity of few biggest towns and along major roads. The average level of education of rural inhabitants will gradually improve. This conclusion is based on the current educational population structure in which a strong correlation between age and educational level is noticeable.

The economic significance of agriculture for rural households income will be reduced. Thus, the regional character of land use and landscape of rural areas will be gradually changing. However, the decline of farming significance will be associated with diversification of farms. Commercial farms will be developing and will become more specialised as the investments are made. This can partly compensate the regional trend of agriculture significance declining in majority of individual farms. As a consequence, the number of small farms conducting production and applying

traditional methods will be decreasing. These will shift entirely the purpose of agricultural production from market-oriented as a source of income to self-supplying production.

Taking into consideration the land use changes of the low economic development scenario, called marginalisation of rural depleting regions scenario, a further afforestation in the South-West of the region and meadows in the other parts can be expected. This scenario brings economic stagnation and the adoption of such state policy as preferring efficiency rather than equality. In the marginalisation scenario, the changes of land use will be proceeding very slowly with various processes of marginalisation the economy in areas located far from acknowledged cores of development. Wild life will become richer and of improved condition therefore with the proper marketing of the region, the touristic function can be co-existing with traditional agriculture to a broader extent.

In the moderate development scenarios, the extinguishing of afforestation process can be expected with a gradual introduction of settlement and services along main roads in the rural areas especially nearby major towns.

The first of moderate scenario called the polarisation scenario relies on dynamic economic development with adoption of national policy preferring efficiency than equality and cohesion. According to this scenario, the space will be polarised through diverse processes in the surroundings of towns of regional rank and on the rest of the region.

The second of moderate scenario called the depression scenario brings economic stagnation but with the policy of development level equalising. In theory the policy is aiming at equalising inter-regional disparities. Current economic crisis however, will not allow to generate real rural development.

In the fast economic growth scenario called the unification scenario described process concerning land use will be accelerated. In this scenario generally favourable economic circumstances will contribute to apply effectively the cohesion policy at European, national and interregional scale. Although the agriculture development, intensification of animals production and increasing of environmental pressure can be expected, competition between regions is inevitable and is determined by the limitations of peripheral rural areas development. Despite the forced promotion of lagging of them by stronger performer it will allow to create at the most averagely-developed region. However, such scenario probably will not be sufficient to develop a competitive region of Chełmsko-Zamojski in longer terms and with the lost of traditional advantages sustainable development can be impossible. In this scenario traditional agriculture will be gradually disappearing. There is also a variant of this scenario with introduction of energy production based on the wind energy and/or slate gas exploiting. Both, land use and economic structure will change then definitely.

5. MULTIFUNCTIONALITY OF LAND USE

5.1. Functional differentiations

Agricultural function dominance is clear. The second function in the land use sense is the forestry. Agricultural function is co-existing with tourist function to a broader extent as new investments in the region are made (accommodation infrastructure, ski lifts, studs and artificial water reservoir).

Agricultural function dominates in the central part Chełmsko-Zamojski region. It consists of slightly larger and more market-oriented farms in the North and East and very scattered, mostly self-supplying farms in the South and West. Forestry has a predominant role in the south-western edge of the region. Tourist function is associated with agriculture and has a significant role mainly in Roztocze Hills and in the vicinity of water reservoirs. However, the region is rather peripheral and traditionally is not a tourist one. Therefore, it does not register many visitors and the tourist function does not change the land use at a significant scale (fig. 28).

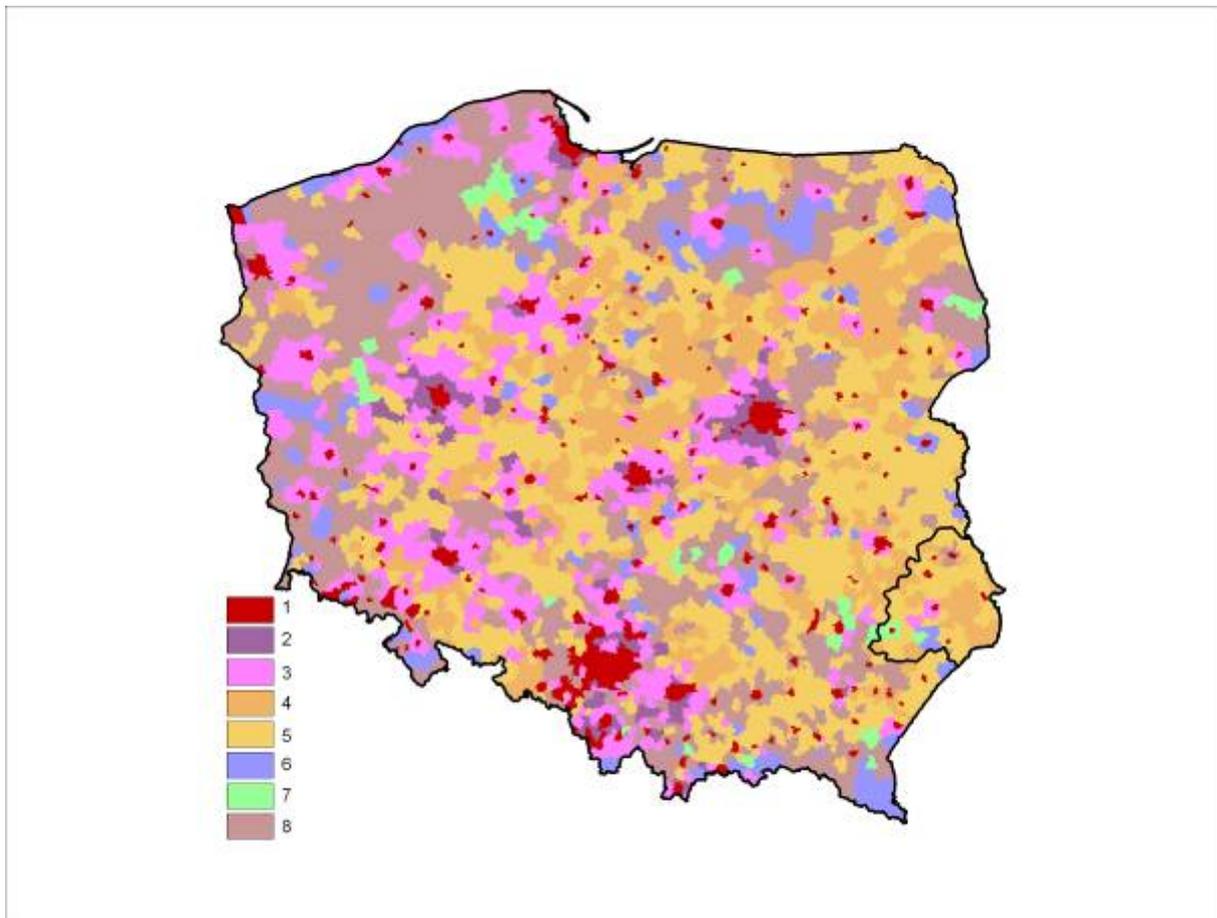


Fig. 28. Functional typology of Chełmsko-Zamojski on Polish background. 1 – urban municipality. 2 – urbanized area. 3 – multifunctional transitional area. 4 – highly agricultural area. 5 – area of agricultural function advantage. 6 – area of tourist and recreational function. 7 – area of forestry function. 8 – area of mixed functions

Source: Bański J.. 2010

5.2. Current multiple uses of land

Agricultural function co-existing with tourist function is often found currently although with little tourism significance in the region. This is an effective way of multifunctional development implementing in the region especially for rural areas, despite the lack of significant impact on the local economy so far. The areas of greater potential for tourism are located in Roztocze Hills, the South-Western forested outskirts of the region and in the river valleys with relatively deficient natural conditions favour traditional way of farming with little use of mechanisation. The tourist function development relies on attractive and natural landscape and some recreational infrastructure for skiing, biking, swimming, fishing and horseback riding.

Another field of potential multifunctionality is to be seen in the framework of agriculture and energy production linkage. Green energy production became a new trend as an effective development direction of European agriculture and it seems to be one of future opportunities for Chełmsko-Zamojski economic activation. Using agricultural land for energetic plants cultivation or for wind power stations is in the initial state.

5.3. Potentiality of multiple uses of land

There is an opportunity of introducing the energy production in the region at a larger scale. Wind power plants can co-exist with agricultural activities what gives a chance for development of peripheral rural areas. According to the national plan from 2005 to 2014 the production of energy from renewable resources in Lubelskie voivodeship should increase from 3.12 to 11.63 TWh and its share in Poland from 2.2 to 7.5% (*Wojewódzki Program Rozwoju....* 2006).

However, it is difficult to decide where the new investments should be forbidden due to unique landscape protection because it will deprive some poor communes of important short-term and relatively easy to achieve source of income. In that areas it is probably more reasonable to introduce less landscape interfering energetic plants cultivation, for instance the energetic willow.

Exploitation of the slate gas deposits requires transformation of entire region's character and creates a significant environmental pressure. It could not co-exist within the current land use structure. Exploitation of the slate gas deposits would create a spatial conflict at regional scale. Nevertheless, opportunity of using these deposits as an endogenous potential for regional development seems to be attractive as the regional policy direction.

Co-existence of agriculture and rural tourism is an effective way of land use in this case but as contemporary experiences show, rural tourism in the peripheral region without unique natural conditions and longer traditions as a tourist region with young enterprising society cannot exist as a main direction of development. Although this multifunctional way of land use can have a role as an additional source of income for some individual farms offering not only bed and breakfast but some proposal for spending leisure time linked with traditional farming as this already takes place in some villages.

6. POLICY CONTEXT OF LAND MANAGEMENT

6.1. Land use in the regional/local documents

There are:

- *Strategy of Lubelskie Voivodeship Development for 2006-2020.*
- *Strategy of Powiat Development of each of 8 powiats in the region.*
- *Plan of the Spatial Organisation of Lubelskie Voivodeship* (in preparation).
- *Plans of Spatial Organisation* of many communes.

The Strategy is a general document of voivodeship development priorities.

Plan of the Spatial Organisation of Lubelskie Voivodeship includes three volumes:

- *Internal and external conditioning.*
- *Directions of spatial policy.*
- *Map of the directions of spatial policy (scale 1:200 000).*

The Plan is predicting agriculture, tourism and recreation development excluding the ecological area of the highest natural values in Roztocze Hills.

The structure of documents is hierarchic. The local plans of spatial organisation are related to the plans of a higher level. They facilitate localising new investments consistently with general spatial pattern of the region. However, sometimes local societies complain for the lack of municipal or local plan of spatial organisation, especially in the suburbs where attractive terrains for harmful economic activities are situated in the vicinity of settlements or in the areas of the highest environmental values which are attractive for residential function consisting of single dispersed houses sometimes pressuring the network infrastructure development.

There are also some strategic documents on the level of voivodeship which are linked with the land use issues like:

- Program of Sustainable Development of Agriculture and Rural Areas of Lubelskie Voivodeship.
- Voivodeship Program of Transport and Communication Infrastructure Development for Lubelskie Voivodeship.
- Program of Environmental Protection of Lubelskie Voivodeship for 2008-2011 with perspective until 2015.
- Voivodeship Program of Alternative Energy Resources Development for Lubelskie Voivodeship.

The most important strategic document concerning the land use changes in the regional point of view is *Program of Sustainable Development of Agriculture and Rural Areas of Lubelskie Voivodeship* which contains diagnosis and some predictions regarding the changes of land use itself but also predictions of farm size structure improvement of their spatial organisation, plant production structure, animal production structure, ecological agriculture development, alternative agricultural plant production development, fallow and waste lands management. perspectives of

sustainable development of agriculture and rural areas, development of agro-industry, development of trade and services on rural areas and producer groups.

6.2. Influences of regional/local planning

In the case of Chełmsko-Zamojski region, future plans are assuming no general changes of land use with multifunctional development of rural areas especially in the Western Roztocze Hills region and Northern outskirts of Chełmsko-Zamojski region, where tourism based on environmentally valuable areas can develop.

The regional plans have a relatively low influence on the spatial pattern of the region due to limited pressure for the large scale land use changes.

The major role for the reasonable land use lies in the hands of municipal and local plans which should organise investments and spatial pattern of functions but with natural resources preserving including unique landscape and natural values. Especially in the suburbs and in the environmentally valuable areas they are playing an important role. Unfortunately, the system in such cases does not function properly so far, because of lack of municipal plans in some communes and needs to be made by municipal authority and individual decisions concerning building conditioning and limitations. This system is more flexible and convenient in the case of the need of attracting the investors but at the same time it provokes a danger of making some incorrect decisions and puts pressure of individual interests on local government as well. The most common spatial conflicts took place in the cases of decisions concerning dispersing of residential functions in the areas of high environmental values lacking network infrastructure and decisions dealing with permission for building the wind power stations or mobile phones transmitters.

7. CHALLENGES AND POLICY RECOMMENDATIONS (2020 PERSPECTIVE)

The level of economic development of Chełmsko-Zamojski region is one of the lowest in Poland. There are a number of demographic and economic processes of negative sense. Thus, it is very important to find an optimal scenario for the future development and cope with the main challenges of the region allowing to release the principal, potential directions for development. Therefore, a fundamental aim of policy is to develop a proper spatial diversification concerning the functions. First of all, a general direction of the strategic development should lead from mono-functional agricultural to multifunctional and as a consequence, with zoning the areas of the best conditions for different possible directions of functions co-existence. The entire region has a favourable environmental conditions for agriculture but its linkage with function of residential sprawl, energy production, services, tourism and recreation or nature and cultural landscape preservation can take place effectively only in some specific areas. For this reason a greater attention should be paid for the non-agricultural functions development but with a realistic potential evaluation and reasonable spatial planning restricting and supporting of different multi-functionality combinations in different parts of the region. It seems to be a long term goal and a challengeable task in the region where socio-demographic and infrastructural problems interact. The recent years are showing, that in spite of it, development of diversified functions is possible. However, the major task is to begin organising future spatial multifunctional pattern today what will more effectively use an endogenous potential at regional scale.

In spite of considerable technical infrastructure development in the last years, it is still one of the most important fields of investments. It can bring profits in a long term perspective and become a first necessary step of gradual limitation of young people outflow, improving the demographic structure and developing the activity other than farming on rural areas. In the framework of infrastructural development of rural areas absolutely one of the most important is improving of internet access.

Another strategic challenge is to improve significantly the opportunities in acquisition of higher education in Chełm and Zamość related to supporting of initiating career in the profession learned within the region, even if creating of self-employment would be necessary. This is a system of mutual relations but working effectively guarantees not only improvement of the level of education but also recovery of regional demographic situation and level of qualified services in the region, helping in development of towns based on their more up-to-date functions. Currently a group of small farms owners and their children, statistically have the lowest level of education but the same group needs to be shifted to services firstly as well. Special support for such families willing to acquire an education and stay in the region would be probably reasonable.

Major future challenges:

- Evaluation of real opportunities for diverse directions of multifunctionality development in different parts of the region;
- System of supporting the acquisition of higher education and starting professional career within the region;
- Implementing services on rural areas;

- Supporting the traditional agriculture in some areas and marketing of regional rural tourism;
- Co-existence of the agriculture development and unique values of environment;
- Exploitation of the energy sources with co-existing unique regional character.

8. CONCLUSION

In this peripheral, mono-functional agricultural region, the land use changes are of relatively low dynamics. Natural conditions are mostly very favourable for agriculture but at the same time, the region belongs to the poorest in the EU. Chełmsko-Zamojski registers a demographic structure imbalance and difficulties in local economy as a consequence.

During the last two decades, the changes reflected macroeconomic condition of agriculture as a principle and this was the major actor of land cover transformation. The gradual land use changes within agricultural land are observed. Generally, its area is slowly decreasing mainly due to the abandoning of meadows mowing and neglected drainage systems in the river valleys or forestation of steep slopes. The most common change in land cover is the increase of cereals cultivation and the abandoning of sugar beetroots, tobacco, flax, hemp and potatoes cultivation. This trend reflects a general extensification of plant cultivation. Introduction of rape cultivation results from the development of one of the best prospering workshop of food industry branch – fat processing factory. Initiation of maize cultivation for fodder purposes within the region is caused by cattle breeding intensification. Average farm size is increasing dynamically, mainly due to a more significant dynamics of land leasing.

There were no other important external impulses which could become land use change initiators like for instance transport, industry or tourism bringing broad investment. The only capital expenditure of that kind included new artificial water reservoir with an area of approximately 1 000 ha. However, a gradual implementing of land use multifunctionality on rural areas is observed. The residential areas in the vicinity to Chełm and Zamość along the main roads are enlarging. On the other hand, the area of Roztocze Hills and the water reservoirs surroundings are gaining in importance in the field of tourist and recreation function with some desired infrastructure developing. Agriculture becomes more frequently associated with green energy production, mainly because of wind power plants or energetic plants cultivation. Only 1% of the total area of Chełmsko-Zamojski region is protected in the form of national park. Environmental and landscape protection function is linked nowadays with agriculture to a greater extent and as a result, the wildlife is significantly richer than for instance 20 years ago, when more intensive farming and industrial activity dominated.

Initiating the transformation of the region towards further multifunctionality is an adequate time to implement more restricted spatial planning and organise optimal, spatially varied functions co-existence with preserving the most valuable natural sites. Unfortunately, some examples of unfavourable decisions concerning location of certain investments in the region appeared.

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EU-LUPA

European Land Use Patterns

Appendix 1

Verification of land use changes typology in practice



Land use changes identified by Corine Land Cover pictures analysis were verified in practice by field study of three cases in Chełmsko-Zamojski region. Verification was carried out by the sample of three squares 1 x 1 km², where the changes were the most intensive in the region, but were processing in different directions:

- Square 1. is situated in the eastern part of Chełmsko-Zamojski region, approximately 40 km East from Zamość, between villages Malice and Kotorów, upon Huczwa river. The surrounding has generally very favourable environmental conditions for agriculture. However, the square is situated in the flat river valley and it tends to be relatively moist in the spring time. The square distinguishes agricultural internal conversion.
- Square 2. is situated on the outskirts of Werbkowice, big village by the main road from Zamość towards East, heading to one of three important Polish-Ukrainian border crossing points in Zosin. Werbkowice is well known for one of two still active sugar-refineries in the region. The surrounding has the best quality of environmental conditions for agriculture in European scale. The square distinguishes urban residential sprawl.
- Square 3. is situated ab. 1 km to the West of the main road from Zamość towards South, to one of three important Polish-Ukrainian border crossing points in Hrebenne and further to Lviv. The square distinguishes forest creation and management.

Square 1.

The land in spring time is partly flooded meadows with some woodland and shrubs. The area is situated in the flat valley of meandering Huczwa river. In the 1990s there was good a quality arable land here, with cultivation of barley and maize predominantly. It was possible with the drainage system working properly. After negative change of macroeconomic circumstances of Polish agriculture, extensification of this

area took place with neglected drainage system (phot. 1 and 2) and reappearance of natural grasslands as a consequence (phot. 3). The grasslands were used by individual farmers as cattle grazing area, but due to concentration and intensification of cattle breeding in Poland during 2000s it is almost cast-off now. After the rise of ground water level, the expansion of wildlife is observable.



Phot. 1. Neglected drainage system



Phot. 2. Drainage ditch seen in the landscape



Phot. 3. Natural grassland upon Huczwa river

Square 2.

The area is an outskirts of big village with developing housing function. It is situated approximately 0.5 km to the main road from Zamość to border

crossing point in Zosin, hence the general accessibility is relatively good, what makes it attractive. However, the development of road infrastructure within the settlement is slower compared to housing investments (phot. 4). The oldest houses in the area are 30 years old, but the majority of the houses was built during the 2000s on the former arable land of very high soil quality (phot. 5) with predominance of sugar beetroots cultivation. Before 1990 sugar beetroots could be easily sold out to big sugar-refinery in the village.



Phot. 4. New houses and cars, but old road infrastructure



Phot. 5. New house with very fertile soils in background

Square 3.

The area is a state forest nearby important national road of international importance. The forest is situated along the valley in W-E direction. Forestry is still active in the area due to profitable wood trading. Wood is a raw material desired by local furniture factories and used for building construction. However, on the valley slopes at the edge of the forest there is a natural forest succession that in the last years merged to the abundant unfavourable arable land (phot. 6). This is a result of a deteriorating macroeconomic situation of Polish agriculture.



Phot. 6. Transition between arable land on the hill and forest in the valley

Conclusions:

In the case of Chełmsko-Zamojski region field studies confirmed the typology of land cover flow, even in spite of large scale of examination. Field investigation verified the appropriateness of the method used in explanation of generally indicated directions concerning the changes in the region and can applied for their more detailed description. Based on the sample of the three points in Chełmsko-Zamojski region, it can be stated that the assessment of the typology results is positive.

However, one significant conclusion considering the typology and its general assumption needs to be emphasized. All investigations are regarding only land cover changes in spatial dimension. In some cases, in square 1. for instance, it can be mistaken without more detailed studies, because the land cover flow can be extensification of land use itself (converting arable land into natural grassland), but at the same time it is much more difficult to observe that this is a result of cattle breeding intensification.

EU-LUPA

European Land Use Patterns

Appendix 2

Field study – interviews questionnaires

I. Socio-economic factors of land use change

1. *Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?*

Ageing of rural society and lack of farming interesting among young people because of economic circumstances have a great impact on significant average farm size increase in the region last years.

2. *What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?*

Rather weak process. As principle it is observed near from towns, not in the nearest surrounding of this farm in typical rural area.

3. *What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?*

Significant average farm size increase is observed in the region last years. Land is shifting from small to larger farms. Great share in this shifting is in the form of leasing because of direct payments. There are examples of land leasing from owners living in Western Pomerania. There is process of buying the land by bigger farms, but they own many plots of land e.g. 30 Ares each of them. Farmers in the region flax and hemp cultivation abandoned and sugar beetroot cultivation are abandoning. Cereals cultivation area is currently definitely dominating. There is a process of maize cultivation area increase as well, mainly for fodder for cattle, but for corn as well.

4. *Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.*

Tourist function introducing in Krasnobród and Zwierzyniec communes. It appeared on the areas of weaker natural condition firstly.

5. *What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?*

There is no important new industrial and infrastructural investments. The main transport investments is outside of the region. It's a modernization of main road from Lublin in direction of Chełm and Zamość. The only past investment of this type was building road connection between Szczepieszyn and Frampol and transforming this corridor into country road.

6. *What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming*

pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Infrastructure for tourism development is generally weak. It rely on houses of farmers in some villages.

- 7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.*

Depends on economic circumstances for agriculture. Generally unemployment and weakness of local economy have an impact on land concentrating.

II. Environmental issues

- 1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?*

There is an afforestation process observed, especially on the weak soils of Biłgoraj surroundings.

- 2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?*

The major threat is discovery of slate gas deposit and opportunity of industry development. Agricultural function isn't competitive.

- 3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?*

There were no important natural disasters.

III. Multi-functionality

- 1. Please name socio-economic and environmental functions of land use in the region.*

There is agricultural predominance in land use and in economy of the region. In the last decade it is strongly merged with environmental protection.

- 2. Multifunctional land use - which of the functions in your region co-exist?*

There is no multifunctionality of land use in the region. Especially in Western Roztocze agriculture is the only function, although very high environmental and landscape advantages of the region.

- 3. Which of the functions are the most important in the context of land use?*

No opinion

- 4. Is the number of functions of land use increasing or decreasing?*

No opinion

5. *To which extent is the land in your region used in multifunctional way?*

No opinion

6. *What kind of functions co-existence is:*

- a) the most effective?*
- b) the most desirable?*
- c) the most common?*
- d) the most difficult?*

No opinion

7. *Which of the functions of land use are the most important for the future regional development?*

Investments creating employment increase both, in rural areas and in towns. This is the only way to preserve traditional agriculture and landscape values.

IV. Spatial conflicts

1. *Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).*

There is no important spatial conflicts in the region. The reason is lack of important strengths aiming to intensify land use.

2. *What are the "competing" actors and functions (environmental, agricultural, industrial, settlement etc.)?*

No opinion

3. *Which of the actors are the most dynamic and successful in obtaining new land?*

Big farmers, who have enough economic power to buy a land regardless dynamic increase of its price last years.

4. *What are the most likely conflicts related to land use in future and what could be its impact on land use?*

No opinion

V. Government and policy

1. *Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?*

Law concerning spatial management allow creating spatial organization in positive way.

2. *Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).*

The only negative thing is a long time of decision making caused by bureaucracy. It is also a barrier for potential investors.

3. *Is there any monitoring of land cover changes in the region? (Please describe briefly).*

The only way of land use changes monitoring is this applied to the direct payments. It's effective way, what can be proof by actual basic agricultural activities, which are done each year even by non-commercial farmers.

VI. Localization (depending on the region)

1. *How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?*

There is no influence of borderline neighbourhood. Before Schengen treaty many people from eastern part of the region had their important share of income from trans-border trade.

2. *How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?*

Not concerning.

VII. Land use in general

1. *Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.*

Changing of cultivated plant structure from industrial plants to the cereals and average farm size increase.

2. *In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by "agricultural". Is it a proper type for your region? Please explain.*

Agricultural type is the most adequate. It's fact in both, land use and economic importance sense.

I. Socio-economic factors of land use change

8. *Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?*

Impact of permanent young people out coming and low birth rate is reflecting in increase of big farm number in the region and more common land from smaller farms leasing.

9. *What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?*

Changes seen in the Chełm and Zamość the closest surrounding. More dynamic in the 1990s', where they were the capital cities of voivodeships. Then there was created over 300 plots with technical infrastructure for housing in Jarosławiec (Sitno municipality) after liquidation of big state farm. They were intended for doctors employed in new built hospital in Zamość. Multi-family houses in the bigger towns surroundings are building even in the wet terrains (e.g. Karolówka – western Zamość or Łapiguz – southern-east from Zamość).

10. *What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?*

Enlarging of average farm size and land concentration in ownership sense. There are several farms definitely the biggest and buying the land in each of the municipalities. Abandoning of agricultural using of areas with inconvenient environmental conditioning, especially in the case of not mowed meadows, where invasion of forest is observed. They are sometimes converted into the energy willow cultivation areas, like in Sułów municipality. Extensification of plants cultivation is observed, what is connected with economic circumstances for agriculture. Area of cereals cultivation is increasing, sugar beetroots cultivation area is disappearing in connection with sugar refineries liquidation. Animals breeding is decreasing, especially in the small farms. There are at most several farms with animals breeding in each of the villages.

11. *Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.*

Weak process of new settlements building, observed mainly along transport corridors close to Chełm and Zamość. It's stimulated generally by young emigrants employed out of the region. There are intentions to using land under wind power plants in the future. Untilled land is observed on former meadows, and not-seen on terrains with good soils' quality.

12. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

New technical investments are mainly sewage network enlarging in the surrounding of Zamość. It's observed currently in Żdanów (south from Zamość). In towns the biggest areas are converted from industry to trade function.

13. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Mostly new wedding houses are building from the sphere of new tourist investments – not traditional in rural areas. New gastronomy and accommodation investments are mainly located by the main routes. New built artificial water reservoir on Wieprz river in Nielisz (940 ha) is attracting second houses building.

14. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

The region is weak in the economic sense and for many years is seeking new investments. Almost the only industry are small furniture factories, in Biłgoraj, Tomaszów Lubelski or in Zwierzyniec.

II. Environmental issues

4. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

There is no pressure on the environmentally valuable areas. There is no harmful human activities in the national parks surroundings thanks to adequate protection.

5. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

There is a good organization of environment protection network in the region. An example is reserve of gopher in Miączyn, where on the 30 ha of former state farm by the country road it is provided meadow thanks to meadow mowing by one of the local farmers. New big water reservoir attracted new birds species to the region. Ground water level is currently higher in the region.

6. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

There were no natural disasters in the region. There were only some troubles in the Wieprz valley near to the Krasnystaw after longer rainy periods, but without impact on the land use change.

III. Multi-functionality

8. *Please name socio-economic and environmental functions of land use in the region.*

Outside of the towns function of agriculture and forestry in south is dominating. In towns industrial function almost disappeared during last two decades and trade areas are increasing the dynamically.

9. *Multifunctional land use - which of the functions in your region co-exist?*

Agricultural and forestry function is co-existing with agritourism in the Zwierzyniec, Krasnobród, Skierbieszów, Radecznicza and Szczepieszyn communes. They are benefiting from the EU financial support.

10. *Which of the functions are the most important in the context of land use?*

Agriculture and forestry in south of the region. Environmental function is co-existing with them on relatively big area.

11. *Is the number of functions of land use increasing or decreasing?*

Increase of the agritourism role, which is still marginal and will stay such. Along main roads in Chełm and Zamość neighborhood settlements in rural areas with urban services are enlarging in aerial sense.

12. *To which extent is the land in your region used in multifunctional way?*

There is low level of multifunctionality. New functions in traditional agricultural areas are just becoming popular. Especially in Roztocze Hills agritourism and leisure activities functions are relatively important, as well as near from Nielisz water reservoir and in Skierbieszowski Landscape Park. The most common co-existing of functions in rural areas is agriculture and environmental protection.

13. *What kind of functions co-existence is:*

a) the most effective?

In current conditioning the most effective is co-existing of traditional agriculture and environmental protection.

b) the most desirable?

The most desirable is protection of landscape not only from environmental point of view, but also as human traditional activities landscape thanks to creating opportunities for young people in rural areas.

c) the most common?

The most common is co-existing of agriculture and environmental active protection thanks to direct payments.

d) the most difficult?

Co-existing of dominating function with agritourism is effective and desirable, because of common rural origin of towns inhabitants. Agritourism became common in rural areas last years.

14. *Which of the functions of land use are the most important for the future regional development?*

Lack of important investments in the region is causing forecasts of no dynamic land use change. New industrial investments, if not harmful for environment, are required, because can stop young people migrating. Small industry doesn't change the land use itself, but can help indirectly by the economic processes in the region change.

IV. Spatial conflicts

- 5. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).*

There were no important spatial conflicts. There were only small local conflicts connected with new investments, like land buying for the road broadening.

- 6. What are the "competing" actors and functions (environmental, agricultural, industrial, settlement etc.)?*

The most frequent are local conflicts between neighbors. They have their source from calling into question new buildings or other investments in plots of neighbors.

- 7. Which of the actors are the most dynamic and successful in obtaining new land?*

Big farms buying land. Thanks to direct payments they have economic power to enlarge their properties and concentrate land in own hand.

- 8. What are the most likely conflicts related to land use in future and what could be its impact on land use?*

There is no plan of big investments in the region, so there is no threats of important spatial conflicts.

V. Government and policy

- 4. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?*

The state law (special act) makes the most common investments in the region, roads broadening, easier.

- 5. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).*

No opinion.

- 6. Is there any monitoring of land cover changes in the region? (Please describe briefly).*

Grounds registry is registering of land excluding from agricultural production and finishing of the new investment.

VI. Localization (depending on the region)

- 3. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?*

In neighborhood of state border there is less settlements and less scattered farms. Localization of the region near to the borderline is reflecting in low level of economic development. It has also positive impact in the case of furniture industry and its background of Ukrainian furniture market.

- 4. How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?*

Not concerning.

VII. Land use in general

- 3. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.*

The major changes of land use were forests invasion on not mowed meadows and arable land distinguishing unfavourable environmental condition for agriculture using. Human impact is observed mainly in the towns surrounding as the housing.

- 4. In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by "agricultural". Is it a proper type for your region? Please explain.*

Agricultural is the adequate type of land using in the region. The development of other functions is rather weak due to lack of economic power of local investors.

I. Socio-economic factors of land use change

15. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

The key process influencing changes of regional economy and land use is earning emigration, especially among youngsters, which isn't represented in official statistics. It has seasonal character sometimes, but people are staying abroad for longer time very often as well. This is a reason of ageing of population in the region. Some outline of scale of this process gives to us repeated relatively low number of given votes in the region. After emigration of young people farms having no successors selling or leasing plots for stronger farms concentrating land. The another effect of demographic process in land use is appearing of untilled and not mowed meadows belonging to small farms with abandoned animal production. Sample of it we can observe in Bodaczow surroundings, where in the Wieprz valley many meadows are untilled. Ageing of society have an impact on low birth rate, so in many villages of almost each commune primary schools are closing. So this process is deepened like feedback and gives bad future perspectives.

16. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

The new plans of spatial organization accepting of good soils quality plots function converting for non-agricultural purposes in Zamość surrounding are reflecting stronger and stronger housing pressure. Often buying of converted plots in suburbs, like in Płoskie or Jatutów, or in Roztocze Hills by inhabitants from the big cities, like Lublin or Warsaw, is a kind of speculation about housing function future increase. This process is especially observed along main roads, so new settlements won't be dispersed and investments in infrastructural networks will be relatively easier.

17. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

Animal production is more concentrated nowadays in bigger farms, what influence more intensive type of it. On the other hand specialization of animal production and fodders using leded to extensification of land use, like untilled meadows. In sandy soils areas even arable land is being untilled. Extensification of land use by small farms is strengthened by direct payments. More powerful farms are buying neighboring plots and are enlarging. The biggest process of merging plots and farms took place in Skierbieszów Commune. Crop structure is changing for more monocultural crops and legume and rapeseed introducing thanks to UE payments. Crop structure is changing year after year, what is caused by macroeconomic situation changes. E.g. in spite of general trends last year we observed higher popularity of sugar beetroots due to pick of sugar prices and lower area of rapeseed cultivation due to economic disturbances of big fat factory in Bodaczów.

18. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

In the region there is a trend of recreational function and building and mechanical services introducing in rural areas. It hasn't changed land use a lot so far. However it causes building up even the best quality soils along main roads, like in Wielacza village, ab. 10 km west from Zamość, nearby country road.

19. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

Industry and technical infrastructure hasn't got significant impact on land use changes. Only collapsing of industry can influence some changes, like in the case of sugar refinery in Klemesów closing down impact on the sugar beetroots cultivation area. The similar case can be observed during economic disturbances in fat factory in Bodaczów last time. Among new investments in towns and suburbs the most dynamic increase in aerial dimension can be observed in the case of big shops. Even transport corridors area doesn't rising last years, although existing ones are modernized.

20. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Development of tourism take place on the areas of weak agriculture, so near from Zwierzyniec and Krasnobród in Roztocze Hills. Accommodation facilities are improving that side, but tourism hasn't got significant influence on land use changes yet.

21. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

Food processing industry collapsing had a great impact on crop structure. Many factories are closed, but remaining ones reduced buying agricultural goods. It has influenced unemployment increasing as well and young people outflow from agricultural farms as a consequence. That's why economic role of agriculture in the region is decreasing in spite of still predominance in land use. Agriculture has more self-supplying function nowadays and very often isn't a major income source any more, even in spite of EU payments.

II. Environmental issues

7. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

The area of Natura 2000 enlarged last years. The total forests area in the region increased as well, especially in Roztocze Hills. Nowadays Natura 2000 determine stopping of afforestation process, but there are some changes in regulations concerning Natura 2000 functions planned. Ground waters raised due to drainage of meadows abandoning. The more numerous beavers activity has an important influence as well. Apart of them, there is increase of wild boars, foxes and roe deers number observed. This phenomena means not only more rich current wildlife, but also a kind of ecosystem balance disturbing. Environmentally valuable areas are enlarging in majority on fallow lands. E.g. in Szewnia – village in Roztocze Hills, there is observed grow of over 20 ha of fallow land per year.

8. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

The most common threat for natural areas is observed on meadows, as they are abandoned, which leads to trees succession and lakelet overgrowing. These changes can cause lack of birds nest yards. The another environmental threat is energy production needs. E.g. on some fields in rural areas slate gas is searched for and wind power plants are building, having negative influence on birds and rural landscape. Even some municipal spatial plans were changed due to demands of energetic sector investors. This purpose is changing of crop structure as well, like appearing of energy willow cultivation. Masts for transition of mobile phones signal are causing another common threat for nature live. E.g. in Gorzków village, northern-west edge of the region, birds totally escaped after building of such mast.

9. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

There were no significant natural hazards last decades. The most important were small floods in river valleys, e.g. in Skierbieszów or on Biłgorajska Flatland. They destroyed cellars in a few houses. However they are very positive for beavers population. Apart of that hails destroyed some greenhouses, what can be one of reasons, that fruits and vegetables production isn't so developed in the region.

III. Multi-functionality

15. Please name socio-economic and environmental functions of land use in the region.

The most important functions of land use are agriculture and agritourism. Some areas are used as mine of sand or stones as well.

16. Multifunctional land use - which of the functions in your region co-exist?

Multifunctionality introducing is the most advanced in northern borderland of Western Roztocze Hills, where Local Action Group "Upon Wieprz and Por" works on 440 km² of four municipalities with one town and 70 villages. There are different functions coexisting with agriculture: renewable energy production, environmental protection, agrotourism, recreation and other services.

17. Which of the functions are the most important in the context of land use?

The most important is still agriculture, in spite of food processing industry collapsing.

18. Is the number of functions of land use increasing or decreasing?

Multifunctionality is increasing, but with less diversified agriculture, which is still the most important function.

19. To which extent is the land in your region used in multifunctional way?

No opinion.

20. What kind of functions co-existence is:

a) the most effective?

Additional functions in typically agricultural areas are economically effective generally.

b) the most desirable?

Effective using of untilled former meadows is the most desirable from environmental point of view.

c) the most common?

Agriculture, agritourism and environmental protection.

d) the most difficult?

Traditional functions are not to co-exist with energy production, which is an important chance for regional economy transformation.

21. Which of the functions of land use are the most important for the future regional development?

To make multifunctionality more common in the region, food processing industry is needed. In agriculture it would be very helpful to vegetable production introducing for local market.

IV. Spatial conflicts

9. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).

The best known spatial conflict was related to bio-gasworks location in Zamość surroundings. There was also spatial conflict during location in Sitno wind-power plant near Zamość and Skierbieszowski Landscape Park. There are needed spatial plan changes already made and measurements are currently lasting. There were also spatial conflicts due to waste dump location near houses in Dębowiec village last time.

10. What are the "competing" actors and functions (environmental, agricultural, industrial, settlement etc.)?

Competing actors of land use changes are mostly investors intending to involve of renewable energy production into areas of other functions. The only non-competing kind of such energy is energy from solar cells.

11. Which of the actors are the most dynamic and successful in obtaining new land?

Generally the most successful in obtaining new land is function of environmental protection, because it's mostly non-competing function. However it would be probably far less successful against more economically powerful actors, like huge companies producing energy.

12. What are the most likely conflicts related to land use in future and what could be its impact on land use?

Discover of slate gas rich deposits is causing fears, but it hasn't important impact on real spatial conflicts so far. However its future impact is unknown. Another important threat of future spatial conflicts is related to permission for relatively cheap local land buying by foreigners, what can be way for destructive, intensive, monocultural agricultural activities relocation for them.

V. Government and policy

7. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

The law doesn't favour biodiversity protection and support. The restrictions aren't sufficient for current threats. The system isn't adequate for real effective spatial planning as well, because the main axis of conflict between environmental protection and local administration supporting economic development, e.g. industrial and infrastructural investments, still exists. Still many communes decide individually having no plan of spatial organization, but only study of conditioning and directions of unit spatial organization. It isn't a common current problem only because of lack of economically powerful actors in the region.

8. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

Local and regional administration is relatively effective in the framework of given responsibilities and in given external conditioning of state law. There are examples of individual solutions of potential conflicts, like e.g. exchange of some roads between commune and county to make managing of them easier.

9. Is there any monitoring of land cover changes in the region? (Please describe briefly).

There is one person in each commune to monitor and analyse an official statistical data concerning land use, given by Central Statistical Office.

VI. Localization (depending on the region)

5. *How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?*

Before Schengen zone accession in 2008 close distance to national border had positive influence on local economy and, indirectly, for young people outflow. E.g. good accessibility of foreign market of individual customers was a positive impulse for vegetable production near Zosin and Tomaszów Lubelski, in the surroundings of road border crossing points.

6. *How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?*

Not concerning.

VII. Land use in general

5. *Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.*

The major trend were concerning agrarian structure changes and heads of animals in farms decrease. Strong concentration of cattle breeding is observed as well, what is an effect of rural society ageing and competition in agriculture.

6. *In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by "agricultural". Is it a proper type for your region? Please explain.*

The region is typically agricultural. Changes in this type are slow. Permanent outflow of young people from rural areas caused preservation of traditional regional economic structure.

I. Socio-economic factors of land use change

22. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

Migration of local population and ageing of society created abandoned farms in the region of very good natural conditions for agriculture.

23. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

It exists only in suburbs and along the main routes, rather in linear form. It started developing since 1990.

24. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

The major factor is profitability of the agricultural activity. Bipolar changing of agriculture, general extensification of plants cultivation and intensification of animals breeding. Increasing of the cereals cultivation and decreasing of the industrial plants cultivation, like tobacco, sugar beetroots or potatoes. Rape cultivation appeared thanks to fat factory prospering. In animal production changes, especially milk production development is observed.

25. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

Housing in suburbs, untilled land on former meadows and near to the forests, forest area increasing during the last 20 years.

26. What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?

There is no important industrial and infrastructural investments. Furniture factories haven't got negative impact on the area of forests, but only on the wood resources in the forests.

27. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Tourist function of rural areas in the region is just starting of development. It has rather weak importance in both dimensions, land use share and economic importance.

28. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

Weak condition of economy has significant impact especially on emerging of untilled land on former meadows and forests area increase on terrains of less favourable environmental conditions.

II. Environmental issues

10. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

Forests area and biodiversity increase. Quality of waters improved. Level of ground water and springs efficiency lowering. Generally the last two decades were very good period for environment of the region.

11. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Intensification of agriculture is the main realistic threat for environmental conditions. There is no pressure of transport or industrial investments.

12. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

There were no important natural disasters.

III. Multi-functionality

22. Please name socio-economic and environmental functions of land use in the region.

Agricultural function strong domination still exists. It is concentrating as source of income in smaller number of farmers but number of self-supplying farms and depending on social payments increased due to ageing of rural society.

23. Multifunctional land use - which of the functions in your region co-exist?

Co-existing of agricultural and tourist function introducing, for instance in the case of ski lifts building.

24. Which of the functions are the most important in the context of land use?

Definitely agricultural function is predominant. Tourist function is rather weak in land use sense.

25. Is the number of functions of land use increasing or decreasing?

Slowly increasing thanks to tourist and other services on rural areas introducing. More advanced in tourism on rural areas introducing are more attractive Roztocze Hills.

26. *To which extent is the land in your region used in multifunctional way?*

Not clear question.

27. *What kind of functions co-existence is:*

a) *the most effective?*

Agricultural function with protection of traditional landscape and environmental function. The region has a potential as future second houses area.

b) *the most desirable?*

Stronger protection by law of traditional agriculture and environment co-existing in the current shape. To achieve this target creating workplaces in rural areas and opportunities for young people to live there is necessary.

c) *the most common?*

The most common in aerial dimension is co-existing of traditional agriculture and environmental protection.

d) *the most difficult?*

Co-existence of agriculture and variety of tourist kinds is the most effective, desirable, and common as well.

28. *Which of the functions of land use are the most important for the future regional development?*

Increase of variety of kinds of tourist on rural areas development. It will help to create local diversified labour market for young people who will be interested in preserving of traditional landscape. This will help to promote this region as future second houses area, which can be only one realistic way of future development of such peripheral region without urban tradition and many tourist attractions in international scale.

IV. Spatial conflicts

13. *Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).*

There is no important spatial conflicts, because there is no economically strong actors aiming land use changing.

14. *What are the "competing" actors and functions (environmental, agricultural, industrial, settlement etc.)?*

Mainly competing actors are administration of protected areas and inhabitants building new houses.

15. Which of the actors are the most dynamic and successful in obtaining new land?

Inhabitants interested in creating new housing areas are the most important actor so far due to economic aspect. Price of land for housing is much higher than for agricultural activities, so it's important economic potential in rural areas. They're successfully converting the land of weaker and medium agricultural quality for housing area if at least any road to given plot exists.

16. What are the most likely conflicts related to land use in future and what could be its impact on land use?

Maybe investing in wind energy power stations will be the future source of local conflicts. Complaints of inhabitants of settlements surrounding wind power plants appeared last years.

V. Government and policy

10. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

Generally positive assessing, especially where plan of spatial organization is resolved.

11. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

There are extremely distinct examples of administration impact on land use changes. Human factor decides about it, because very often given municipality hasn't got the plan of spatial organization and decision of possible permission for land use change is left to local authorities.

12. Is there any monitoring of land cover changes in the region? (Please describe briefly).

There is need to introduce land use changes monitoring from couple of years. If such system is created, Chełmsko - Zamojski region will be probably one of the last in Poland, where it will be introduced due to low dynamic of changes.

VI. Localization (depending on the region)

7. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?

There is negative impact on economic development opportunities. It had also impact on land use and farms size structure in the past, what didn't change in significant degree so far.

8. *How land use changes are resulting from vicinity of sea coast (how the coastal location influence land use in your region)?*

Not concerning.

VII. Land use in general

7. *Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.*

Housing in suburbs, untitled land on former meadows and near to the forests, forest area increasing during the last 20 years.

8. *In a typology elaborated on the basis of statistic data, your region represent the type X, characterized by "agricultural". Is it a proper type for your region? Please explain.*

Agricultural is the only correct type for this region. Although the other functions in rural areas are existing and their importance increased last years, they are still marginal.

EU-LUPA
European Land Use Patterns

***Jeleniogórski Subregion, Poland
Case Study Report
Appenix 7***

Applied Research 2013/1/8

Konrad Ł. Czapiewski



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1. INTRODUCTION TO THE REGION

The main focus of the case study is the Jeleniogórski subregion (according to NUTS 3 classification – its code is PL515) located in south-western part of Dolnośląskie Region in Poland.

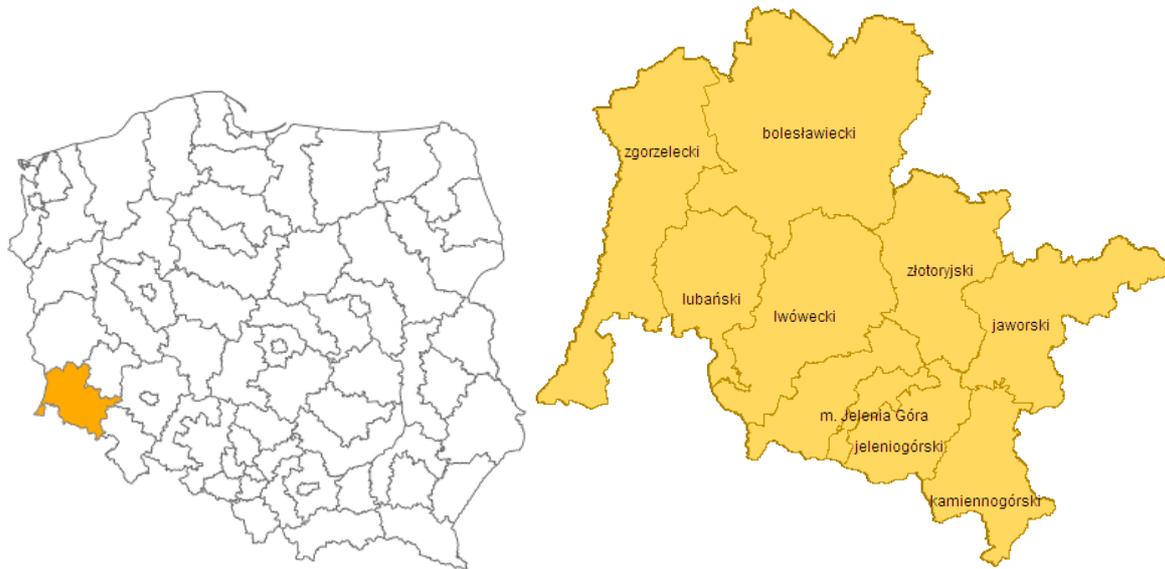


Fig. 1. Division of Poland into the NUTS3 units and division of the Jeleniogórski subregion into counties (LAU1)

Source: own work and the Central Statistical Office of Poland (www.stat.gov.pl).

At the beginning of the report the administrative division of Poland should be briefly described. Since 1999, the administrative division of Poland has been based on three levels of territorial subdivision. Thus the territory of Poland is divided into 16 voivodeships (regions; NUTS2); these are further divided into 379 powiat-units (counties; LAU1), and these in turn are divided into almost 2500 gmina-units (communes or municipalities; LAU2). Each of the tiers of the government and self-government has very precisely designated responsibilities, legal status, authorities, budget and other things. According to that system, such areas as subregions (NUTS3) do not have any legal and administrative responsibilities. In Poland, the NUTS3 subregions are only statistical units created from groups of counties (LAU1), but always within the borders of one of the regions (NUTS2). It is very important to mention it at the beginning of the report, because the general recommendations of the land management should be based both on a more general level and addressed to regional authorities and also prepared on a more locally diversified and oriented level and addressed to counties' authorities, since the conclusions for subregional level do not have any legal addressee.

Also, there is one more thing that should be mentioned in that part. The Jeleniogórski subregion was created in 2007, when in Poland the correction of statistical units on NUTS3 level was made. Before 2007 there were 45 units, and after the correction - 66. Till 2007 there existed the Jeleniogórsko-wałbrzyski subregion (PL511), but after the correction, two separate subregions were established: Jeleniogórski (PL515) and Wałbrzyski (PL517). Because of the aforementioned change it is impossible to conduct some dynamic analysis in a long time series.

The Jeleniogórski subregion consists of 9 counties – the biggest town being Jelenia Góra (84,000 inhabitants). In total the subregion has 575,000 inhabitants (as of 2010), which is ca. 1.5% of Poland's population. The surface of the region is 5,570 km², and the density of population is 103 people per km².



Photo 1. Old Market in Jelenia Góra.

Source: author's own materials.

The most important characteristics of that subregion can be listed as below:

- Borderland location – borders with the Czech Republic in the south and with Germany in the west;
- Diversified landscape – in the southern part there are the Sudety Mountains, with its highest range - the Karkonosze (the highest mountain – Mt. Śnieżka 1602 m a.s.l.) and in the northern part there are lowlands;
- Hugely diversified land cover and diversified land use functions as well;
- Relatively high rate of unemployment, resulting from the transformations of the industrial sector that has taken place during the last 20 years;
- In the past, problems with big pollution;
- The increasing role of tourism in southern part of the subregion.

The analysis in the report is based mostly on the statistical data and literature review.

The report will centre on three spatial levels – all of these being subjected to detailed investigation.

- Some of the analysis will be made for the area of the Jeleniogórski subregion in relation to regional and national average.
- Some of the research will focus on intraregional diversification of the Jeleniogórski subregion, concentrating on spatial units of counties and communes.
- And also some of the analysis will be made, based on a very detailed spatial resolution – making use of the data from the Corine Land Cover and providing

some examples of a very detailed location of some elements of spatial organization (settlements, industrial districts, arable lands, forests, roads and other elements).



Photo 2. The Karkonosze – the highest range of the Sudety Mountains.

Source: author's materials.

But also very important data and information were collected by the author during the field studies in the Jeleniogórski subregion in the periods: 3-7 March and 26-28 April 2012. During the study four interviews were conducted with:

- Jolanta Borejszo and Włodzimierz Słodkiewicz – Secretary and Vice Secretary (Director of the Organizational and Legal Department) in the Office of the Jelenia Góra County.
- Prof. Jacek Potocki – professor at the Wrocław University of Economics – Branch in Jelenia Góra, member of the Scientific Council of the Karkonoski National Park and member of the Advisory Group in the Marshal Office of Dolnośląskie Region, specialised in the tourism analysis.
- Dr Sylwia Dołzbłasz – researcher in the Institute of Geography and Regional Development at the Wrocław University, specialising in the trans-border and transnational analysis, especially on the border with Germany and Czech Republic.
- Dr Helena Dobrowolska-Kaniewska – head of the regional analysis units in Dolnośląskie Agency for Economic Cooperation (DAWG) – agency carrying out European and regional projects and co-operating with the Marshal Office of Dolnośląskie Region.

At this point the author would like to express his special thanks for the interesting interviews.

2. CHARACTERIZATION OF LAND USE AND LAND COVER

2.1. Definitions of land use

In this report it is very important to define two terms: land cover and land use.

The first one corresponds to a physical description of space, the observed (bio)physical cover of the earth's surface (di Gregorio, Jansen, 1997). It is the one which overlays or currently covers the ground. This description enables various biophysical categories to be distinguished - basically, areas of vegetation (trees, bushes, fields, lawns), bare soil (even if there is a lack of cover), hard surfaces (rocks, buildings) and wet areas and bodies of water (sheets of water and watercourses, wetlands). This definition has impact on development of classification systems, data collection and information systems in general.

As for the second one, various approaches are proposed in the literature. There are two main "schools" of thoughts that may be distinguished. Land use in terms of functional dimension corresponds to the description of areas in terms of their socio-economic purpose: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc. Relationships with land cover are evident; that is it may be possible to infer land use from land cover and conversely. However, situation is often quite complicated and relationships not so obvious. Another approach, termed sequential, has been particularly developed for agricultural purposes. It can be defined as a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources. Contrary to land cover, land use is difficult to "observe". The information coming from the source of observation may not be sufficient and may require additional data.

2.2. Surface and structure of land use

Surface and structure of land use is strictly connected with topography of the Jeleniogórski subregion (Figure 2). The physical structure of land in this subregion is highly diverse. In the southern part there are the Sudety Mountains – the old chain of mountains lying on the border of Germany, Poland and the Czech Republic. The Sudetes are divided into many ranges – the average altitude for these ranges is approximately 1000 meters, however the highest range – the Karkonosze – is about 1300-1400 meters with the highest mountain summit - Mt. Śnieżka (1602 m a.s.l, this being at the same time the highest mountain peak of the Czech Republic. Than more to the north, there are uplands – diversified landscape with the small hills – around 300-600 meters. Then, the more to the north of the subregion, the average altitude is lower (around 100 meters). In that subregion we can notice only few lakes – mainly in the mountainous part or artificially created on the rivers by building the dams. The longest and the most important rivers in the analysed region are Bóbr, Kwisa and Nysa Łużycka.

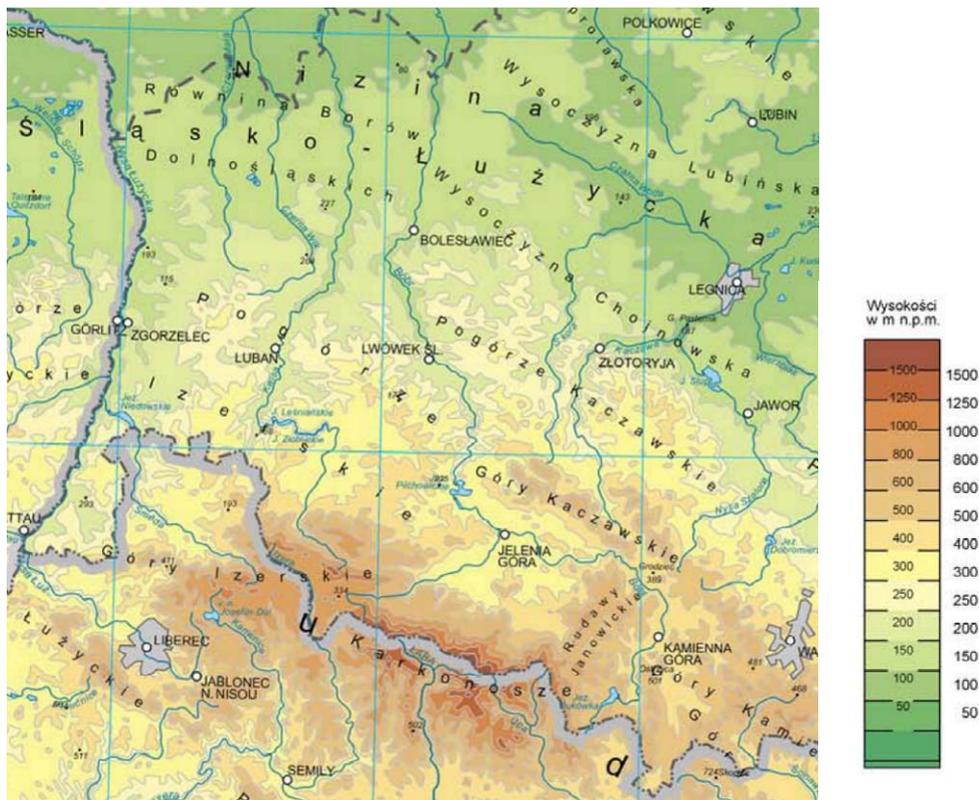


Fig. 2. Hypsometry of the Jeleniogórski subregion

Source: <http://eko.wbu.wroc.pl>

About 88% of the land in the Jeleniogórski subregion is covered by agricultural land and forests. Such amount is comparable with the national and regional average. But what is specific for the Jeleniogórski subregion is a higher proportion of forests. On average in Poland and in the Dolnośląskie Region the share of forests is around 30%, while in the analysed subregion it is almost 40%. Such amount is correlated with two important factors – a diversified landscape and high proportion of forests in the mountainous part of the region in the south and a poor quality of the soils in the north, which are covered by the biggest compact complex of forests in Poland – Bory Dolnośląskie.

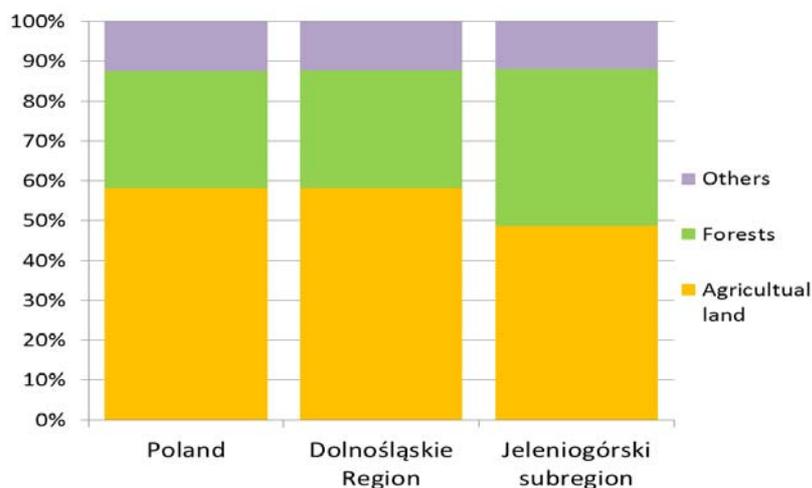


Fig. 3. Land use in Poland, Dolnośląskie Region, Jeleniogórski subregion, 2005

Source: the Central Statistical Office of Poland (www.stat.gov.pl)

But the Jeleniogórski subregion is much diversified internally in regard to the general land use. There is a group of five counties located in the central belt of that subregion (going from the west: lubański, lwówecki, złotoryjski, jaworski and kamiennogórski) where the share of the arable land is above average. Contrarily, in counties – jeleniogórski (high share of mountains), zgorzelecki and bolesławiecki (big complex of Dolnośląskie Forests) over 50% of the land is covered by forests. In Jelenia Góra town, over 25% of the land is used by other types (mostly built-up and industrial areas). The highest than average share of “others” category in zgorzelecki and bolesławiecki counties is connected with brown coal mining and occurrence of military areas (see more about that later in the report).

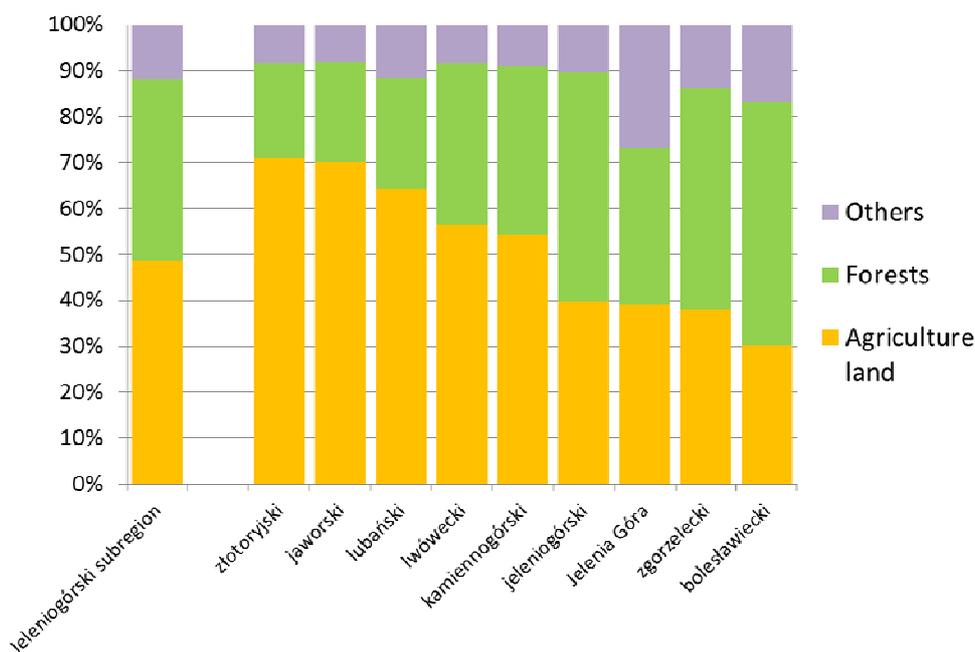


Fig. 4. Land use in the Jeleniogórski subregion and its counties in 2005

Source: the Central Statistical Office of Poland (www.stat.gov.pl)

The more detailed way of the contemporary diversification of the land use, based on the data from the Corine Land Cover, can be found on the map below (fig. 5). It is a clearly visible complex of forests and meadows in the mountainous part of the subregion and large complex of forests in the north. Between these areas, there is a domination of agricultural areas. As presented on the map, the settlement system in that subregion is a polycentric one – there is no a big centre with a dominant position (Jelenia Góra – 84,000 inhabitants), but there are also other towns that play an important role in the settlement system (Zgorzelec – 32,000; Jawor – 24,000; Lubań – 22,000; Kamienna Góra – 21,000; Złotoryja – 16,000). The settlement system is supplemented by many smaller towns and villages – most of them has a very linear character (houses are built along the main roads, which means that they are not a complex settlements). It has to be mentioned that there are two important large complexes of artificial land, which are not settlements.

First one is located in zgorzelecki county (the most south-western part of the subregion) – it is the brown coal mine Turów, which is part of the brown coal mining complex on the Polish-German-Czech border. It is one of the biggest open coal mines in Poland. Next to the mine power plant is located, which produces around 8%

of total Polish production of electricity. The power plant (1900 MW) has been in operation since the 1960's and in 2005 it underwent a complex. The mine, power plant and surrounding infrastructure exert a big impact, bringing about the changes in the land use. The second important artificial land is located in the bolesławiecki county – there, the largest military training area in Poland is found.

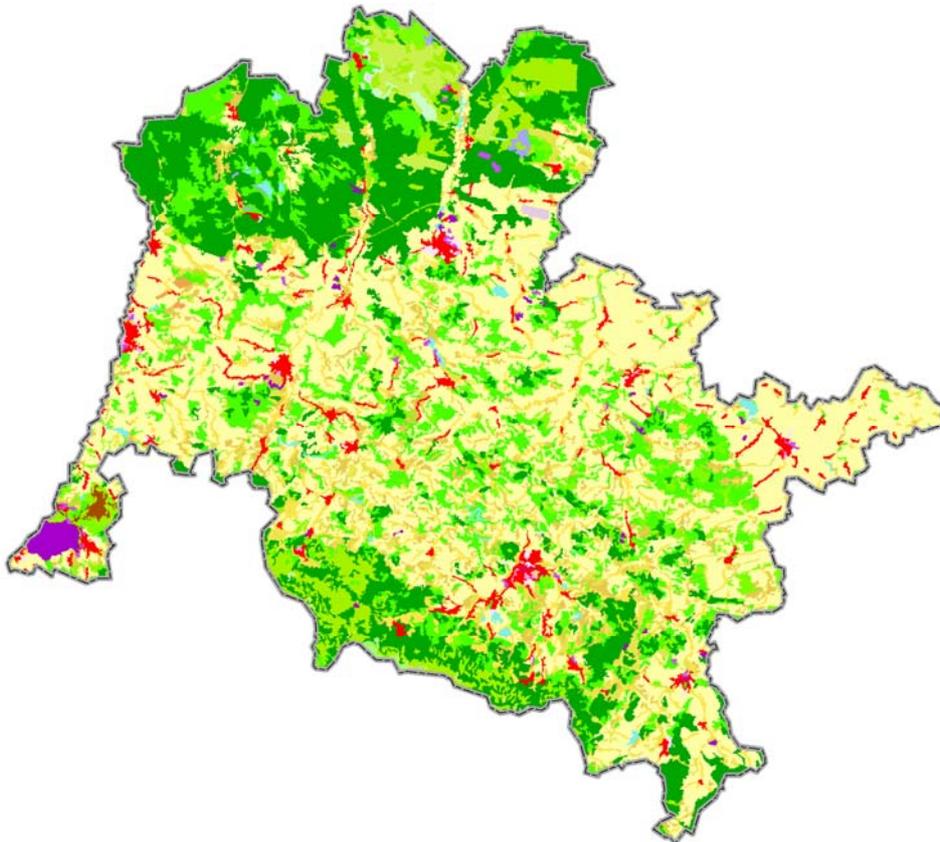


Fig. 5. Land cover of the Jeleniogórski subregion in 2006

Source: own work based on the Corine land Cover data



Photo 3. Brown coal mine in Turów (zgorzelecki county).

Source: photo by Krzysztof Janc.

Extremely important elements in the structure of the land use are the changes that have taken place in the recent years. In the Jeleniogórski subregion these changes have not been very dynamic – the share of agricultural land has remained rather at the stable level, the share of forests has been on the increase from 37% to 39%, and the category “other” - on the decrease, mainly in such subcategory as: the abandoned, not utilised land. After the accession to the European Union and implementation of agricultural payment connected with the Common Agricultural Policy, a considerable share of formerly abandoned agricultural land started to be utilized again (in the whole of Poland the share of abandoned land decreased by 60% between 2002 and 2006).

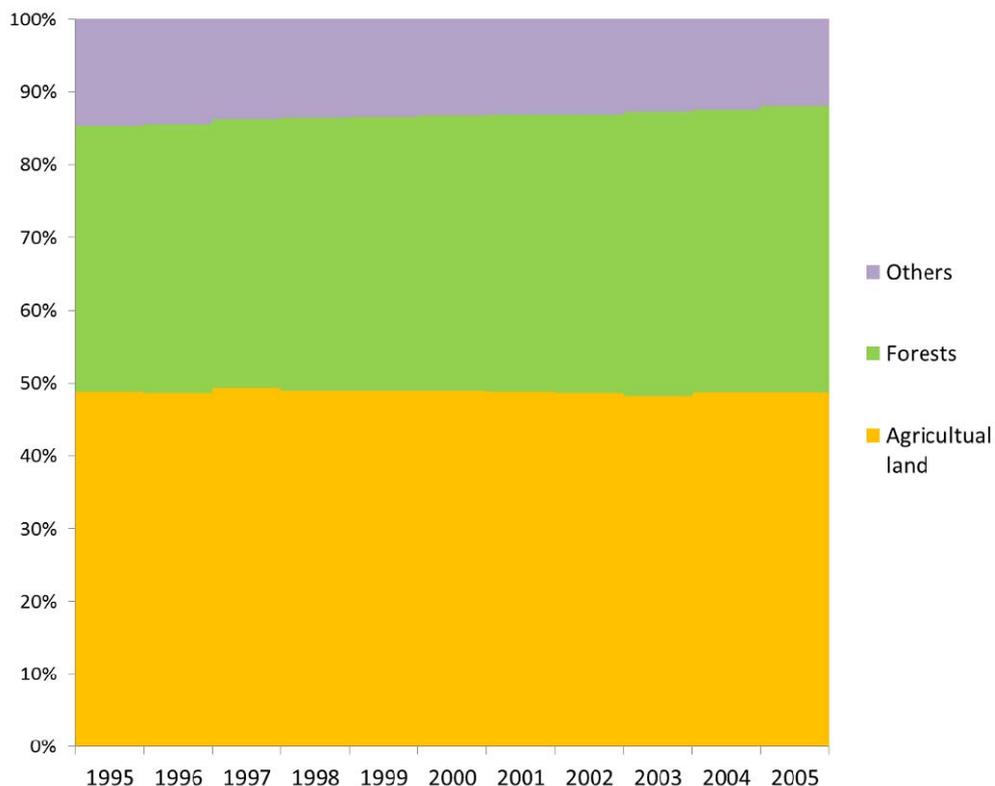


Fig. 6. Changes in the land use in Jeleniogórski subregion in 1995-2005

Source: the Central Statistical Office of Poland (www.stat.gov.pl)

In the Jeleniogórski subregion the share of pastures and meadows is higher in comparison to a national and regional average – it is the result of the land-relief and also of the climate and soils conditions (more about that in the next chapters).

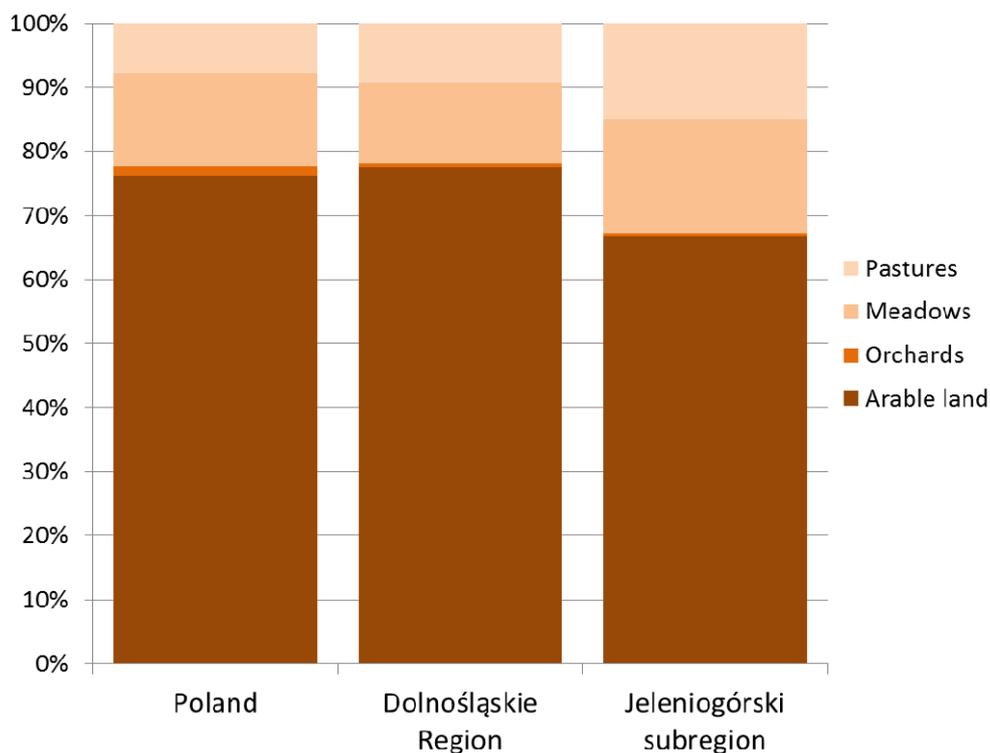


Fig. 7. Utilization of the agricultural land in Poland, the Dolnośląskie Region and the Jeleniogórski subregion as of 2005

Source: the Central Statistical Office of Poland (www.stat.gov.pl)



Photo 4. Grasslands in the vicinity of the Karkonosze (on the photo the highest peak of Sudety Mountains – Mt. Śnieżka).

Source: author's materials.

2.3. Land cover characteristics

Where the land cover in the Jeleniogórski subregion is concerned, two specific elements should be pointed out. As was mentioned above, there is the higher than average share of grasslands (pastures and meadows) as well as fallow and waste

lands in the total area of arable lands. This situation is due to many factors among which are: relief and hypsometry – areas of inconvenient relief (all mountainous and upland areas in Poland has similar characteristics), poor quality of soils and other elements of agricultural space (eg. short growing season in the mountainous areas), out-migration from that areas, resulting from the fact that fewer and fewer inhabitants want to deal with agriculture (more about demographics in chapter 3) and also changes of agricultural land into the built-up areas due to the higher prices. It has to be stressed that even that the arable lands has the highest share in total agricultural lands, but in generally in that subregion the share of grasslands is higher than average and as well relatively high share of arable land is not utilized.

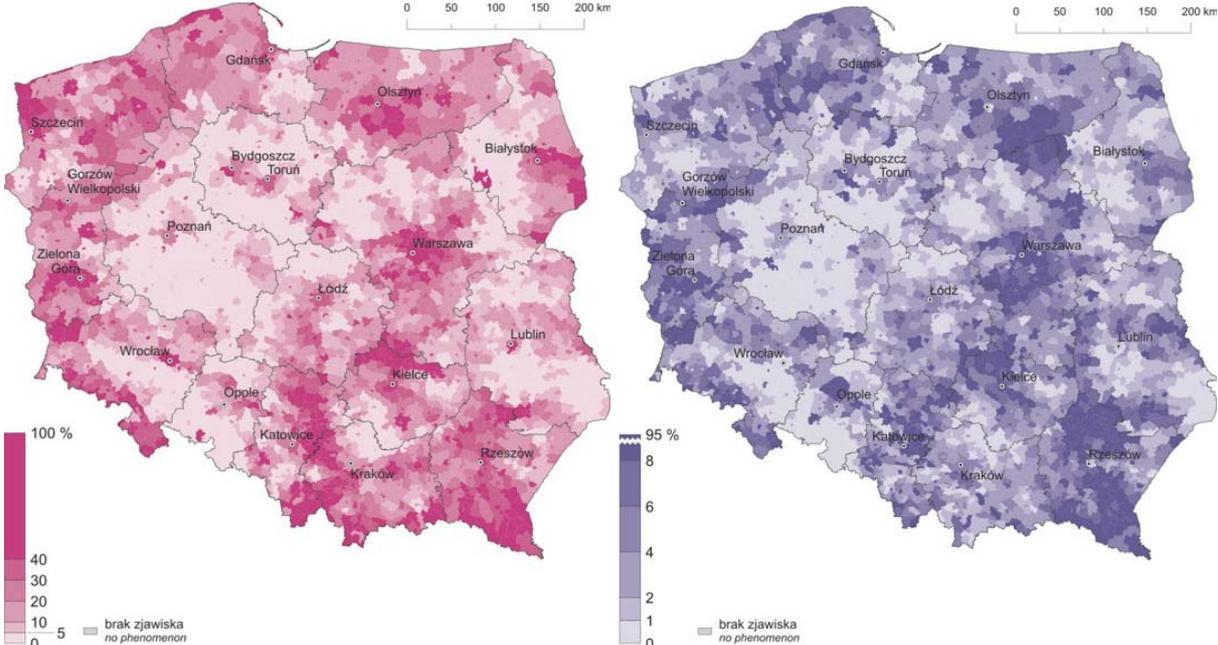


Fig. 8. Share of fallow lands and waste lands in total area of arable lands, 2002
 Source: *Atlas of Polish Agriculture* (2010).

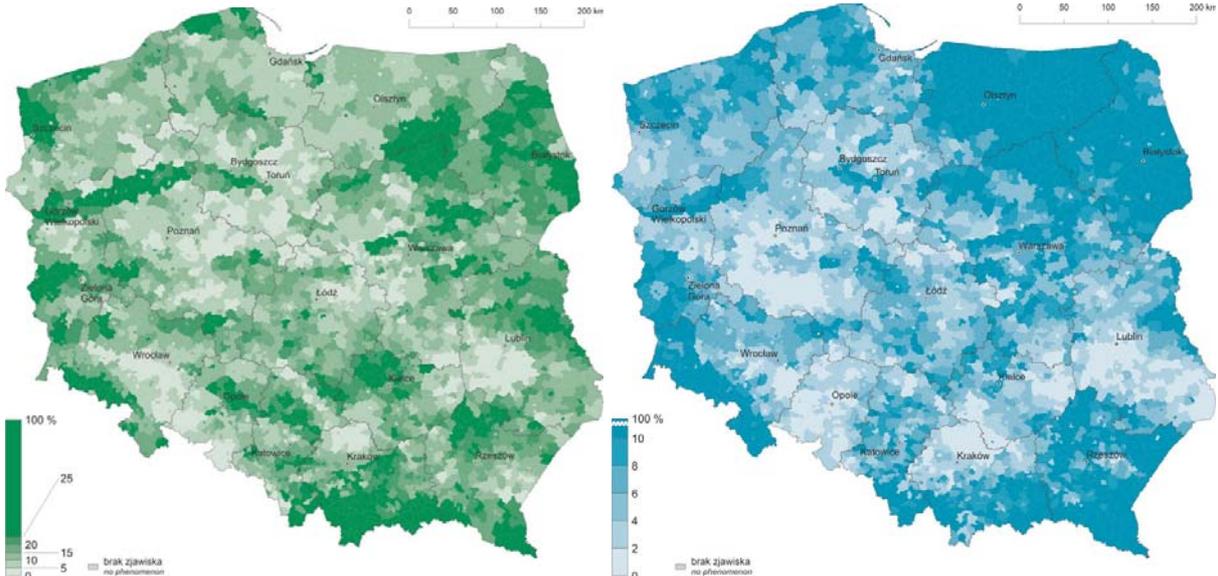


Fig. 9. Share of meadows and pastures in total area of agricultural land, 2005
 Source: *Atlas of Polish Agriculture* (2010).

Other important element of that region, which greatly influences the land cover, is its diversified geological structure. The Sudety Mountains are very old from the geological point of view and hugely diversified. It results from a big diversity of the soils conditions. As visible on the maps below, generally, in that subregion, we can observe such tendency – the less diversified relief, the better quality of soils (fig. 10). But that general relationship is varied, depending on locally occurring specific conditions. That is why we can observe and notice a very mosaic character of the soils conditions, which is strictly connected with the land cover.

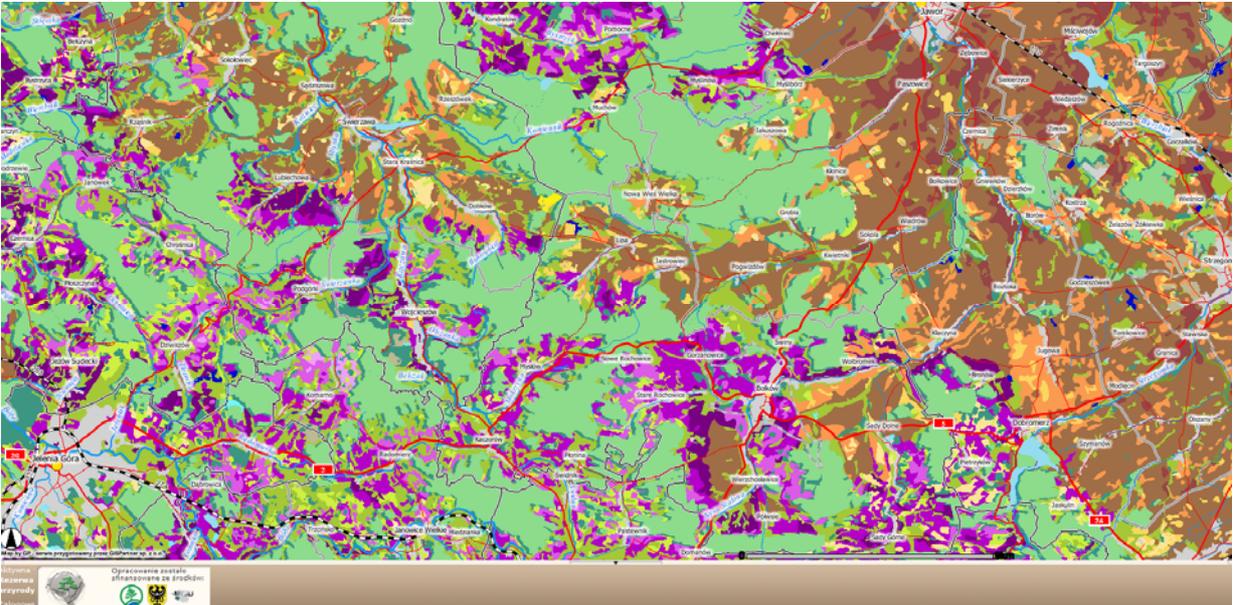
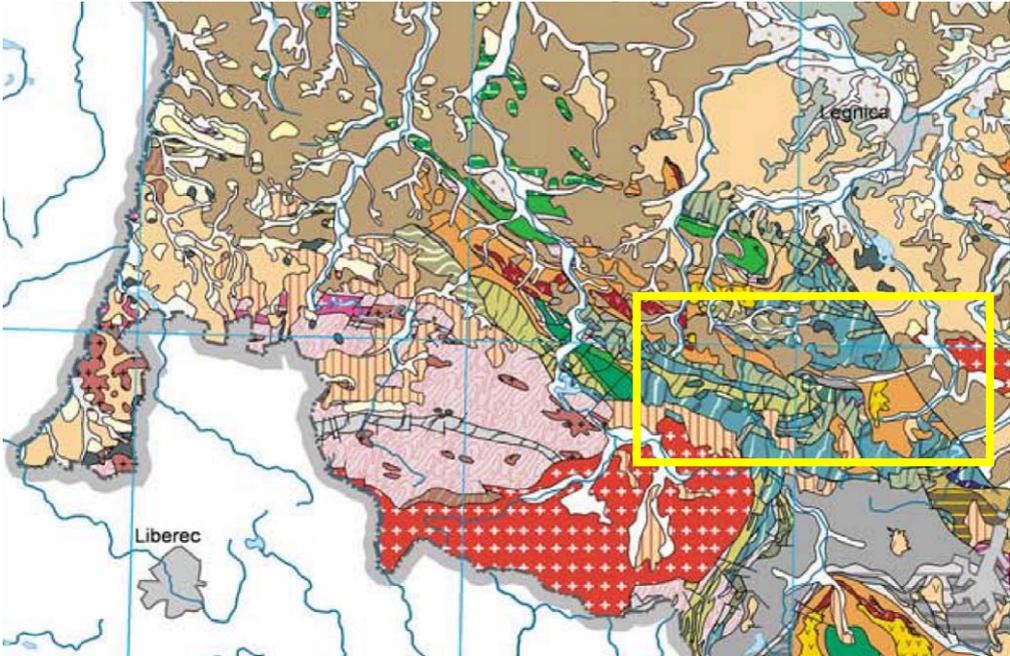


Fig. 10. Diversified geological situation in the Jeleniogórski subregion (above) and a proof of a hugely mosaic nature of the existing soils conditions on the example of the area between Jelenia Góra and Jawor (below)

green: forests, violet: very poor quality of soils, orange and brown: average and good quality of soils

Source: <http://eko.wbu.wroc.pl>

2.4. Technical management of the land use

This area before the II WW was characterized by a very good organization in terms of spatial planning and technical infrastructure. However, the war brought about significant changes in the situation there due to following factors: (1) a location close to the border (not so many investments were made in such zones in the socialist era), (2) a migration to these places of inhabitants from the ex-Polish territories (now Ukrainian territories), who were unfamiliar with the use of the technical equipment that left after the war, (3) a lack of investment in development because of the fear that these territories may return to the previous owners and also (4) the state policy, which gave high priority to the development of state agriculture and industrial towns. That is why during the last decades the level of development of infrastructure has slowly decreased. A considerable depreciation of existing buildings and infrastructure has been noted. For example, as can be seen on the map below, in the analysed subregion more than 35% of houses were built before the I WW (fig. 11). Thus the aforementioned high level of depreciation is due to three basic elements: year of construction of the houses, type of used elements (eg. woods) and lack of modernization of the older settlements (Ciok, 1991, 1994). Many villages, because of the permanent out-migration from these areas, have virtually disappeared.

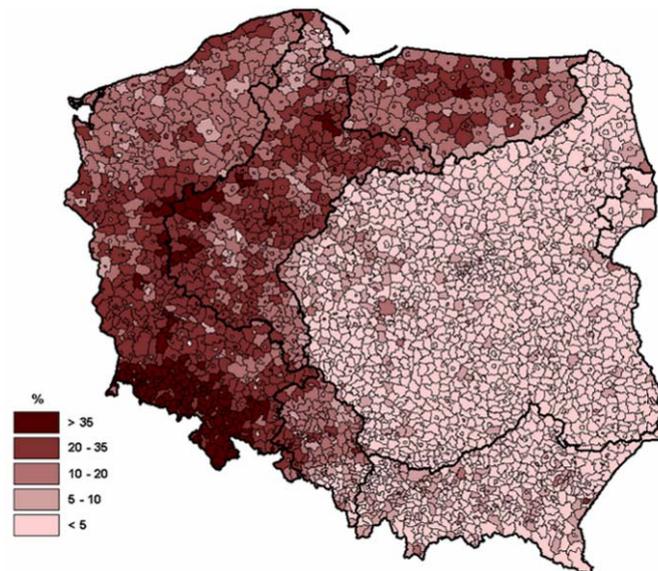


Fig. 11. Share of houses built before 1918 (historical borders of partitions in XIX century)

Source: own work based on data from the Central Statistical Office of Poland (www.stat.gov.pl)



Photo 5. Example of renovated and desolated old houses (zgorzelecki county).

Source: photo by Krzysztof Janc and author's materials.

Generally, as can be noticed on the graph and maps below, the situation in terms of development of technical infrastructure is comparable to a national average (fig. 12, 13). But taking into account that in Poland, generally, the level of development of infrastructure (technical, transport and others) is higher in its western part, the situation in the Jeleniogórski subregion should be analysed within the borders of the whole of the Dolnośląskie Region. In such analysis, it has to be stressed that there is a significantly lower level of development for all selected elements of technical infrastructure.

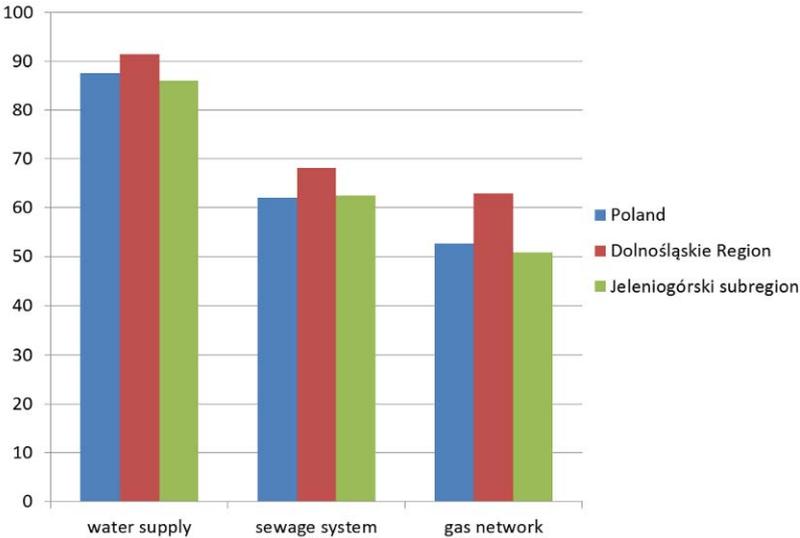


Fig. 12. Percentage of population with the connection to water supply, sewage system and gas network in Poland, the Dolnośląskie Region and the Jeleniogórski subregion, 2010

Source: own work based on data from the Central Statistical Office of Poland (www.stat.gov.pl)

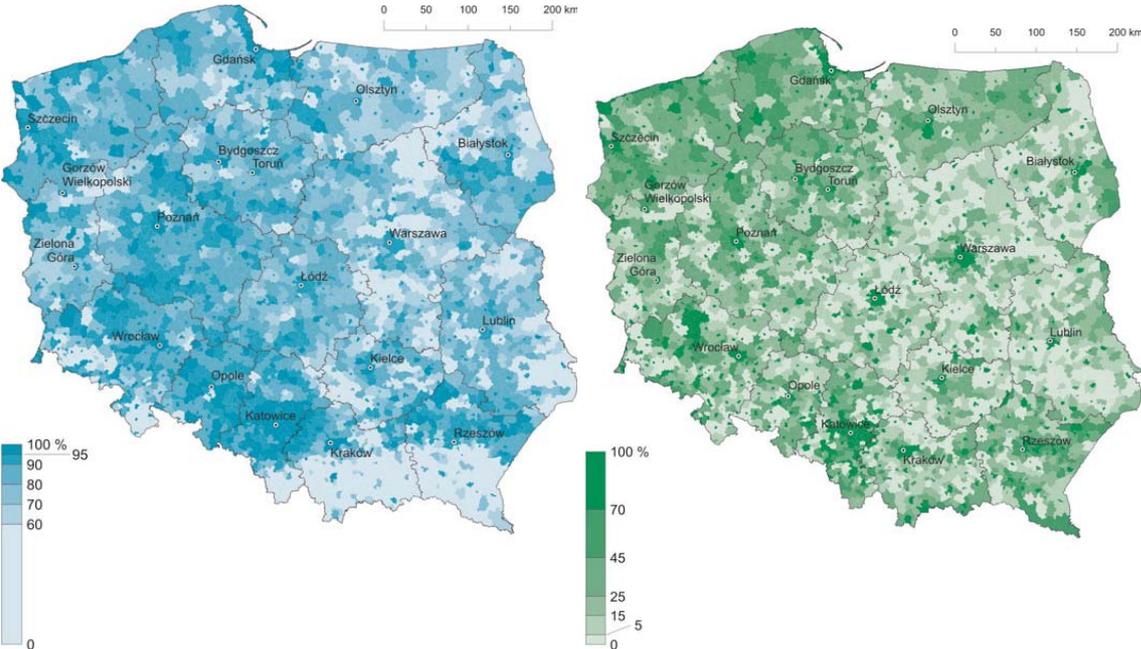


Fig. 13. Percentage of population with the connection to water supply and sewage system, 2007

Source: *Atlas of Polish Agriculture* (2010).

2.5. Major trends in historical context

In the Dolnośląskie Region, it is very characteristic that most of the towns were created only in two historical periods: i.e., in the 13th or 20th century. The first period dates back to the medieval times, when the initiators were mainly some dukes or bishops. These towns have a typical settlement structure – there is a market surrounded by the houses, a church and some civil facilities like town halls and sometimes castles. Especially during the 19th century these towns started to grow due to the industrialization processes. Other type of towns was created in the 20th century – their existence was mainly connected with the development of industry (new factories – “green field” investments – eg. Bogatynia, Pieńsk) and tourism (old villages such as Karpacz or Szklarska Poręba growth very quickly). There are marked differences between these two kinds of towns: the medieval one has a well-planned structure of the core and then differentiated peripheral parts, while on the other hand the newly created towns are characterized by much more chaotic development. These differences are very important in the present-day analysis of the land use and land functions.



Fig. 14. The century in which the charters with towns rights and privileges were given to localities located in the Jeleniogórski subregion and a plan of the typical medieval settlement of Lwówek Śląski

Source: Miszewska (2009).



Photo 6. Chaotic character of the Karpacz town built-up area (town’s rights charter given in 1960) and a more complex settlement pattern of Kowary (town’s rights charter given in 1513) – a distance between those towns is 6 kilometres.

Source: author’s materials.

Before the II WW that region was a peripheral part of the Germany. It fell behind the rest of the country in economic development, however, in addition to some investments made in the industry there (mainly based on fossil deposits), also the development of tourism (mainly in the Sudety Mountains) and transport infrastructure was promoted (relatively high density of railway network).

After the II WW that area was inhabited mostly by the people from the ex-Polish territories (mainly present-day Ukraine). New inhabitants were far behind in terms of education, had no experience of working in the industry, as well as being pioneers taking the first steps in learning the art of agriculture in the mountains and uplands. That is why at the beginning the efficiency of the land use was much lower than before. Similarly as in the case of all ex-German territories in the western Poland, the land was collectivised and the state-owned farms were created, but still in the Jeleniogórski subregion the share of private owners exceeded 50%. During the whole socialist period the industry constituted the important sector of economy. But the state government did not invest a lot in that region. Taking advantage of the industry that was developed here by Germans before the II WW, the government utilised these factories, without undertaking any necessary renovations, and instead investing money in projects developed mostly in other parts of Poland (Ciok, 1991). However, there was one huge investment into development of the brown coal mine and accompanying that mine the power plant near Bogatynia in zgorzelecki county (as was mentioned in the previous chapters). For that reason at the end of the socialist era, the level of depreciation of existing factories was the highest as compared to the whole Poland. Because of that processes: namely, depreciation of infrastructure, houses and industry, depopulation processes, high level of pollution, difficult or unfavourable conditions for agriculture, that area was started to be called the “problem area” (Potocki, 2009).

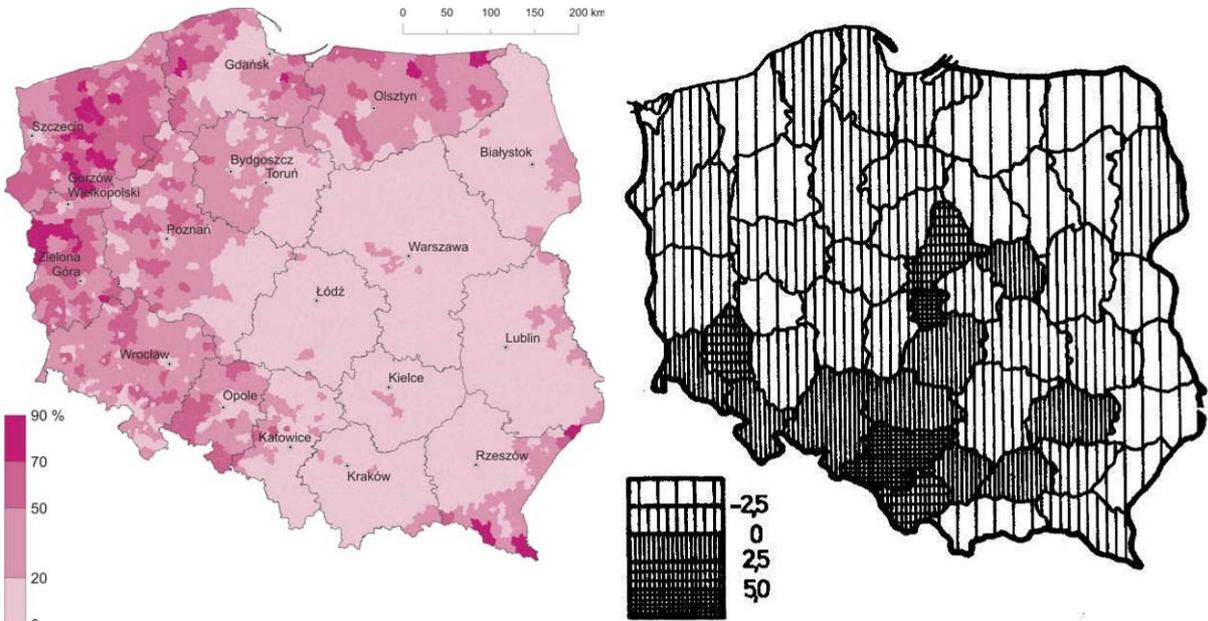


Fig. 15. The share of agricultural land managed by the state and co-operative sector farms in 1989 and level of development of industry sector in 1984

Source: *Atlas of Polish Agriculture* (2010) and Ciok (1991).

After the 1990 many of the factories collapsed, because they were depreciated and not sufficiently competitive on the open market. This resulted in the high level of unemployment and the increased out-migration. In the recent years the development of tourism and settlement can be observed (in the suburbs and these parts of the region that are characterised by beautiful landscape) – more about contemporary processes in the next chapters.



Photo 7. Power plant in Turów (near Bogatynia, zgorzelecki county) directly connected with the brown coal mine.

Source: photo by Krzysztof Janc.



Photo 8. Development of the new built-up areas near Jelenia Góra on the post-agricultural areas.

Source: author's materials.

3. DESCRIPTION OF CHANGE IN RELATION TO LAND USE

3.1. Socio-economic

As was already mentioned several times, the Jeleniogórski subregion is classified as depopulating region. According to ESPON typology it is one of a few subregions in Poland which are marked by both negative natural and migration balance.

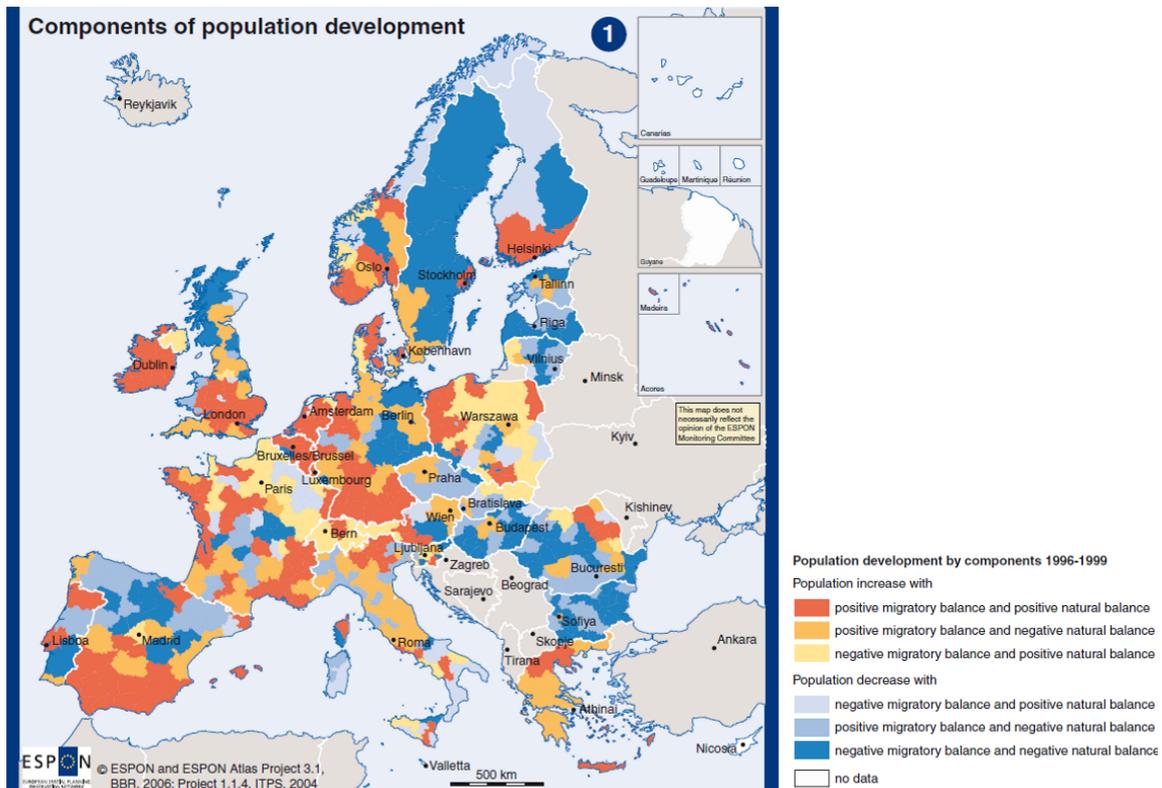


Fig. 16. Population development by components of migratory and natural balance, 1996-1999

Source: *ESPON Atlas* (2006).

In the recent 15 years, the overall population of Poland has decreased by 1%, however in the Dolnośląskie Region by 4% and in the Jeleniogórski subregion by 7%. Each year on average the negative net migration is about minus thousand inhabitants (approximately -2‰). When compared to other parts of Poland, we can point out areas with more intense dynamics in population change (for example in eastern Poland), but still the present-day model of migration processes, which attests to the concentration of inhabitants in big regional centres and their surrounding zones, adversely affects the analysed area. As can be seen on the maps, this process has been in operation for a long time in that subregion (fig. 18). Since 1960, that region has lost about 25% of its population, this being justification why some scientific and strategic documents call it the “problem area”.

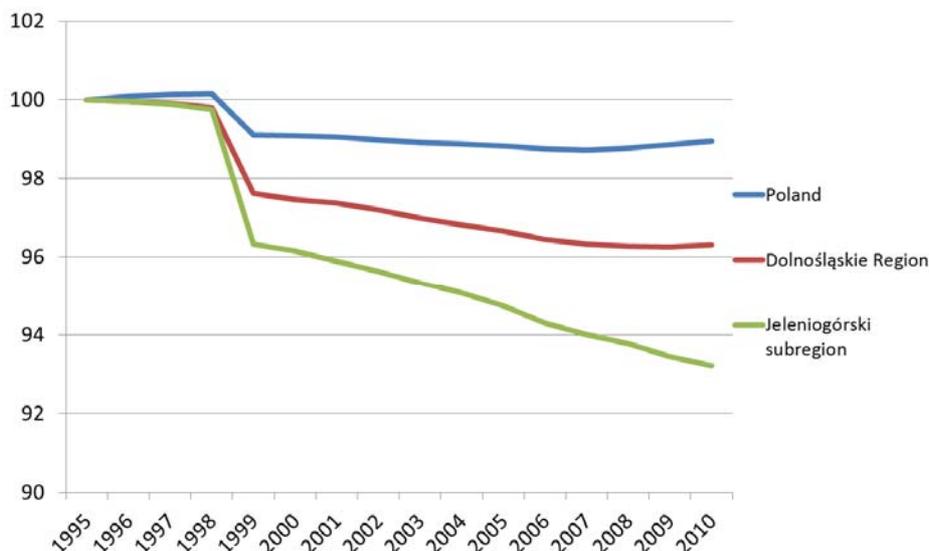


Fig. 16. Changes of population in Poland, the Dolnośląskie Region and the Jeleniogórski subregion in the years 1995-2010 (1995=100)

Source: own work based on data from Central Statistical Office of Poland (www.stat.gov.pl)

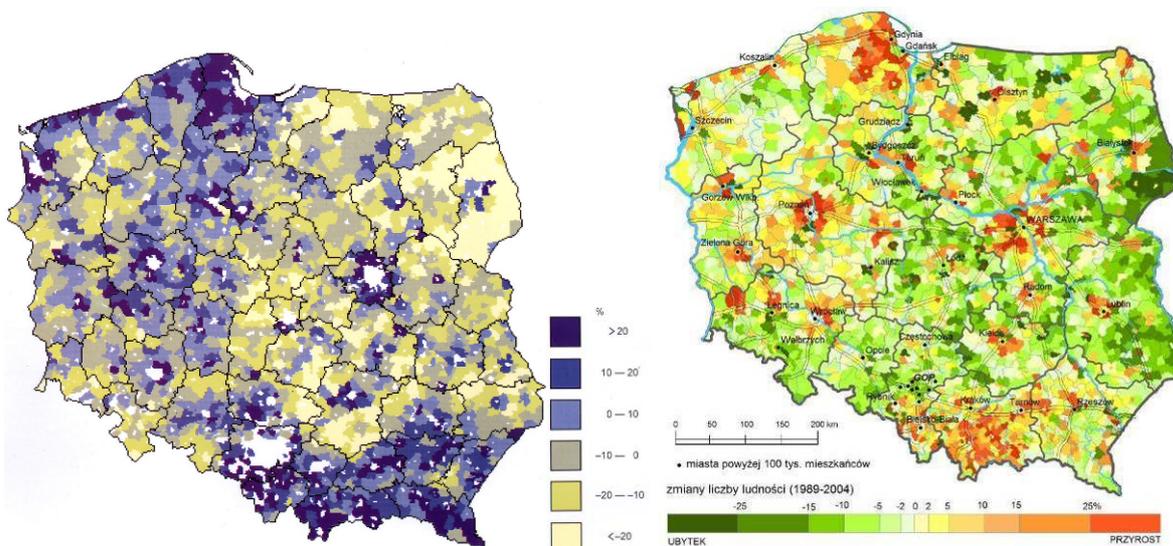


Fig. 17. Changes of population in Poland by communes in the years 1961-1988 and 1989-2004

Source: Frenkel, Rosner (1995) and Węclawowicz *et al.* (2006).

The above-mentioned processes that take place within the framework of demographic developments are heavily influencing not only the general (total) number of population, but also its composition. In 1995 the share of inhabitants in pre-productive age (less than 18 years old) was in the order of 27%, in 2010 this index decreased to 18%. Within the 15-year span, the total number of inhabitants in the productive and post-productive age increased by 24,000 people, while at the same time the number of inhabitants in the pre-productive age decreased by 67,000 people! In 2010 the total population of that group was at the level of 60% as compared to the one that was registered in 1995. This is the most important demographic problem of that region – it significantly affects both the way of and strategies of the infrastructure development, labour market, transport connections, etc. The reasons for such situation are twofold – general trends and specific

characteristics of this area. Generally, in Poland, there is a decrease in number of newly born children due to noticeable widespread changes in the life style. Also it can be noticed that, due to the rapid growth of agglomeration areas which offer better possibilities of employment, the peripherally located area are witnessing steady decline in population. Factor of much significance that started to gain in importance in Poland about 20 years ago, is the education, facilitating fast development of universities and private higher institutions most of all in major regional centres. Many of the late teenagers and young persons, who migrate to those regional centres for education, decide to stay there after finishing their studies. One factor of key significance that contribute to a decrease of population in the Jeleniogórski subregion is poor opportunities for employment there. As a consequence of collapse of many industrial companies, a high level of unemployment is endemic (Pisz, 2008).

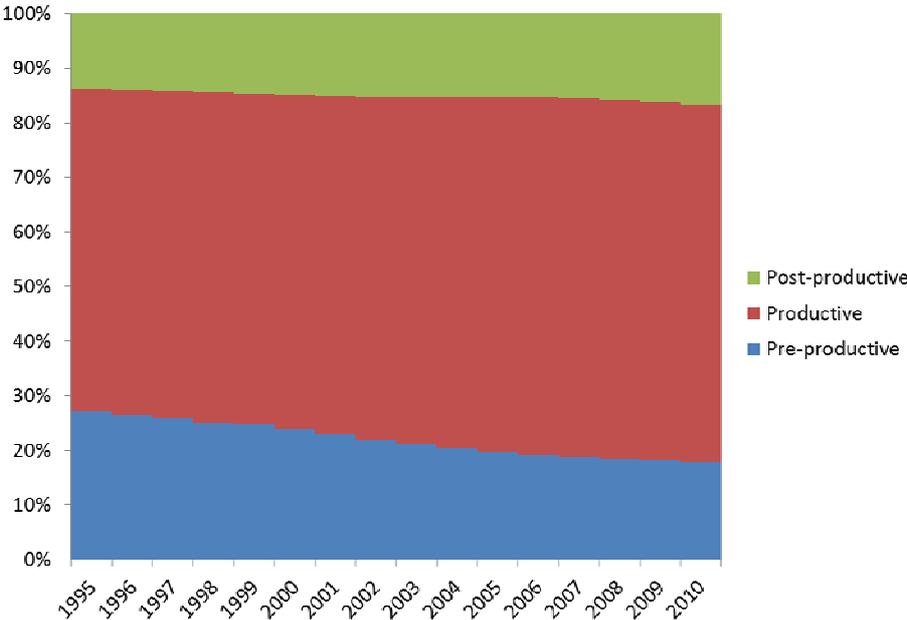


Fig. 18. Changes of the age structure in the Jeleniogórski subregion, 1995-2010
 Source: own work based on data from the Central Statistical Office of Poland (www.stat.gov.pl)

The Jeleniogórski subregion is characterised by a dominant role played by industry and services in employment. The gross added value of agriculture and also the share of employment in the primary sector is on a very low level. Generally the gross domestic product *per capita* in the Jeleniogórski subregion in 2008 was at the level of 26,300 PLN, which constituted 78% of the national average and only 73% of the regional average. These figures shows that the Jeleniogórski subregion is characterised by a relatively better demographic and economic situation than many subregions in eastern part of Poland, however its situation is much worse as compared to the regional and also national average.

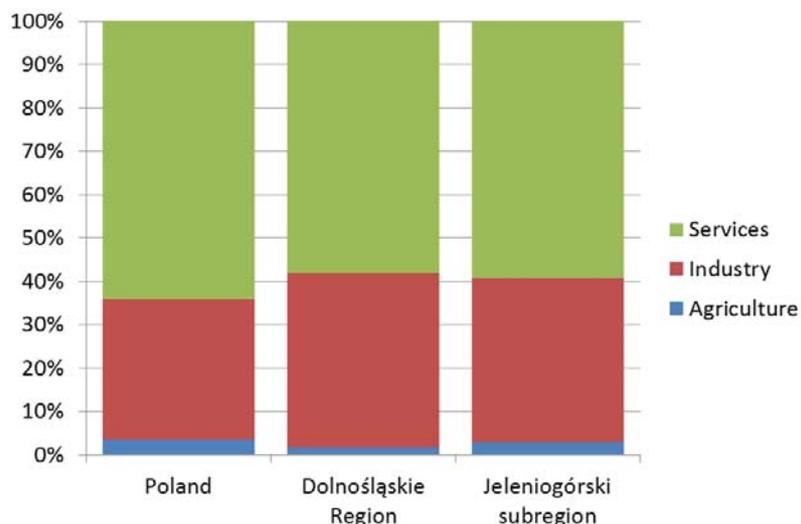


Fig. 19. Gross added value by sectors in Poland, Dolnośląskie Region and Jeleniogórski subregion in 2009

Source: own work based on data from the Central Statistical Office of Poland (www.stat.gov.pl)

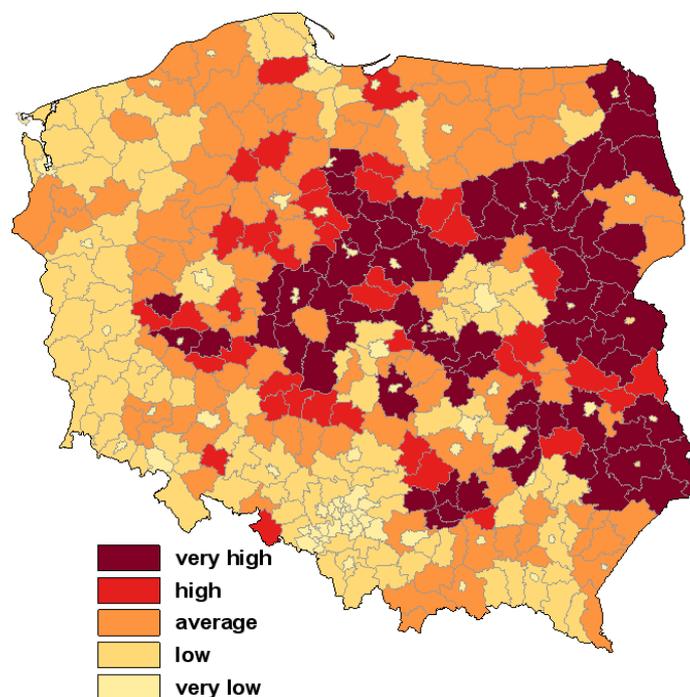


Fig. 20. Share of households depending upon income from agriculture, 2003

Source: own work based on data from the Central Statistical Office of Poland (www.stat.gov.pl)

3.2. Environment

Generally the climate in the Jeleniogórski subregion is much wetter and colder than in the other parts of Poland and especially than in other parts of the Dolnośląskie Region. On the whole this area of Poland, i.e., the Dolnośląskie Region is much warmer, with the growing season longer than in the rest of the territory of Poland, but owing to the influence of the Sudety Mountains, the situation in the Jeleniogórski subregion is a little bit different. The precipitation totals in the Jeleniogórski subregion are about 50% higher than average in Poland. Consequently, the growing season in

this area oscillates around 190-200 days, while in the neighbouring subregion of Wrocław exceeds 220 days.

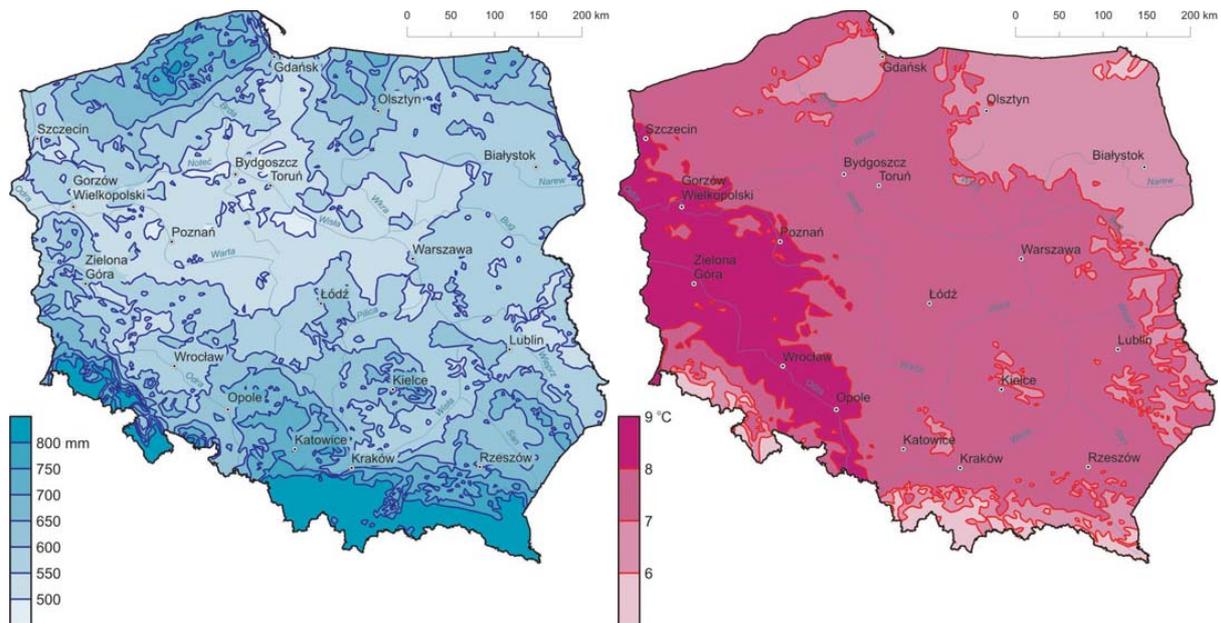


Fig. 21. Average precipitation and temperatures in Poland.

Source: *Atlas of Polish Agriculture* (2010).

In general the relief features of the Jeleniogórski subregion are much diversified. The differences between the highest and the lowest point of that subregion reach around 1500 meters. Such relief influence all kinds of human activity – roads construction, housing, infrastructure, agriculture, etc. – as well as influencing the land use too.

The soils are of poor quality, as was already mentioned a little in the previous chapter. But when we take a closer look at the map, we find that the quality of soils for agricultural production is especially poor in the mountainous part of the subregion and not sufficiently good in quality in the northern part (fig. 22). Only small portion of this subregion that is located in the east (primarily złotoryjski and jaworski counties) enjoys favourable conditions.

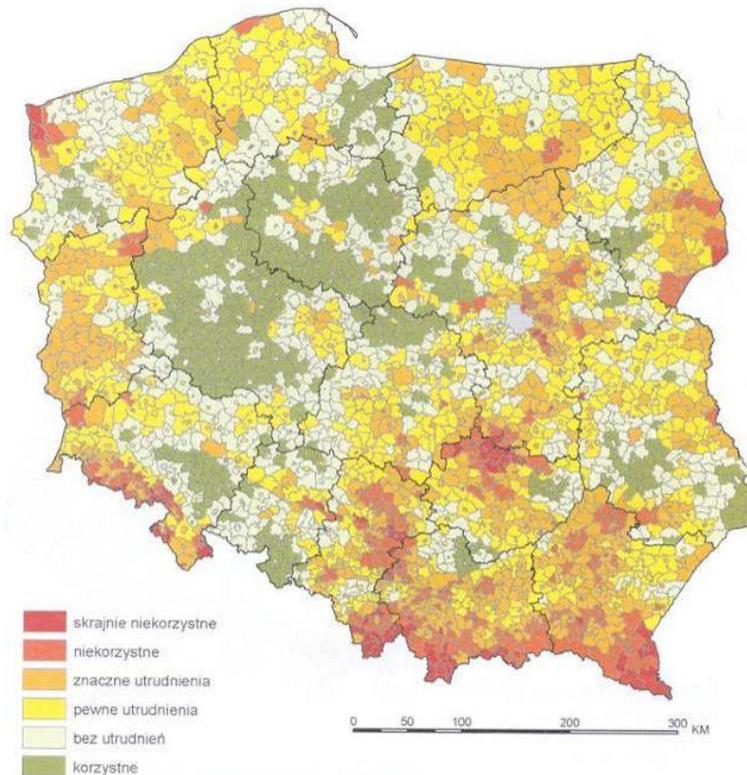


Fig. 22. Natural conditions for agricultural production in Poland.
 green – favourable, then from yellow to scarlet the conditions are getting increasingly worse
 Source: Bielecka, Ciołkosz (2003).

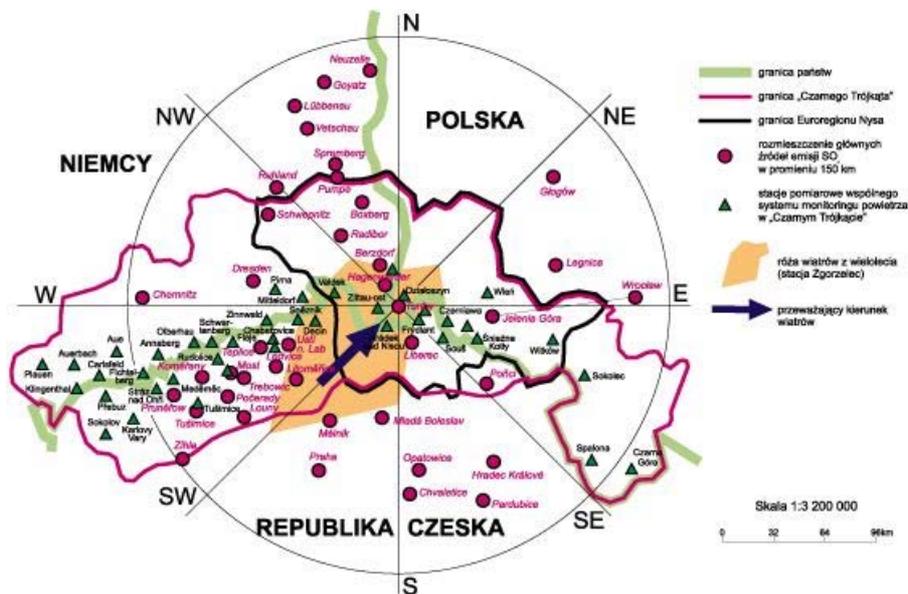


Fig. 23. German-Czech-Polish Borderland.
 Green line – national borders, Red line – border of “Black Triangle”, red points – main emitters of pollutions, arrow – prevailing direction of winds.
 Source: www.geoland.pl/.

In the last decades (especially in the 1970’s, 1980’s) the said subregion experienced severe problems with environmental pollution. In the borderland of Germany, the Czech Republic and Poland, considerable emitters of air pollution were located – mainly SO, CO₂, NO. Owing to the fact that almost 60% of winds in the region blows

from the west or south-west, pollutants were mostly transported into this subregion, precipitating as the so-called “acid rains”. Because of much damage done to the environment by these pollutant emitters, this borderland region started to be called “Black Triangle”. In the last two decades the situation has changed enormously, due to such factors as follows: a more restrictive environmental policy, restructuring of the existing factories, the collapse of many of the industrial activities and also because of increased length of the sewage network. Thus nowadays the situation in the region is much improved and thanks to tremendous efforts on the part of many institutions, the quality of environment is getting better and better.

In the analysed subregion, on the one hand, there are not so many environmentally protected areas, however, on the other hand, the oldest and well-known the Karkonoski National Park is to be found here. It was established over 50 years ago with a view to protect the unique landscape of the highest mountain range in that part of Poland and the Czech Republic – the Karkonosze.

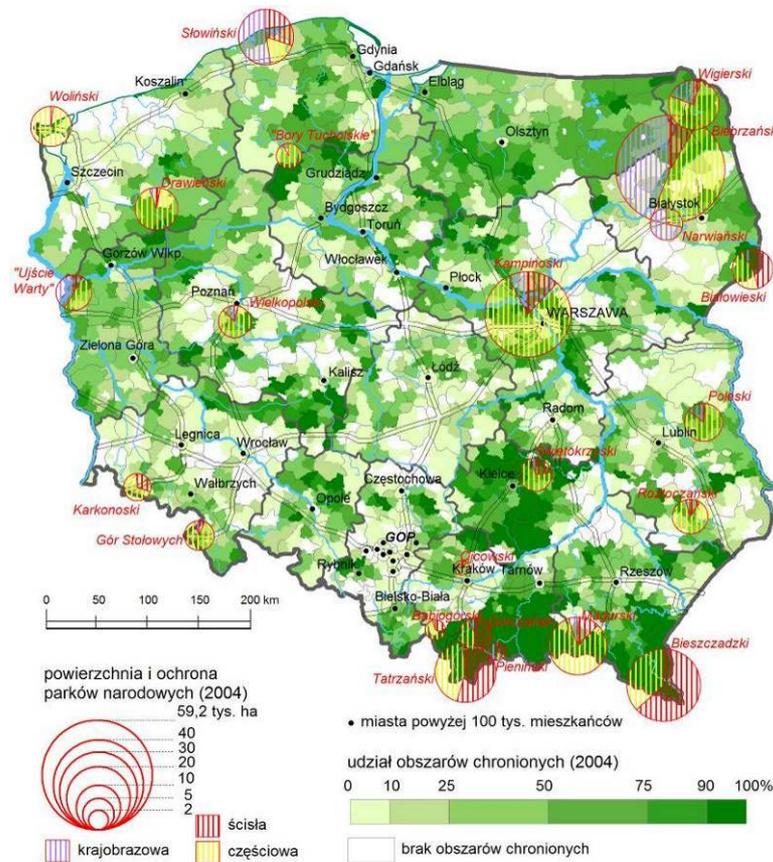


Fig. 24. Share of protected natural areas in the total area of the communes in 2004 and size of the national parks

Source: Węclawowicz *et al.* (2006).

3.3. Government and policy

As was briefly described in the introduction, in Poland there are three levels of government, in addition to the national government. Each of that level has its own specific competences and responsibilities, by means of which local authorities can influence directly or indirectly the changes in land cover and land use functions. In

particular, it is the communes' authorities that enjoy considerable powers (gmina – LAU2 level). In the Jeleniogórski subregion there are 51 communes – they are much differentiated in terms of size, population (from 1,600 inhabitants in rural commune Platerówka to 84,000 inhabitants in Jelenia Góra town), budget, etc. But the range of responsibilities that rest with each communal authorities is similar – among other things, following can be mentioned: the water management, communal roads, water supply systems, the sewage system, public transport, the sports facilities and tourism including recreational grounds and, what is very important in this analysis - the spatial harmony and real estate management. The commune's authorities are equipped with legal tools to accept and monitor the spatial management and planning. There are three basic documents on the commune level – the study of conditions and directions of spatial planning (general document on the commune level), the local plan (highly detailed document) and, lastly, the local self-government decision concerning spatial planning on the areas where there are no local plans. Such situation, whereby the decision about development of land in this way or another lies in the responsibility of the authorities of the commune, does not contribute to proper spatial planning. In the analysed area of the Jeleniogórski subregion, we can observe that a significant share of the land is covered by the very detailed local plans. Unfortunately, in the areas, where there exists the greatest pressure on the land on the part of developers, namely in a touristic zone of the Karkonosze Mountains, the share of the local plans is the lowest. As a result, in some parts of this area a very rapid and “uncontrolled” development of the recreational and touristic buildings can be observed. The most well-known case was a construction of the huge hotel in Karpacz town – in order to build that hotel special changes in the local plans of that town were made (for more details see Appendix 1).

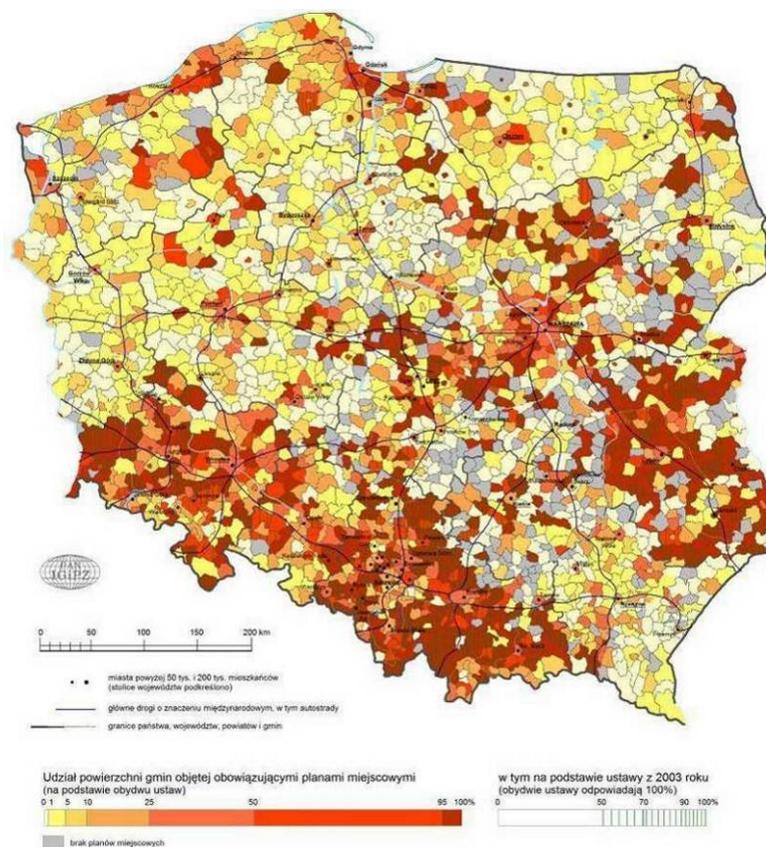


Fig. 25. Share of commune territory covered by the local plans in 2010
Source: Śleszyński (2011).

The role of the counties (LAU1 level) in the process of changes in land cover and land use functions is rather limited to indirect elements. They can just provide the favourable conditions for development of some regions in these or other directions. It is important to have closer look at the directions in which each of the county attempts to develop its territory, but because of the limited amount of own budget incomes and small responsibilities and powers in relation to communes and regional responsibilities, it is enormously problematic for the counties to accomplish all of their ideas and goals. Below the main concepts of development for almost all of the counties in the Jeleniogórski subregion are presented:

- Zgorzelecki County – clean environment, development of individual housing, development of tourism functions, multifunctional development of economy, improvement of social infrastructure (medical, educational and recreational), providing greater opportunities on the labour market, improvement of spatial harmony, etc. (*Strategia rozwoju powiatu zgorzeleckiego na lata 2004-2014*, 2001).
- Lubański County – development of touristic, spa and recreational functions, improvement in the situation on the local labour market, development of a high-quality educational offer (especially vocational training), high-quality of all possible elements of the environment, revitalization of obsolete and devastated urban areas, improvement in the quality and level of life of the local inhabitants (*Strategia rozwoju powiatu lubańskiego*, 1999).
- Lwówecki County – economic development with a particular regard to the environment protection, taking advantage of the existing landscape values, development of tourism and rural tourism, ecological production of food, restructuring of the existing economic and social problems of the county (*Strategia rozwoju powiatu lwóweckiego 2010-2020*, 2010).
- Jeleniogórski County – poli-functional economy, market facilitation of the county (for investors and tourists), more intensive development of tourism functions, development of environmentally friendly industry, supplemented role of agriculture with regard to the dominant functions, diversified labour market, development of all potential spheres of infrastructure (technical, social, transport, touristic, etc.), sustainable development, etc. (*Strategia zrównoważonego rozwoju powiatu jeleniogórskiego 2006-2014*, 2006).
- Jelenia Góra Town – modern European town with well-developed many functions, one of the major centres of development in the Dolnośląskie Region, development of spa (in some districts), massive tourism, clean industry, higher functions (education, medical, services), development of infrastructure, creation of better spatial harmony, sustainable development (*Strategia rozwoju Jeleniej Góry na lata 2004-2015*, 2004).
- Jaworski County – improvements of the living conditions of its inhabitants, development of all possible kinds of economy (agriculture based on a relatively good-quality soils, industry and manufacturing based on a good location and tourism based on a cultural heritage – i.e., palaces and churches [church in Jawor town is on the UNESCO list]), development of the social and technical infrastructure (*Strategia rozwoju powiatu jaworskiego*, 2001).

- Kamiennogórski County – active participation in transnational cooperation, clean environment, complex and overall development of technical infrastructure, economy based on environmentally friendly small and medium sized industry, active tourism and specific agriculture, taking advantage of its transit location (the best transport connections with the Czech Republic in the whole of the Sudety Mountains), providing better accessibility to education, medical services and other elements of social infrastructure (*Plan rozwoju lokalnego powiatu kamiennogórskiego na lata 2007-2013, 2008*).

Based on this presented-above brief summary of the main visions of development of the counties, it is clearly evident that most of these county-districts build their development upon tourism, environmentally friendly industry and, in some places, also on agriculture. The quality of the existing landscape is also of huge importance for all of the counties. In addition, the development of any kinds of infrastructure is listed very high in the hierarchy of challenges.

On the regional and national level, there are rather general concepts of development than very specific ones which can really influence and impose the changes in the land use and land cover. In general, according to the vision of the regional government, the Dolnośląskie Region should become a nodal region – with well-developed connections to the inland of Poland and also to neighbourhood countries. Also, importance of aspects of the social, economic and territorial cohesion within the region are pointed out. The internal connectivity not only can improve the region's cohesion, but also is important for the full utilization of endogenous potential and to prevent out-migration from the peripherally located communes. On the maps below the concept of the creation of the highly developed net of internal and external connections of Dolnośląskie Region is presented (fig. 26). Special attention is given to the so-called "Sudety corridor" – which is to connect all major towns located in the southern part of the region (including Kamienna Góra, Jelenia Góra, Gryfów Śląski, Lubań and Zgorzelec, which are located in the Jeleniogórski subregion) to strengthen their potential for economic development.

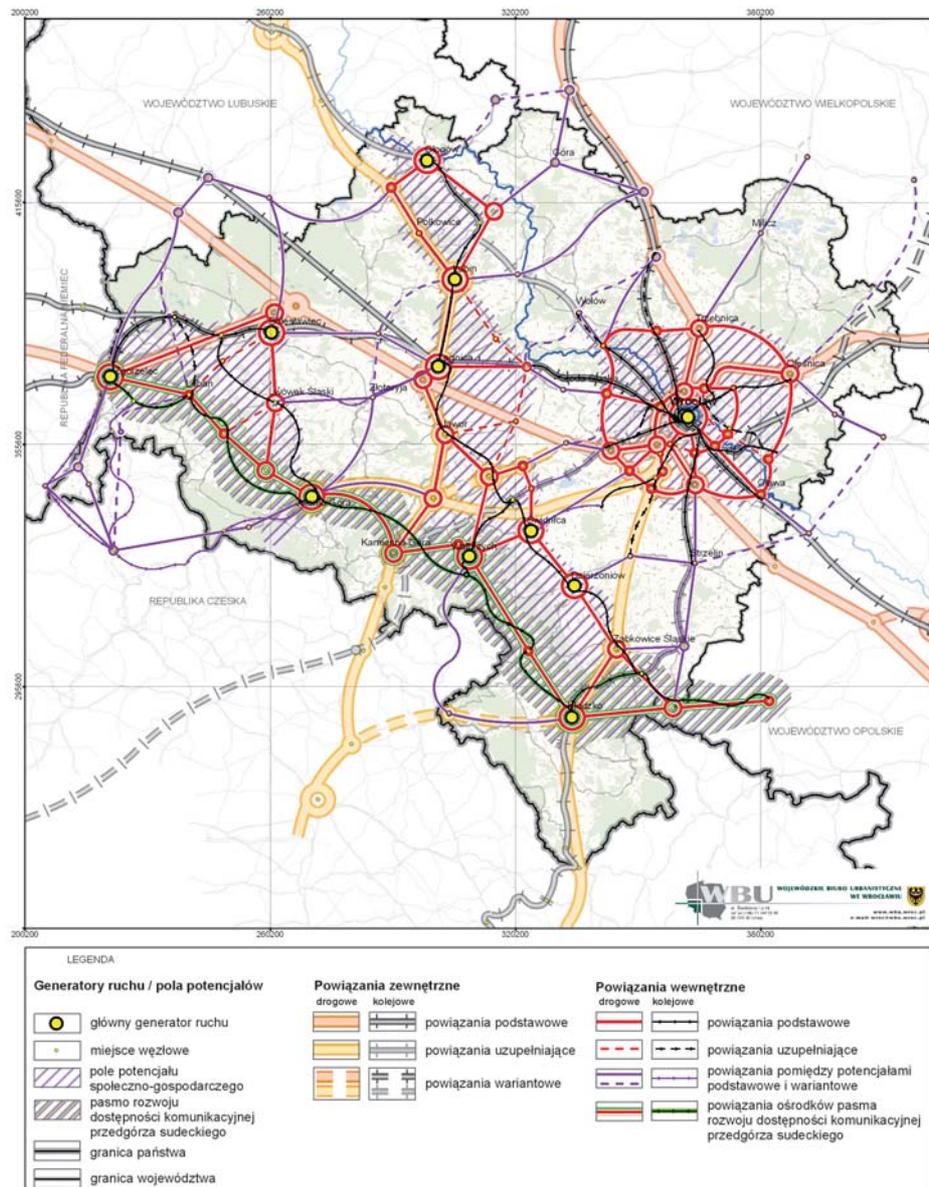


Fig. 26. Directions in development of the transport infrastructure in the Dolnośląskie Region

Source: Błaszczyk, Majkut, Zathey (2010).

3.4. Location

Generally the location of the Jeleniogórski subregion is one of the most peripheral one from the point of view of national and regional centres. For the vast majority of the subregion territory it takes above two-hour drive by car to get to Wrocław and about 7 hours to arrive in Warsaw (fig. 27). From the local point of view the distance to Wrocław is obviously much more important, but as is presented on the maps, only from the north-eastern part of the subregion (Jawor, Złotoryja) the accessibility is within one-hour travel-time. From the remaining parts of the region it is much longer distance – the greatest travel-distance is from the place of location of the brown coal mine (Bogatynia town).

Improvement of the accessibility is important for this subregion for at least two reasons. First one is concerned with the depopulating processes – when the

accessibility to the main centres of development will have been better - then maybe some of the people will resign from migrating but decide to commute to work. Second, if the accessibility to that subregion will be much improved then it will be undoubtedly easier to attract new investors and new tourists.

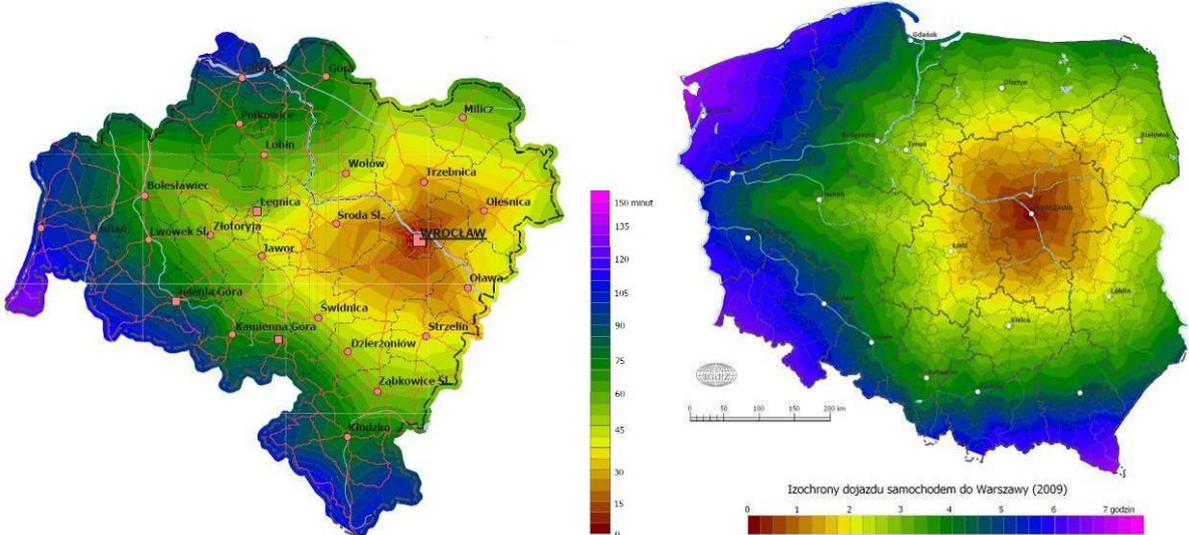


Fig. 27. Time accessibility by car to Wrocław and Warsaw, 2009
 Source: Komornicki *et al.* (2010).

The general schemes of the road and rail network in the Dolnośląskie Region are presented on the maps below. Except for a few connections, on the whole, it is very monocentric network with only one key centre, i.e., the capital of the region – Wrocław. Generally the northern part of the Jeleniogórski subregion is quite well-connected with Wrocław via the motorway E40 and the reconstructed railway line Wrocław-Zgorzelec. More serious problems are associated with the connections from its southern part. For example, the average time-travel by train from Jelenia Góra to Wrocław (127 km by rail) is around three and a half hours.

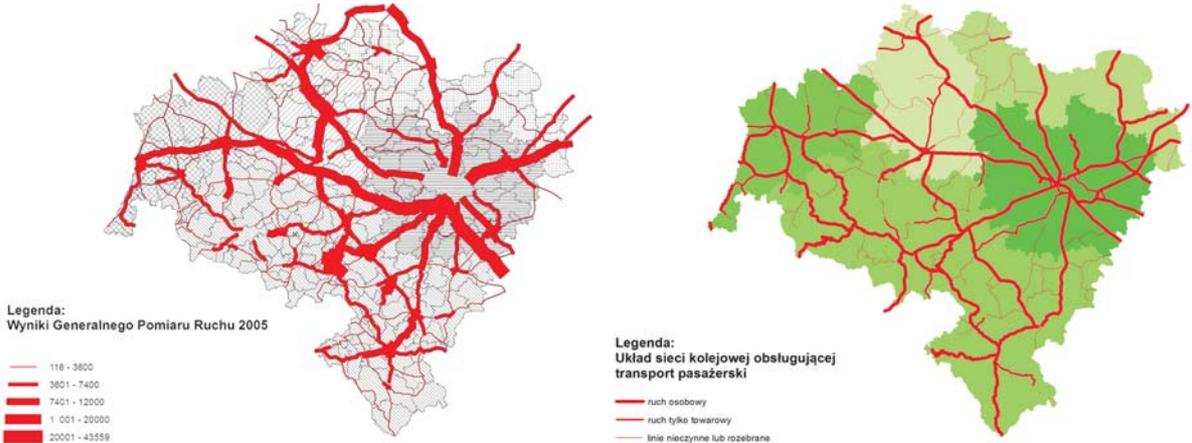


Fig. 28. Number of cars on the main roads in 2005 and railway network in 2010
 Source: Błaszczuk, Majkut, Zathy (2010).

Location near the border, on the one hand, provides some advantages, but, on the other hand, these limited benefits were outweighed by even more acute disadvantages. Because of its border location, this subregion has been very often

overlooked in terms of investments of major significance, such as location of industry or development of the transport systems. Some of the towns were even closed for some time (for example – Kowary, because of its location and mines of lead). Border of that subregion with Czech Republic has a mountainous character, that is why the development of a joint infrastructure or connections and cooperation was and still is difficult, especially in some parts of the subregion. In the last decade, some joint international projects have been initiated – mainly associated with the development of a common promotion and market facilitation of tourism. Few years ago direct rail connections were opened in the vicinity of Karkonosze Mountains. Cooperation with Germany started at the beginning of 1990s – at first it was very rapid development of markets and services on the Polish side. In view of the differences in prices, it was very important factor underpinning development of private entrepreneurs. Later on, common bottom-up approaches started to occur between Polish and German institutions. A very good example are the projects carried out by one of the communes from zgorzelecki county (Pieńsk commune) – there have been the joint projects, for example, connected with building the bridge, opening bilingual kindergarten, organizing shared social and sports events, common market facilitation of the existing touristic attractions and as well plans to develop common technical infrastructure. In general, the development of the main functions of the Jeleniogórski subregion is not directly connected with or influenced by the borderland location. Such location results in, on the one hand, peripheral location in relation to regional centre, but, on the other hand, presents possibilities to support the projects from the programmes addressed for international cooperation.



Photo 9. Example of a common Polish-German cooperation – Pedestrian and bicycle footbridge Pieńsk – Deschka built within the Interreg Programme

Source: author's materials.

3.5. Conclusions in the context of land use

Concluding the general description of the said subregion, some of the key elements that impact the current changes of the land use should be underlined:

- (1) Overall socio-economic situation in this subregion is very much below the average level that is noted in the Dolnośląskie Region.
- (2) We can observe an outmigration from the subregion – with only few exceptions such as the suburban areas (especially around Jelenia Góra), however these zones are very narrow. Also, on the areas of great touristic and cultural value, people are migrating from bigger towns (mostly from

outside of the subregion). New settlements are much more scattered. It leads to the chaotic development of spatial structures.

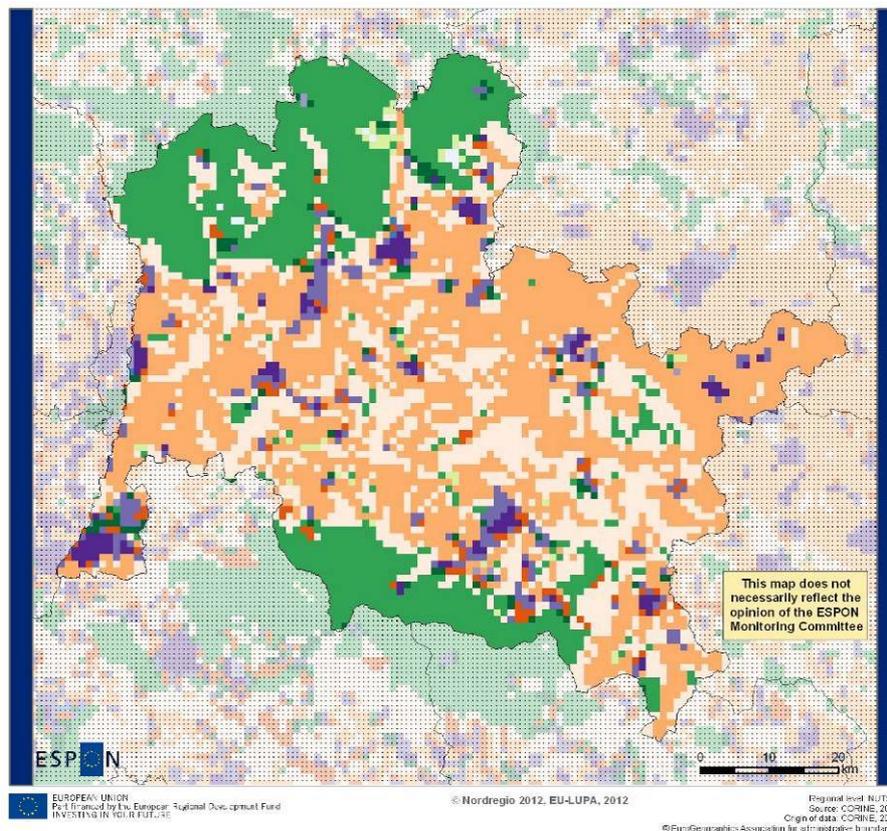
- (3) There is dichotomous process in settlement development. There are some villages, which are totally not inhabited, as well as there are some villages with good location and attractive landscape surroundings that have noted a considerable share of newcomers in last two decades.
- (4) There is one principal and basic reason for an outmigration – collapse of industrial functions which were dominating on these areas in the past.
- (5) High level of unemployment – collapse of many industrial activities; reduction in the previous employment in industrial factories cannot be compensated by employment offered by tourism institutions.
- (6) In the lowland part of the subregion, the big agricultural enterprises have appeared – process of consolidation of land can be observed. In the upland and mountainous part, the agriculture plays less and less important function in spatial organization and economical structures.
- (7) The biggest tourist investments are now located in the touristic areas.
- (8) There still persists a stereotype that that region is very polluted and ecologically destroyed – the so-called “Black Triangle”. In the past, a number of large industrial factories did really produce a lot of pollutions – right now this situation has changed for the better. Now the quality of environment is much better.

4. ANALYSIS OF LAND USE CHANGES

4.1. Dynamics and directions of land use and land cover changes

As was described in the second chapter, land use in the Jeleniogórski subregion is greatly diversified – both by the structure and by the spatial disparities. In this chapter, a detailed analysis of the land use and land cover changes will be made based on detailed resolutions maps generated from the Corine Land Cover database.

At the beginning, just to remind, the land cover typology is presented, based on data from 1990-2006.



Stable Land Types

- Urban cores and metropolitan areas
 - Suburban residential and economic areas
 - Special urban areas with relation relationships to the marine environment
 - Arable land in predominantly rural areas
 - Pastures and agricultural mosaics in peri-urban or rural community areas
 - Forested areas and agricultural mosaics in peri-urban areas
 - Rural forest
 - Pastures, agricultural mosaics and mixed forest in predominantly rural areas
 - Transitional woodland or sparsely vegetated areas
 - Lands primarily associated with water courses
 - Sparse vegetation, wetlands, water bodies and snow or arctic conditions
- Points of investigation
 Areas outside the case study region

Fig. 29. Stable elements of land cover in the Jeleniogórski subregion

Source: Nordregio, based on Corine Land Cover

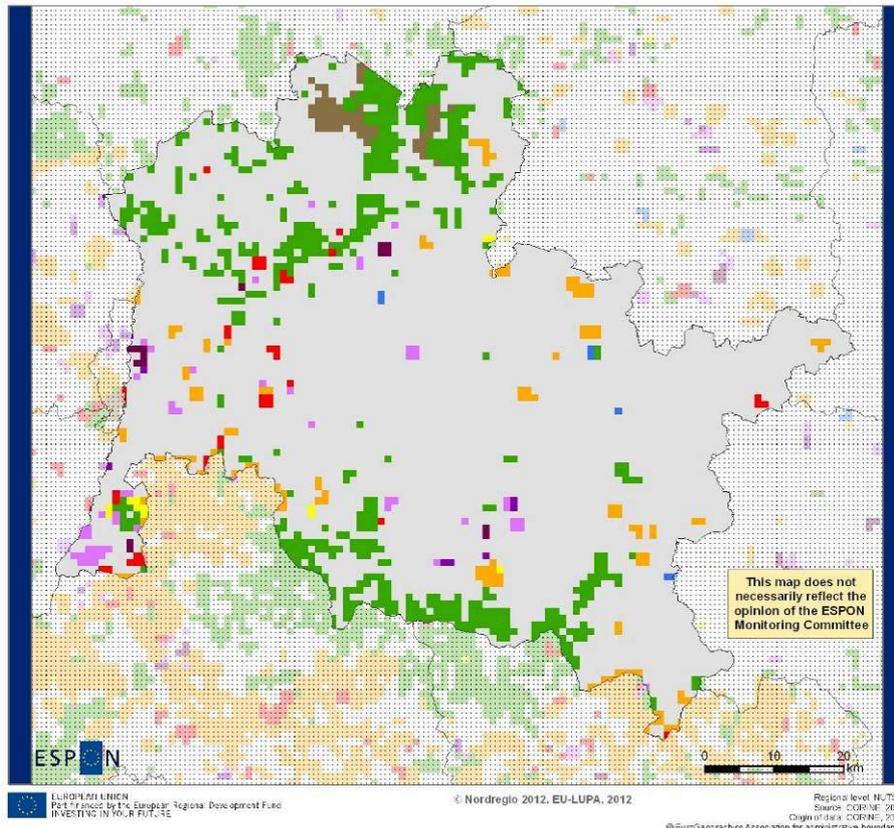
There are 44 Corine Land Cover classes. So altogether there can be 1936 possible combinations – 1892 of which could be classified as changes (44x43 possible one-to-

one changes of classes) and 44 classified as “no change”. The total amount of flows was generated and grouped, by way of the special procedure prepared by Nordregio, in nine major land use processes:

- lcf1 Urban land management - Internal transformation of urban areas.
- lcf2 Urban residential sprawl - Land uptake by residential buildings altogether with associated services and urban infrastructure from non-urban land.
- lcf3 Sprawl of economic sites and infrastructures - Land uptake by new economic sites and infrastructures (including sport and leisure facilities) from non-urban land.
- lcf4 Agriculture internal conversions - Conversion between farming types. Rotation between annual crops is not monitored by CLC.
- lcf5 Conversion from forested & natural land to agriculture - Extension of agriculture land use.
- lcf6 Withdrawal of farming - Farmland abandonment and other type of withdrawal of agriculture activity in favour of forests or natural land.
- lcf7 Forests creation and management - Creation of forests and management of the forest territory by felling and replanting.
- lcf8 Water bodies creation and management - Creation of dams and reservoirs and possible consequences of the management of the water resource on the water surface area.
- lcf9 Changes of Land Cover due to natural and multiple causes - Changes in land cover resulting from natural phenomena with or without any human influence.

Basically, the classification of land cover flows distinguishes change between broad land cover classes and changes internal to these classes. Analysis of land cover flows allows for immediate visualization of processes taking place. What is important the Land Cover Flows are made in a hierarchical system – there are three levels of aggregation. So each of the classes of changes can be studied in much more detailed way when necessary.

As was mentioned in the second chapter, generally we have observed very small changes of land use in the Jeleniogórski subregion for the last two decades. This process is very well visible on the maps illustrating the land cover flows. Less than 2% of land changed its classification in the period between 1990-2006. More significant changes took place in the period 1990-2000 than 2000-2006. We can identify some places that underwent the suburbanization processes (concentrated only near Jelenia Góra and Zgorzelec), some areas of agriculture internal conversions and very locally water bodies creation (including one artificial lake Sosnówka near Jelenia Góra – surface area of 1.5 km², opened in 2001). But the most considerable changes were identified in the category “lcf7 - Forests creation and management”. These changes take place in the mountain areas as well in the forest complex of Bory Dolnośląskie in the north of the subregion. Later, these changes of forest will be identified in a much more detailed way and also some detailed examples of changes are demonstrated in Appendix 1.



Areas Subject to Land-Use Change

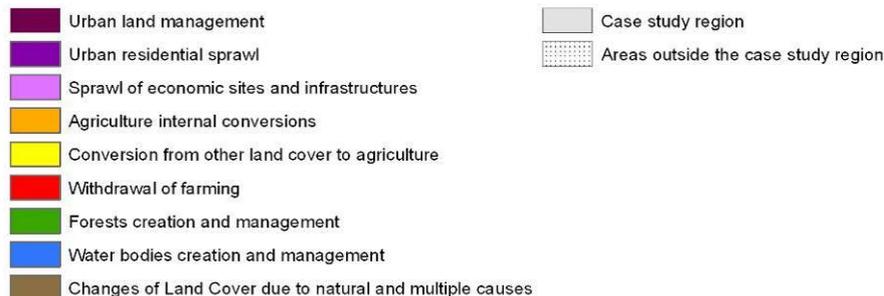


Fig. 30. Land Cover Flows typology in the Jeleniogórski subregion in the years 1990-2006

Source: Nordregio, based on Corine Land Cover.

Detecting of forest changes is a little bit problematic by Corine Land Cover, due to the cycle of 10 years analysis. In such a period of time only part of the shrubs are tall enough to be identified as trees. But because of the fact that in the Jeleniogórski subregion the biggest changes take place in the class “lcf7”, it is worth to make some detailed analysis of these changes. As was mentioned before, the used typology has a hierarchical character, which helps to make a more detailed analysis. Following subdivisions of flows can be identified within class “lcf7 - Forests creation and management”:

- lcf71 Conversion from transitional woodland to forest - Conversion from transitional woodland to broadleaved, coniferous or mixed forest, taking place when shrubs can be detected as trees.
- lcf72 Forest creation, afforestation - Forest creation and afforestation take place on all previously non-agricultural landscapes where new forests can be identified. Extension of transitional woodland shrub over non-agricultural land is recorded

as afforestation. Conversions from transitional woodland to broadleaved, coniferous or mixed forest are not a creation of forest territory and are therefore registered separately (lcf71).

- lcf73 Forests internal conversions - Conversions between broadleaved, coniferous and/or mixed forest.
- lcf74 Recent felling and transition - Conversion from broadleaved, coniferous and/or mixed forest to open semi-natural and natural dry land resulting more likely from felling. Due to uncertainties, all are provisionally considered as transitional states of forests.

First subcategory “lcf71 conversion from transitional woodland to forest” has a very mosaic character and is located in southern and northern part. Location of that class in southern (mountain) part is connected with the ecological disaster which took place in that area in the 1980,s, when due to a high level of industrial pollution and the so-called “acid rains” many of forests were destroyed. Then in the 1990,s thanks to enormous efforts of woodmen that area started to be forested again. So the reasons for that changes are the growth of trees enough to be detected as a forest. In the north it is connected with normal forest production – Bory Dolnośląskie are subject to economic use, and simply this means that some parts of it are cut down for wood and new plantations are created. So the identified changes indicate places where previously the trees constituting part of the old forest were cut down and now trees in the new forest are growing.

Second subcategory “lcf72 Forest creation, afforestation” is concentrated on the areas where the training military zone is located. After the collapse of communism, the Soviet Army left Poland (in 1993) and also the total number of soldiers in Polish army was much reduced. That is why the military training zones are not used now as intensively as previously and some new environment processes can be detected in such areas.

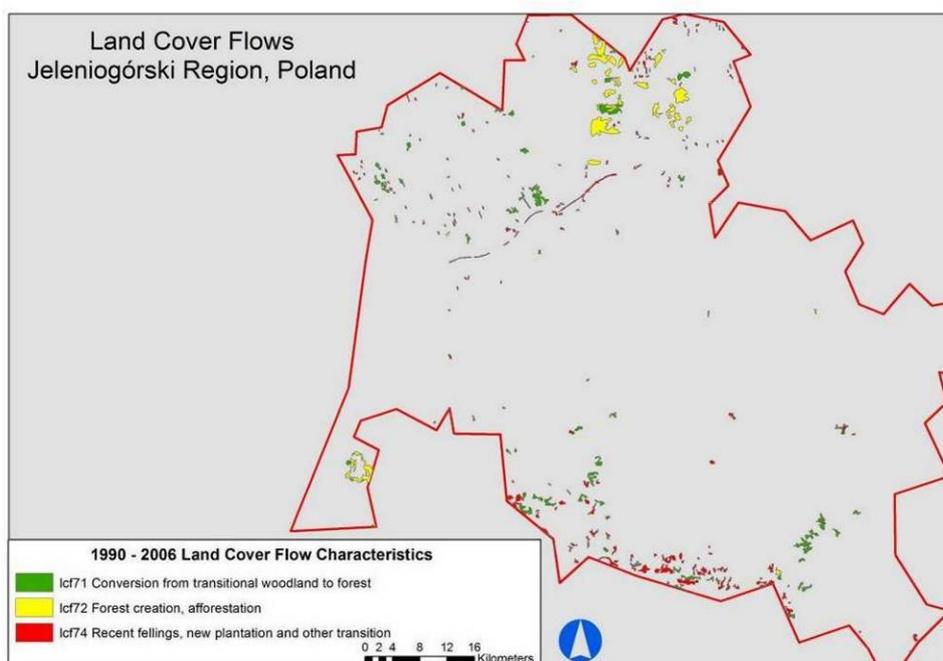


Fig. 31. Land Cover Flows characteristics within class “lcf7” in Jeleniogórski subregion in the years 1990-2006

Source: Nordregio, based on Corine Land Cover.

Third subcategory “lcf74 Recent felling and transition” is concentrated in two areas. In the southern part it is connected both with the activities undertaken by the woodmen and national park in the 1990,s after that ecological disaster in the former decades and as well with re-utilization of previously abandoned meadows. In the north we can identify a linear structure of that subcategory. It is directly associated with the construction of the motorway A4 (E40), which was opened in 2009. The data from CLC of 2006 identify those changes as conversion from forest to open dry land – this is because in that period the trees were cut down for the future investment but the construction works started in 2007.

Concluding, it can be stressed that almost all of the changes presented on the Land Cover Flows typology can be explained by the environmental and socio-economic processes which took place in the Jeleniogórski subregion in the years 1990-2006 and are directly or indirectly affected by the previous conditions and general trends of development both in Poland and in this area during the transformation period. Undoubtedly, there are more changes of the land use or land use functions, which have not been detected in the typology, owing to the fact that the resolution of those changes is too small to be identified. Lack of good spatial planning in Poland leads to mosaic and chaotic development of some investments – built-up areas or industrial plants. When the changes in land use are very scattered and dispersed, the CLC data are not able to identify those changes. Description of some examples of detailed changes of land use are given in Appendix 1.

4.2. Trends, actors and drivers of the changes (micro and macro scale)

The processes of land use in this subregion are very differentiated. In general we can observe a stabilization in land utilization and land cover – the changes of land use presented in the second chapter, based on statistical data and also in the previous chapter based on CLC data, do not show intensive changes. Due to peripheral location, an outmigration and a big share of agricultural lands and forests, such situation is natural. But in some parts of the subregion these changes are very intensive, even though they are not registered by the official statistics. Those changes are mainly concentrated in the suburban areas and touristic zones. Intensive development of houses (recreational or normal) and elements of tourism infrastructure are affecting the economical and functional structure of the area more than the land cover changes. This is so because the present-day settlements and production plants are scattered and do not form a complex structures. So in some delimitations and statistics these areas are still registered and classified as an agricultural areas. And even if they are registered properly, their influence and importance in the social, economic and functional structures are much higher than in land use structures.

Such processes can be described and explained by the intensity of the influence of both types of land use utilization. Extensive land use – like agricultural or forests – even if it covers a higher share of area, does not have such big influence as intensive land use – like built-up, industrial or touristic areas. So even a small, from the point of view of surface, changes from extensive to intensive in land use, have important influence on the functional and economic structures.

According to that we can point out the two main actors of land use changes – they are primarily local representatives with prevalence of extensive land use, and external investors as well as developers who are transferring the land use into much more intensive way. The examples of the representatives from the first group are – farmers, national park, State Forest company, ecologists, and the example of the second group are – newcomers (in the suburban and touristic areas), owners of touristic infrastructures, investors in the industrial activities, etc. Thus, generally, all the actors that influence the land use changes, can be divided into those two groups. Of course, there are a lot of exceptions, but on the whole the representatives of the first group are much more conservative (in terms of land use), live in the subregion and are characterised by a high level of the so-called “territorial capital”. On the other hand (also with a few exceptions), the second group is much more liberal, does not care much about the spatial planning, and the economic profits are the most important factors behind their activity. As was stated by one of the interviewed experts (see Appendix 2): “the most effective and desirable actors are those who offer the new work places to people and provide incomes for the budgets of local self-governments. However, more often than not the biggest investors come from the outside of the subregion in question and it is the financial benefits that are of much importance to them, rather than the environment protection, cultural values or the so-called territorial capital”.

The present-day processes in terms of land use are affected by the two central drivers of change – legal status and economic pressure. Legal status of spatial planning in general is a good tool for a proper administration and management by local governments in Poland. But since local plans are not obligatory for the local governments, the situation is very diversified in different communes. Some of these have local plans and some of these do not possess such documents at all, or have them partially prepared – usually these communes that exert the most intense pressure on the land use changes (suburban, touristic). In such places the second driver – economic pressure – can play the crucial role. All the local governments want to have a more intensive utilization of land – as it is tantamount with a greater number of investors, increased incomes for the local budget and better opportunities for employment on the local labour market. The economic pressure from external investors is more intensively felt on the attractive areas (with better location, accessibility, higher touristic values, etc.). And if these areas do not have local plans or else are not protected as highly valuable land from the environmental point of view, then the economic pressure is “winning” and it is easier for external investors to develop and change the land in any directions they may wish. That causes some serious problems with a proper land management, leading to spatial chaos, confusion of functions and fragmentation of land use.

4.3. Contemporary and potential conflicts

Situation described in the previous chapter can be treated as one of the most important and common descriptions and causes of spatial conflicts. The intensive functions and intensive land uses are competing with extensive ones. We can provide some examples of these competitive pressures – intensive and massive tourism development versus environment protection, built-up areas and some industrial plants versus agricultural function, heavy industry versus environment, spatial harmony versus new built-up areas and new industrial plants (they are located not in old industrial areas, but are very dispersed, which leads to chaotic way of spatial organization). Some spatial chaos is created by the mixture of functions and

investments. Almost always the more intensive investment and more intensive function are successful in this competition. The more intensive land use has to be protected by legal framework or by spatial planning tools – eg. protection of national park, of very good soils for agricultural production or well-prepared spatial planning (eg. local plans). But it has to be stressed that these conflicts are not common for all the subregion are – they are rather limited to some places and localities. So the conflicts have a local character and are connected with location of individual objects – eg. some production plants which were built too close to built-up area or a mine which started its operation in a very quiet touristic village close to the old palace. Previously, the industry was adversely affecting the environment of these areas on a much larger scale – which in combination with acid rains made that the pollutants were deposited on vast stretches areas.

It can be also indicated a very interesting example of spatial conflicts within the framework of a tourism function. Some of the tourist activities are mutually exclusive – for example, in one small town (Świeradów Zdrój) we can witness a development of spa functions which need quiet and the so-called „benign atmosphere of health”, and, at the same time, massive growth of skiing functions – i.e., new investments in ski lifts. Till now there are no problems, but in the future, it is possible that a serious conflict may arise associated with that. But fortunately this is only isolated example, which does not cover the whole of the subregion territory.

As regards the future, the two potential causes of spatial conflicts ought to be mentioned, which can be characteristic for the subregion. There are now and also will be in the future numerous problems connected with the construction of retention reservoirs. The main reason for the problem is associated with vertical agreement between central government and local self-governments – there is no good co-operation on this issue. Also there are social problems – building retention reservoirs is associated with the necessity of removal of some settlements. The second cause of possible conflict in the future is a result of climate conditions (climate change) and development of skiing functions. Those ski resorts which were developed in the lower altitudes can have problems with snow and face bankruptcy risk.

But generally also in the future these conflicts can have rather local character – thus it is difficult to predict now their intensity or localization. Analysing spatial conflicts from a broader perspective, it can be concluded that in the future the macroeconomic factors will be of crucial importance – these will decide whether spatial conflicts arise. If there is an economic decline, there will be less and less investors and visitors, and at the same time less spatial conflicts. And also it has to be remembered that in the areas with high quality of landscape, suitable and attractive for many other functions and purposes, the spatial conflicts are absolutely normal. Multifunctional character causes that many actors want to pursue their own concepts or ideas.

4.4. Scenarios

As was mentioned earlier, the potential conflicts will have a local character in the future, so they should not influence the general trends of land use in the Jeleniogórski subregion. The contemporary changes and processes should be continued in the future – it means that agriculture and forest will continue to have a privileged status in the land use structure, while undoubtedly from an economic point of view services and industrial functions will be of much importance.

According to local strategies and the regional strategy of socio-economic development, in this subregion, co-existence of the touristic, agricultural, industrial, forests, ecological functions and land use is envisaged. So the present-day processes will be further supported and strengthen by the management of the local and regional governments. Since it is much difficult to build and prepare different scenarios of land use management and land use changes, we are inclined to assume the continuation of the contemporary trends.

5. MULTIFUNCTIONALITY OF LAND USE

5.1. Functional differentiations

For ages rural areas have been associated only with agriculture. No other function than bio-productive has been distinguished for these areas. As a result of economic development of Poland, agriculture lost its dominant share in creation of GDP, and employment in agriculture is no longer main source of income for considerable number of rural inhabitants. Dichotomous division into rural and urban area has been progressively vanishing; functions, so far characteristic almost only for urban areas, have appeared also in rural ones (Kostrowicki, 1976). Already in the mid-1980s Stola (1987) wrote that social and economic development results in quantitative and qualitative changes in ways of management in rural areas, as well as in work and life-conditions of people living there.

In the recent ten years, in Polish scientific and planning literature, many functional typologies have been conducted. Below, the three selected ones will be presented.

Bański and Stola (2002) for their functional typology of rural areas eight diagnostic features chose on the basis of which they defined ten functional classes that were gathered in five groups. The whole Dolnośląskie Region, as well the Jeleniogórski subregion, is characterised by a high-level mixture of the functions. In the analysed subregion there is a co-existence of non-agricultural functions, forestry functions, touristic functions, agriculture functions, as well as equal share of various functions.

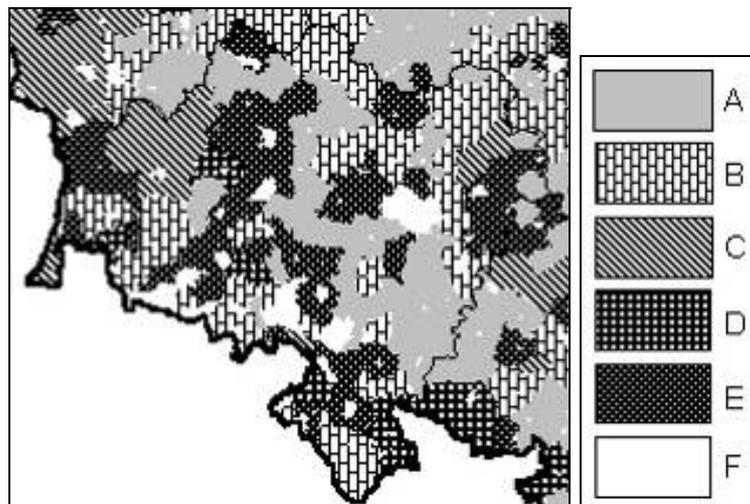


Fig. 32. Functional classification of rural areas in the Dolnośląskie Region

A – prevalence of agricultural functions, B – equal share of various functions, C – prevalence of forestry, D – prevalence of recreational functions, E – prevalence of non-agricultural functions, F – cities

Source: Bański, Stola (2002)

Other typology prepared by Bański (2009) was based on ten indicators (e.g., population density, share of arable lands, share of market agriculture, number of hotel's beds, etc.). 8 functional types were delimited. In the analysed Jeleniogórski subregion, the majority of communes were classified into the category "mixed functions". It means that it was not possible to detect one dominating function for this area. Additionally, some of the communes around Jelenia Góra were classified as a multifunctional, few as a touristic and those located in the eastern part as an agricultural. This classification is in some way similar to the previous one and again the aspect of multifunctionality of that area is stressed.

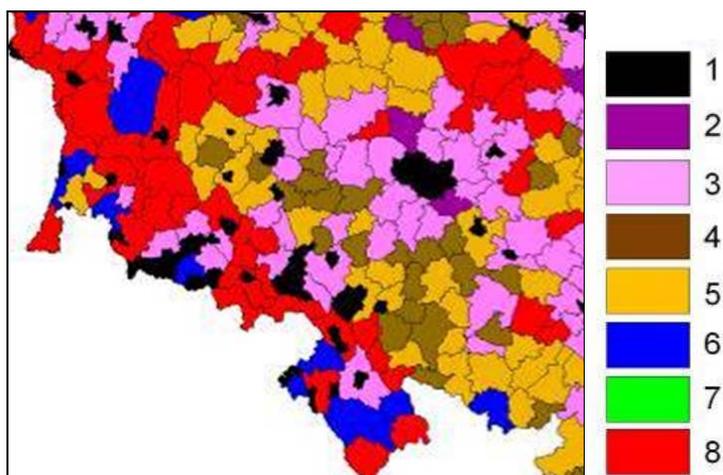


Fig. 33. Functional classification of communes in the Dolnośląskie Region

1 – towns, 2 – urbanizing areas, 3 – multifunctional rural areas, 4 – agricultural areas, 5 – prevalence of agricultural functions, 6 – tourist and recreational functions, 7 – forest functions, 8 – mixed functions

Source: Bański (2009)

The last presented typology has a little bit different character, because is based mostly on location factors, rather than on sectoral features (as the previous two). In the typology presented by Śleszyński and Komornicki (Śleszyński *et al.*, 2007) the most important factors were administrative functions, functional connections, transport corridors – in that typology authors utilised results from the ESPON typology of Functional Urban Areas. According to that typology, again the Jeleniogórski subregion is characterised by a very differentiated functional structure. There is Jelenia Góra with the surroundings subject to urbanization processes, in the southern (mountain) part there are areas with developed tourism functions, some communes are specialized in industry, etc. The comparison of that area with other subregions in Poland (especially in the eastern part) shows, big heterogeneity of that subregion.

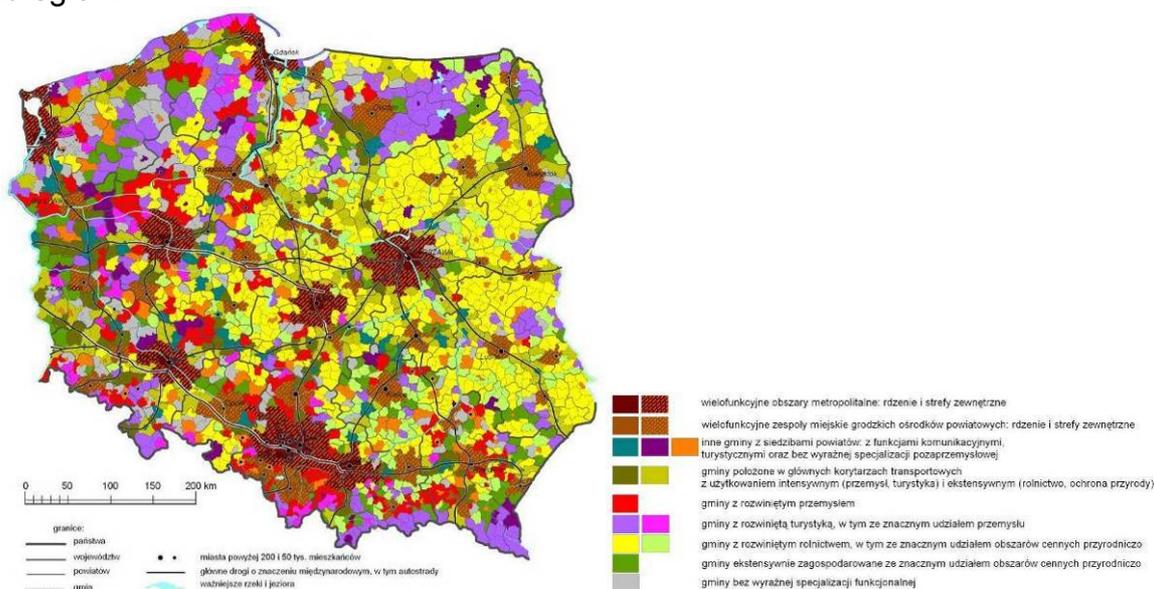


Fig. 34. Functional classification of communes in Poland, 2007

brown – FUA, yellow – agriculture, violet – tourism, red – industry, green – high quality of environment

Source: Śleszyński *et al.* (2007).

All of the above presented typologies show big heterogeneity of functions of that area, and at the same time big mixture of it and polifunctional structure of that subregion. Generally, a few very important elements of functional diversity of the Jeleniogórski subregion can be listed such as:

- Housing function – as was already mentioned, this area is characterised by a polycentric model of development of settlements, the urbanization index is in the order of 62%. There, a set of different sized towns is located, each of which one of the most important functions is housing. Around the biggest settlements (especially around Jelenia Góra) the suburbanization processes take place (for more detailed description see the Appendix 1).
- Touristic functions – these are mostly concentrated in the southern part of the subregion, but at the same time they are very diversified internally. Different kinds of tourism activities are offered, eg. holidays, health stays, congress tourism, sighting, etc. Also, a wide variety of sport activities can be identified in the region: winter sports (skiing, cross-country ski), bicycle roads, mountain trekking, spa, extreme sports, aerial sports, etc.



Photo 10. Examples of different tourism activities in Jeleniogórski subregion – spa (health resort in Cieplice Zdrój) and active recreation

Source: author's materials.

- Agriculture functions – prevalence of grasslands in the mountains part and arable land in the eastern and western part. On the areas with better quality soils the more demanding cereals are cultivating (eg. wheat), while on the areas with poorer quality of soils less demanding ones (eg. rye).
- Industrial functions – as was previously mentioned, the area was characterized by a very high level of industrialization in the past decades. During the

transformation period many of the factories collapsed or reduced its production, but still some of these are under operation and also new companies are starting production. Some of them adapt the old buildings, but for majority of them it is much easier and cheaper to build new constructions. The biggest industrial zone in the analysed subregion, and at the same time in Poland, is located in the area near the brown coal mine.



Photo 11. Examples of newly constructed industrial plants in the last few years

Source: author's materials.

- Forest functions – most of forests are under public administration. Forests have wood production, touristic and military training ground functions.
- Transport functions – in the subregion, the two main important transport and transit corridors are located. One is the motorway A4 (European code E40) which connects Germany (Saxony) with a number of large Polish cities (Wroclaw, Upper Silesia Conurbation, Krakow) and the Ukrainian border. The second one are the connections to the Czech Republic.

5.2. Current multiple uses of land

Multifunctionality can be analysed at least on the two different spatial levels – local and regional. When analysing that topic on the regional level it can be noticed that the Jeleniogórski subregion as a whole can be called a multifunctional territory. As was described detailed in the previous chapter, there are very important functions such as: housing, services, industry, transport, tourism, forest, agriculture, mining, settlement and others. Intensification of each of these functions is different in each of the area. Five functional zones can be delimited: (1) Jelenia Góra (multifunctional town), (2) highly industrialized south-western part of the subregion (the brown coal mine), (3) mountain area – the Sudety Mountains (domination of tourism function), (4) lowland area with domination of agriculture and (5) in the north complex of forests. The importance of each function is different from different perspectives as well – economical or land use. When taking into account economical perspective much more important functions will be industry, tourism, transport and services, and the opposite is the case - when taking into account the land use perspective much more important will be forestry and agriculture. Co-existence between many different functions is very natural in the subregion and is in line with the main strategic idea that is pursued in this area. The number of functions has remained rather the same during the recent two decades – but other functions started to be more important and

some less important – a revaluation of importance of functions was made. Previously, there was a marked domination of the industrial function. Nowadays, we can point out that in the mountainous part there is a fast development of the tourism function, in the northern agricultural one and in some localities there is a development of the industrial functions.

When talking about multifunctionality from the local perspective, it can be stressed that the biggest changes in the land use and functions are observed on two types of areas: suburban zones and touristic areas. On the suburban zones there is intensification of the land use, more intensive functions (as housing or production) are appearing. On touristic areas, open agricultural land is transformed into the settlements of recreational houses and tourist infrastructure. Intensification of functions can be measured again from the economic and land use perspective. The most common changes are transformation of arable land into the built-up areas (but only in the mentioned zones of highest pressure – suburban and touristic).

Also it can be pointed out that development of tourism function takes place in many directions and is very diversified. Nowadays tourism is very complex in the Jeleniogórski subregion, being not based only on one or two kinds of tourism activity.

5.3. Potentiality of multiple uses of land

In the future we can observe a further outmigration of inhabitants from this subregion, generally, and concentration of population in the suburbs of major towns (especially around Jelenia Góra). Those demographic processes should be taken into account when creating the development strategies of this area, and planning the development of new or existing functions and investments.

In the future, this area will still be of multifunctional nature, and should develop in such a way. In recent years, there has been a considerable decrease of agricultural functions. But this area is most suitable for sheep or cattle breeding, because of a high share of grasslands. Lack of agricultural activity resulted in collapse of agro-food industry in this subregion. So in the future some activities and programmes should be implemented to increase the role of agriculture based on utilization of grasslands – sheep or cattle breeding. These activities will certainly improve the quality of environment (there will be no abandoned pastures) and affect positively tourism by improving the cultural and traditional values of this area.

Tourism function will still remain an important one. The problem with development of tourism function is that tourists concentrate their activities in a few settlements, few places, but all the region want to develop on the base of tourism activity, however, it is rather impossible. Also in the future the problem of development of tourism function can be connected with the climate conditions (climate change). Those ski resorts which were developed in the lower-altitude places may face problems with snow and go bankrupt.

The development of industrial functions should be pursued in such a way that will not have negative impact on environment (the so called “clean industry”). In such densely populated areas, as the Jeleniogórski subregion, it is only the development of the secondary economic sector that could provide enough work places to stop the negative demographic processes.

In the future, the macroeconomic conditions will be of utmost importance for creation of spatial conflicts and multifunctional development. If economic decline takes place,

there will be less investors and visitors and at the same time less possibilities for multifunctional development.

6. POLICY CONTEXT OF LAND MANAGEMENT

6.1. Land use in the regional/local documents

The division of competences between different tiers of government (different levels of government) was briefly described in third chapter. As was mentioned there, the communes have the greatest competences in terms of land use, spatial planning and land management. These are responsible for indicating directions of spatial planning and local development. Among other things, the communes are responsible for: water management, commune roads, water supply systems, the sewage system, public transport, the sports facilities and tourism including recreational grounds and, what is also very important in this analysis, spatial harmony and real estate management.

So the basic competences in the spatial planning are exercised on the level of communes. Everything in that matter depends on the activity of the local self-governments. Tools that communes have at their disposal are correct, but their implementation is highly unsatisfactory. From one standpoint, spatial and economic planning faces a growing pressure from external investors and developers. Understandably, each of the commune wishes to have the greatest possible income, so each investor is welcomed warmly by them. Preferred are these investments which tend to use the land in a more intensive way. So, all the communes want to intensify the utilization of the land. At the same time, the problem is with the existing law – according to spatial planning, the local plans in spatial planning are recommended, but they are not obligatory. That is why many areas are short of detailed coverage by spatial planning, and the decision concerning a development of land in this way or another lies in the responsibility of the communal authorities. This situation is not good for a proper spatial planning and often gives priority to economic activity over the spatial harmony. In the analysed area of the Jeleniogórski subregion, we can observe that a very high share of the land is covered by the very detailed local plans. Unfortunately, in the areas where is felt the highest pressure from developers on the land, i.e., in the touristic zone of the Karkonosze Mountains, the share of the local plans is the lowest.

Because of such situation, some of the regulations has to be put in force on the higher levels of government – for example, the regulations pertaining to nature and environment protection belong to the responsibility of the state. Of course, the state and regional responsibilities are concerned also with such things as: ports and airports, air traffic control, railways and inland transportation, basic legislation on environmental protection and on woodlands and forestry. But the responsibilities for activities which affect mostly the land use lies in hands of local governments.

Also, it is the local initiatives and activity that decide what amount of external financial resources will be obtained by the local government and which kind of initiatives will be implemented in the communes. So the local development results almost directly only from the activity of local leaders. Those initiatives are influencing the changes in land use – new roads, new social infrastructure, etc. – that is why, they also have to be mentioned and taken into account. It must be stressed again that the highest responsibility in these matters lies in hands of local governments.

6.2. Influences of regional/local planning

The influences of regional and local planning on land use are registered on many levels. The lack of detailed local spatial plans leads in some places to creation of spatial chaos - thus giving privilege to economic development over the sustainable, territorial one. In addition, some problems faced in vertical cooperation (between different tiers of government) also lead to some conflicts – for example some areas are protected as national park or the state wants to build an anti-flood system. In such cases the state is taking over some part of the competences of the local self-government, which results in the situation that commune leaders cannot develop some parts of its territory as they would wish to do.

Nowadays, the regional office of the Dolnośląskie Region wants to connect spatial planning with socio-economic one – to make it much more coherent and compact. That will certainly help to develop the region in a more sustainable way and preserve, to a some extent, the spatial harmony. However, for now this is only an idea that has to be implemented in the future. Thus far these two parts of planning – sectoral and territorial is rather separate on each spatial level.

Concluding, generally the problems with planning are in the areas where there are spatial conflicts, where many functions are competing for the same space. From the one standpoint, the number of conflicts points to the attractiveness of the subregion land and shows the possibilities of development. From the other standpoint, it indicates that legal framework falls behind the real changes in land use and land use functions and those liberal elements of free economy are prevailing over the harmonious and more stable elements of spatial planning.

7. CHALLENGES AND POLICY RECOMMENDATIONS (2020 PERSPECTIVE)

The main challenge for the proper land management in the Jeleniogórski subregion is a complex and holistic planning – combining sectoral planning (socio-economic) with territorial one. This will help to achieve the sustainability in planning. Those two parts of strategic planning – sectoral and territorial – should be equal to each other and at the same time treated in a coherent way.

Another important thing, partly connected with the first one, is that on regional and local levels the permanent, annual monitoring of spatial organization should be conducted in such spheres as: environment protection, industry investments, housing, cultural landscape and infrastructure. Nowadays, spatial monitoring is under operation only for the keeping records of the borders of the houses and plots – simple cadastre. It is rather keeping records of the situation, and not being a tool for planning of development and creation of new functions. Obviously, in the future that system should evolve to a more complex and holistic tool for spatial management.

Another challenge for spatial planning is the fact that actually the low and institutional assets are not effective in appropriate spatial planning. The easiest thing to do will be to impose national regulations on all the settlements to adopt the obligatory local plans of spatial organization. Maybe, generally the whole planning procedure is correct and transparent, but, because it is not obligatory, is ineffective. This will undoubtedly help to solve some spatial conflicts in the future.

Then, the last main challenge is connected with the higher activity of local institutions – local self-government has to have the initiative. It is difficult from the perspective of regional or national government to show and decide what kind of functions are to be developed in each commune. Regional government, in generally, can support the development of parts of its territory, but this is the responsibility of the local government to utilize to maximum degree the endogenous potential and exogenous sources. Thus the local governments cannot wait for the decisions and initiatives of the higher levels of government bodies, but have to be very active in creation of new possibilities of development.

According to the interviewed persons the Jeleniogórski subregion, in the future, will be still a very multifunctional area. In some parts, a domination of one function (eg. agricultural or forest) will be noted, while, in some places, there will be concentration of many of these (industry, housing, tourist, transport, services of general interests, etc.). So the challenge for the local and regional government is to manage that region in such a way that will help to overcome the demographic, social and economic problems of transformation period and at the same time to harmonize the spatial organization of that subregion.

Taking into account all of the mentioned challenges and situations described in the Jeleniogórski subregion, it can be given following recommendations for the proper land use policy management in this area (since all of them have a broader character they should be also useful and applicable to other territories):

- holistic development of the region requires a very good planning system, which will be complex on the horizontal and vertical level – this means that sectoral

plans should be created in cooperation with territorial ones (cohesion in spatial planning);

- equal importance of sectoral and territorial planning;
- very detailed planning on the municipality level – thanks to that there will not be many conflicts of functions;
- cooperation between different parts of the regions and division of functions within the territory – development of stronger functions of some particular towns has an important influence on the whole region. There should be regional competitiveness and not competitiveness within region;
- permanent monitoring of socio-economic and spatial changes in the region and its communes;
- coherent visions of development of communes, counties and region – there should be some hierarchical way of planning of strategies of development, because thanks to that the “added value” of a larger scale of development will be created and enhanced;
- engaging many institutions, local actors, representatives of main institutions that are important in spatial planning and creation of socio-economic development – thanks to this social consultancy the whole process of planning will be more coherent, transparent and complex;
- good management – giving priority to public needs and public goods over the private benefit.

8. CONCLUSION

Overall socio-economic situation in the Jeleniogórski subregion is much below the average level in the Dolnośląskie Region. The subregion has problems with an outmigration, high level of unemployment, collapse of many industrial plants and poor accessibility to main centres (especially Wrocław). That is why in some strategic and scientific publication it is perceived as the “problem area”.

In the Jeleniogórski subregion there are important functions such as: housing, services, industry, transport, tourism, forest, agriculture, mining, settlement and others. Intensification of each of these functions is different in each part of the area. One can delimitate five functional zones: (1) Jelenia Góra (multifunctional town), (2) highly industrialized south-western part of the subregion (the brown coal mine), (3) mountain area – the Sudety Mts. (domination of tourism function), (4) lowland area with domination of agriculture and (5) in the north, complex of forests.

Total changes in the land use have not been very intensive for last 20 years. On the whole, the domination of two types of land use can be mentioned – agricultural land and forestry. But, in some places, there is a concentration of other types of land use and the changes are much more visible. The most considerable changes are noted in the areas with the highest pressure of different activities, different functions – especially there where areas are attractive for many actors.

However, in general, the spatial conflicts have a local character. That is why the contemporary changes and processes in land use should be continued in the future – it means the privileged position of agricultural and forest functions in the land use structure, while, from the economic point of view, for certain the most important activities will be services and industrial functions.

According to local strategies and regional strategy of socio-economic development, in the subregion will be co-existence of the touristic, agricultural, industrial, forests, ecological functions and land use. So the present-day processes will be supported and strengthened by the management of the local and regional governments. Owing to this, it is difficult to build and prepare different scenarios for land use management and land use changes than these that assume continuation of the contemporary trends.

The greatest challenge for the proper land management in the Jeleniogórski subregion is a complex and holistic planning – connection of sectoral planning (socio-economic) with territorial one. This will help to achieve the sustainability in planning. That two parts of strategic planning – sectoral and territorial – should be equal to each other, and, at the same time, treated in a coherent way. Also, a higher share of land should be covered by the local plans – it will certainly help to preserve the spatial harmony.

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EU-LUPA

European Land Use Patterns

Appendix 1

Verification of land use changes typology in practice

Land use changes identified by Corine Land Cover typology were verified in practice by field study of **five-six points** in Jeleniogórski subregion. Verification were carried out by the sample of squares, where the changes were in different intensity and were processing in different directions. Process of verification consisted of several elements: analysis of the typology maps and satellite imagery, observation of points, perform photographic documentation and talking to local people about factors of changes.

Square 1

The geographical coordinates

N 50° 56' 11"

E 15° 44' 51"

Square 1 is situated very close to Jelenia Góra – this is village and commune Jeżów Sudecki. In that village we can observe the high level of development of build-up areas. According to CLC typology the square distinguishes urban residential sprawl; the intensity level is **XXX**.

Jeżów Sudecki is a village located along a road. Part of that settlement is within the border of Jelenia Góra town and part create the separate village. From the beginning of transformation period we can observed the rapid development of the build-up areas. On the previously agricultural land new houses appeared. That process is connected with two things – very close location to Jelenia Góra town (maximum 2-3 kilometres to the centre) and cheaper prices of land in the suburban zone in comparison to prices within the borders of the town. The investors of that new houses are mainly private people. The problems with such development is that it is not complex, not coordinated. That is why that new houses are still surrounded by the agricultural areas and the basic infrastructure is not developed (eg. the quality of roads is very bad).

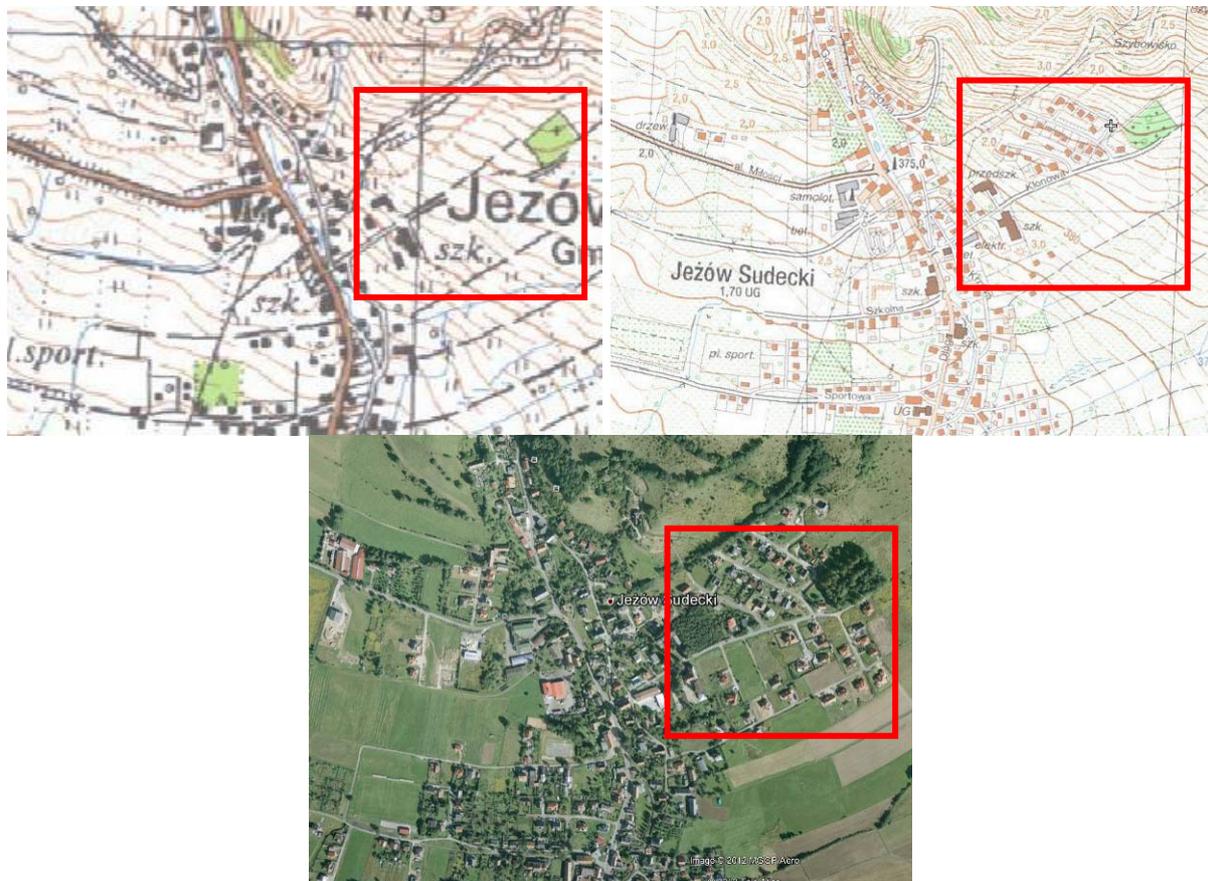


Figure 1a – Square 1 – Jeżów Sudecki – suburban zone of Jelenia Góra

Source: Geoportal (2012) and Google Earth (2012).



Photo 2a – Square 1 – Jezów Sudecki – suburban zone of Jelenia Góra

Source: author's materials.

Square 2

The geographical coordinates

N 50° 46' 37"

E 15° 43' 50"

Square 2 is situated in Karpacz town (settlement located on the level of around 600 meters a.s.l., just on the slopes of Karkonosze Mountains). In that town we can observe a very dynamic development of tourism infrastructure – in that square Hotel Gołębiewski. According to CLC typology the square distinguishes **XXX**; the intensity level is **XXX**.

In Karpacz we can observe a very dynamic development of tourism infrastructure – especially new hotels, ski lifts, restaurants, etc. Previously it used to be a very small village, but slowly it changes its functions into touristic ones. The rapid growth of tourism infrastructure takes place especially in the last years. Some of the investments were very controversial – for example investigated Hotel Gołębiewski. This hotel is very large in comparison to surrounding houses and influenced a lot the spatial organization of the land structures, economic situation and number of tourists. To build that hotel, there were made special changes in spatial local plans and still that construction raises some controversy. But from the other side it is an example that mountain part of that subregion has potential for tourism development.

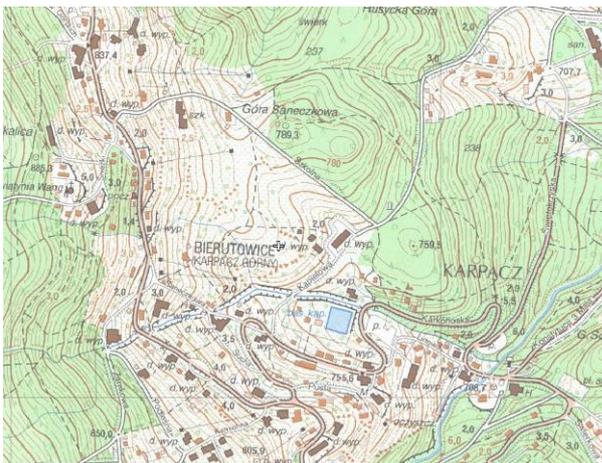




Figure 2a – Square 2 – Hotel building in Karpacz
Source: Geoportal (2012) and Google Earth (2012).



Photo 2a – Square 2 – Hotel building in Karpacz
Source: author's materials.

EU-LUPA

European Land Use Patterns

Appendix 2

Field study – interviews questionnaires

Region: JELENIOGÓRSKI SUBREGION

Place: JELENIA GÓRA

Person interviewed: JOLANTA BOREJSZO and WŁODZIMIERZ SŁODKIEWICZ

Secretary and Vice Secretary (Director of the Organizational and Legal Division) in the Office of the Jeleniogórski County

Interviewer: Konrad Ł. Czapiewski

Date: 05/03/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

Number of inhabitants in Jeleniogórski County was stable in the last few years. From the Jelenia Góra town we can observe some outmigration processes – that people mostly are moving to suburban areas of the town. Thanks to that number of population in that rural communes increased. Also on the areas with big touristic and cultural values people are migrating from bigger cities (mostly from outside of the subregion).

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

There are different kinds of new settlements – both complex settlements, as well also scattered settlements. It depends from many conditions – legal, institutional and environmental.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

It can be noticed stable decreasing role of agriculture on the suburban areas and on the touristic areas (mainly mountains parts). There are changes in the land use – from agricultural to build-up. But also very big agricultural enterprises started to appear on that areas – there is an accumulation of the land which previously belong to state enterprises and small farms. There is observed the concentration of the land in hands of few owners – very common linear internal borders between the fields belong to different owners, now are slowly disappearing.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

See above.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centres, roads, railways etc.)? How would you assess its influence on land use?

Local government very actively invest in the technical infrastructure – they are using external funds, mainly from the European Union. Revitalization and renovation of old and historic centres of towns and palaces is running by very active NGO organizations. Communes are mainly focus on the hard infrastructure, than on revitalization.

Jeleniogórski county was previously very industrialized area, but right now many of that factories collapsed. Of course some of the factories are still operating, as well new one appears. New companies are mainly build in new places – mainly on agricultural lands, not in old industrial zones. Previously Jeleniogórski county was industrial-agricultural-services region, and now is rather services-industrial-agricultural.

In the past decades trains from Wroclaw to Jelenia Góra run two hours, but now it is more than three and a half hours. Right now the regional government invest big amount of money in modernization of that train line.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centres, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

The biggest tourist investments are now located in the touristic areas – especially in Karpacz town – huge hotels and infrastructural investments are using the old touristic elements (eg. swimming pools). Despite big controversy in localization of such huge touristic infrastructure in a small villages and towns – this shows that that county has a big potential in development of touristic functions. Despite big touristic objects, also smaller hotels are appearing in that region. Tourism is developing in many directions, is very diversified. Nowadays tourism is very complex on that area, is not based only on one kind of tourism activity. Many tourism initiative are initiated by NGO organizations.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

High level of unemployment – collapse of many industrial activities and employment in tourism institutions can't compensate that reduction in previous employment in industrial factories.

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

Karkonoski National Park wasn't increased in that period, but one new landscape park appeared. Previously many big industrial factories produced a lot of pollutions – right now this situation was changed for better. Now the quality of environment is much better. Very

good examples are the forests, which were almost totally destroyed in the 1980s because of so-called “acid rains” – now we can observe a big regeneration of them.

Previously many rivers were out of any class of cleanness – because of intensive industrial production and lack of sewage systems. Actually this situation is changing – eg. some species of fishes are coming back to the rivers, which wasn't noticed for many years.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

The main contemporary threat is liquidation of asbestos (which is still very often visible on the roofs). New areas will be added to Natura 2000 list. Environment is a very important element for the development of tourism, so that is why it will be very important factor and assets in the local development strategies and for the mentality of inhabitants.

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

That county, as majority of the south-western Poland, was partly destroyed by a big flood in 1997. Despite in that region there are many so-called dry anti-flood reservoirs/tanks.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

The most important functions of the Jeleniogórski county is for sure tourism – and later on all the accompanying functions (eg. services of general interests, infrastructure, services). There is a strategy of local governments to develop all opportunities which can help to increase the role of tourism. Additionally we can mention the role of such functions as: industry, agriculture and forestry.

2. Multifunctional land use - which of the functions in your region co-exist?

There are such functions as: tourism, production, housing, forest and agriculture. Co-existence between many different functions is very natural in that county and is in line with the main strategic idea of that area.

3. Which of the functions are the most important in the context of land use?

4. Is the number of functions of land use increasing or decreasing?

The number of functions is rather the same – but other functions started to be more important and some less important – there was made the revaluation of importance of functions.

5. To which extent is the land in your region used in multifunctional way?

6. What kind of functions co-existence is:

a) the most effective?

- b) the most desirable?
- c) the most common?
- d) the most difficult?

7. Which of the functions of land use are the most important for the future regional development?

The future development will be based on touristic functions.

IV. Spatial conflicts

- 1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

We can observe the local conflicts which are connected with location of individual objects – eg. some production plants which were built too close to build-up area or a mine which started to operating in a very quiet touristic village close to the old palace. Some conflicts were also connected with building big hotels objects in some mountains small villages or towns. There were also some conflicts with development of new skiing roads in the national park – but finally there was made some compromise.

- 2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

There are such actors as: private investors (entrepreneurships, private people), local governments, NGO, ecologist.

- 3. Which of the actors are the most dynamic and successful in obtaining new land?**

Because the priority of development in that county is tourism, so all the possible regulations and conflicts are solved with giving the priority for tourism function development.

- 4. What are the most likely conflicts related to land use in future and what could be its impact on land use?**

Previous conflicts had rather punctual and local character, so it is difficult to anticipate some possible conflicts in the future.

V. Government and policy

- 1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?**

The basic competences in the spatial planning are on the level of communes (LAU2). Each of the commune what to have as big as possible the incomes, so each investor is welcome warmly by them. Each investment which is using the land in more intensive way (and at the same time gives bigger incomes for commune's budget) is favourable for communes. So all the communes want to intensify the utilization of the land. The regulations according to nature protections has to be given form the state regulation, because communes do not think in such a way.

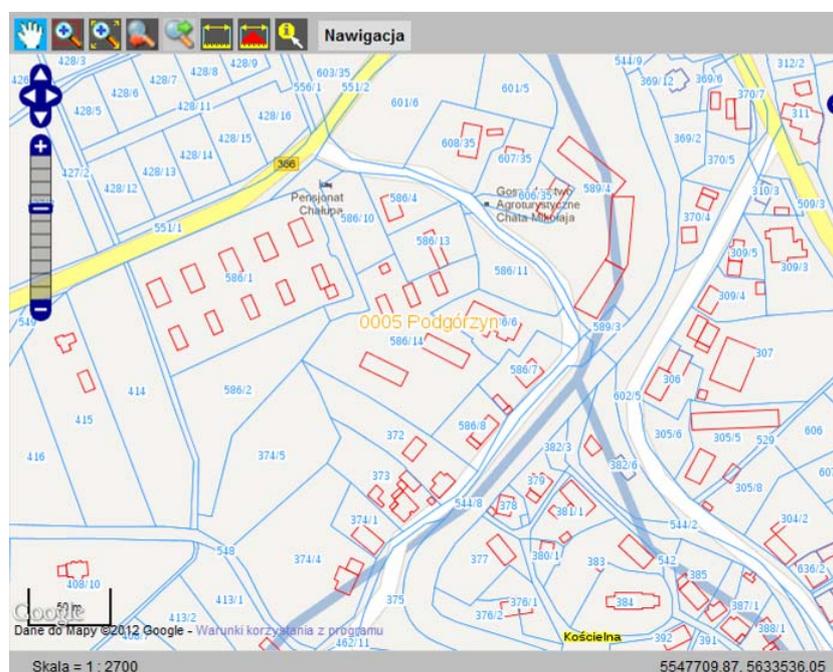
2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

The effective local governments is leading the commune in such a way, that we can observed the local development in a desirable direction according to strategic documents.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

County is monitoring all the investments which is responsible for. The county would like to invest more money, but there are limitation of the budget.

Spatial monitoring is running only for the evidence of the borders of the houses and plots – simple cadastre. It is rather evidence of the situation and not as a tool for planning of development and creation of new functions. It is not a planning tool – rather the stocktaking tool. For sure in the future that system will evaluate to a more complex and holistic tool for spatial management. Right now there are no regulations according to architectural style or colour in which the new hoses are constructed.



The example of cadastre map – source: <http://www.podgik.igora.pl/mapa.html>

VI. Localization (depending on the region)

- 1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?**

On some areas we can pointed the development of some services, which can be somehow connected with the functioning of the state border – eg. hotels close to the transit roads. But generally influence of the border on land use is rather small.

VII. Land use in general

- 1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.**

There are very big changes on the rural areas – there is lack of a traditional agricultural function; instead of that new functions appeared – touristic, housing. There was made the revaluation of the importance of the dominating functions. The planning is much more complex. Also development of tourism functions is much more complex and the offer is much more diversified. Fact, that many people would like to invest on that area show that this county has a big possibilities.

Region: JELENIOGÓRSKI SUBREGION

Place: KOWARY

Person interviewed: Prof. JACEK POTOCKI

Professor at the Wrocław University of Economics – Branch in Jelenia Góra, member of the Scientific Council of the Karkonoski National Park and member of the Advisory Group in the Marshal Office of Dolnośląskie Region, specialised in the tourism analysis.

Interviewer: Konrad Ł. Czapiewski

Date: 05/03/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

We can observe an outmigration from that subregion – the only exceptions are the suburban areas (especially around Jelenia Góra), but that zone is very narrow. There is one main and basic reason for that – collapse of industrial functions which was dominating in those areas. But depopulation of the mountain areas is a natural process – actually the biggest share of people is concentrating in the metropolitan areas.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

We can observe the sprawl of built-up areas – nowadays settlements are much more scattered. It leads to the chaotic development of spatial structures. For example it is easier, and people prefer, to build new houses outside of main centres of villages, even if there are free plots. Newcomers are from different parts of Poland, but mainly from Dolnośląskie Region.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

There is a big decrease of agricultural functions, but for example that area is predisposed for sheep or cattle breeding, because of high share of grasslands. Lack of agricultural activity leads also to collapse of agro-food industry in that subregion. Grasslands are under operation mainly because of different kinds of payments from European Union.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

See above.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centres, roads, railways etc.)? How would you assess its influence on land use?

After the collapse of many industrial activities during the transformation period in that subregion, any big companies did not locate activity in that subregion. Also before the transformation not so many investments was made in the industry in that area. Totally different is in the Czech side of Sudety Mountains – there only in a few places tourism function is developed. In the rest the most important function is industry.

Opening of the motorway in the northern part of the subregion didn't increase the number of entrepreneurs. Even opposite – because of decrease of traffic on old transport roads, some activities lost the clients (eg. hotels, restaurants or car service).

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centres, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

Development of the tourism functions has a big influence on the other areas of the subregion. The main reason of many decision connected with development of tourism functions are the financial aspects.

The problem with development of tourism functions is that tourists concentrate their activities in a few settlements, few places, but all the region want to developed on the base of tourism activity. But it is rather impossible. Even when some of the villages try to develop some tourism attractions, it is not made in a complex way – each investor develop their own activity on their own hand. There is lack of real cooperation between different stakeholders.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

The problem of the majority of the small towns and villages it that there was big domination of the industrial functions – collapse of the industry leads to intensification of the socio-economic problems in that area.

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

There is still a stereotype that that region is very polluted and ecologically destroyed – so-called Black Triangle. But this is no longer true because there was made a real recultivation in that area. New species started to return on that area. Quality of environment is good now.

Landscape parks are rather only artificial institutions. On the opposite the Karkonoski National Park is really doing something, but there are some conflicts with other actors who want to developed some activities and do not respect any environment protection laws. There is even the persuasion, that national park stops the economic development.

2. **Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?**

Not asked.

3. **Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?**

Not asked.

III. Multi-functionality

1. **Please name socio-economic and environmental functions of land use in the region.**

Previously there was big domination of the industrial function. Nowadays we can pointed that in the mountain part there is big development of the tourism function, in the northern agricultural one and in some localities there is development of the industrial functions (eg. stone-pit or industrial plants).

2. **Multifunctional land use - which of the functions in your region co-exist?**

Collapse of industry leads to big economic and social problems. Local and regional government didn't have the idea what to do and in which way developed that area. There was no good idea for the restructuring of the industrial sector during the transformation period. There was conviction that the remedy on all problems will be development of tourism. But in such area with such a big population density it is simply impossible. What is more development of tourism do not need well-educated workers. Relatively in a good economic condition is Jelenia Góra and Jeleniogórski county (tourism, services and industry) and Zgorzelecki county (big power plant, brown coal mine and vicinity of German border), but the other counties – as kamiennogórski, lwówecki, złotoryjski, lubański – are in a much worse situation.

3. **Which of the functions are the most important in the context of land use?**
4. **Is the number of functions of land use increasing or decreasing?**
5. **To which extent is the land in your region used in multifunctional way?**
6. **What kind of functions co-existence is:**
 - a) **the most effective?**
 - b) **the most desirable?**
 - c) **the most common?**
 - d) **the most difficult?**
7. **Which of the functions of land use are the most important for the future regional development?**

There should be development of industrial functions in such a way, that will not have negative impact on environment. Of course also tourism, but in the areas and settlements not

discovered still. Also agricultural functions should be developed – especially cattle and sheep breeding.

IV. Spatial conflicts

- 1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

It can be indicated very interesting example of a spatial conflict in the frame of a tourism function. Some of tourist activities exclude each other's – but in one small town (Świeradów Zdrój) there is development of spa functions which needs quiet and so-called „atmosphere of health” and massive skiing functions – new investments in ski lifts. Till now there are no problems, but in the future, it is possible that there will be big conflict with that.

Of course there are some conflicts, such as: tourism vs. environment protection, new settlement vs. agriculture, spatial harmony vs. new built-up areas and new industrial plants (they are located not in an old industrial areas, but are very dispersed, which leads to chaotic way of spatial organization).

- 2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

The most effective and winning actors are that which offer the work places for people and incomes for the budgets to local self-governments. Most often the biggest investors are from the outside of that subregion and the most important element for that people are the financial benefits, and not the environment protection, cultural values or so-called “territorial capital”. Those investors, owners are not responsible for that area, do not care about the merit level of their offer, about the tradition, culture.

- 3. Which of the actors are the most dynamic and successful in obtaining new land?**

See above.

- 4. What are the most likely conflicts related to land use in future and what could be its impact on land use?**

In the future the problem can be connected with the climate conditions (climate change) and development of the skiing functions. Those ski resorts which was developed in the lower located places could have problems with snow and get bankrupted. Also in the future the macroeconomic conditions will be the most important for creation or not the spatial conflicts. If there will be economic decrease, there will be less investors and visitors and at the same time less spatial conflicts.

V. Government and policy

- 1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?**

Everything in that matter depends on the activity of the local self-governments (communes). And tools that that communes have maybe are correct but their implementation is very weak. Spatial and economic planning is the object of high pressure of external investors and developers.

- 2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).**

Not asked.

- 3. Is there any monitoring of land cover changes in the region? (Please describe briefly).**

Monitoring of spatial organization, spatial planning is conducting very weak or even at all.

VI. Localization (depending on the region)

- 1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?**

Location near the border do not affect the development of that area, changes in spatial organization and land use. State border is still a barrier – maybe not institutional but mental and communicational (there are not any direct bus lines connecting Polish and Czech towns).

VII. Land use in general

- 1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.**

There can be pointed two important processes and elements in that areas: (1) socio-economic transformation and collapse of industry, (2) chaos in spatial planning and not very good lows for spatial planning and spatial organization.

Region: JELENIOGÓRSKI SUBREGION

Place: WROCLAW

Person interviewed: Dr SYLWIA DOŁZBŁASZ

Researcher in the Institute of Geography and Regional Development at Wroclaw University, specialised in the trans-border and transnational analysis, especially on the border with Germany and Czech Republic.

Interviewer: Konrad Ł. Czapiewski

Date: 06/03/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

Demographic processes in that subregion are more polarised than average in Poland. The processes of outmigration are deeper than average, as well the population is going to be older. But the outmigration processes in that subregion even that are much lower than in the German side – Saxony region.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

There is dichotomous process. There are some villages, which are totally not inhabited, as well there are some villages with good location and attractive landscape surrounding, with big share of newcomers in last two decades. New inhabitants build there their “second houses”. Mostly there are new houses – not adaptation of old ones. Mainly new houses are build outside of old, central part of the village.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

In the lowland part of the subregion, the big agricultural enterprises appeared – there is observed process of consolidation of land. In the upland and mountain part the agriculture play less and less important function in spatial organization and economical structures.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

In the mountain part the agricultural areas are less and less utilized – formally they are still agricultural but the real utilization is different.

5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centres, roads, railways etc.)? How would you assess its influence on land use?

Many of the towns in Sudety region was connected (or even depended) on the development of industrial function – collapsed of industry leads to socio-economic deprivation in many small towns and villages. There are big difficulties in that settlements – they are looking for their chances of development, but it is not so easy. Past industrial areas are partly utilized by new companies and partly they are abandoned. Many local self-governments is looking their chances by creating industrial zones, but because of big competition it is difficult.

Thanks to the motorway in the northern part of the subregion for sure the spatial accessibility was improve. But it do not influenced the development of entrepreneurships. There is need to build the roads to connect the subregion with the motorway.

6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?

There is big and clearly visible divide of that subregion into two main zones according to development and importance of tourism development – in the mountain part it is very important and in the western and northern much less important. Development of tourism functions is noticed also outside of traditional touristic centres. Touristic function is the only one which have the transnational character. The investments are influencing the increase of the role transborder tourism. Development of transnational tourism initiatives – of course mainly in the mountain part – is created by the bottom-up initiatives.

7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.

There were and still are such activities in that subregion which influence a lot the spatial organization and land use – extractive industry, tourism, suburbanization, etc.

II. Environmental issues

1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?

There was improvement of all statistics connected with the quality of environment – it was connected with the restructuring of industry and big effort made by the woodmen – forestation of the mountain affected by the “acid rains” in the 1980s. Very positive changes – connections with the “Black Triangle” identity is slowly fidgeted and changed. The mentality of inhabitants according to “environmental thinking” is changing much more slowly.

2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?

Firstly, pressure on the environment in the areas with domination of mines is and will be high, but there are made the recultivation activities. Secondly, mountain areas – on that areas will be pressure from the tourism function side. There is some dichotomy – tourism in that areas is very important function, but its influence on the environment will be more and more visible.

3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?

There are some idea of building the flood tanks – but unfortunately many of them are still only on the plans. The whole system of anti-flood protection do not work, as it should be.

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.

In the Jeleniogórski subregion, it can be delimited five functional zones: (1) Jelenia Góra (multifunctional town), (2) very industrialized south-western part of the subregion (brown coal mine), (3) mountain area – Sudety (domination of tourism function), (4) lowland area with domination of agriculture and (5) on the north complex of forests.

2. Multifunctional land use - which of the functions in your region co-exist?

Definitely that subregion can be called „multifunctional”. Many of functions coexists next to each other's and it is difficult to point dominating one, because it is very spatially differentiated.

3. Which of the functions are the most important in the context of land use?

4. Is the number of functions of land use increasing or decreasing?

There are changes in the importance of some functions, but new ones didn't appeared. There is for sure increase the importance of tourism and services functions, decrease of industrial and agricultural functions and stabilization of the extractive industry (mainly mining).

5. To which extent is the land in your region used in multifunctional way?

6. What kind of functions co-existence is:

- a) the most effective?
- b) the most desirable?
- c) the most common?
- d) the most difficult?

7. Which of the functions of land use are the most important for the future regional development?

In the future such functions will be important: tourism, services and industry (but there will not be new zones of industry but rather in some localisations). There will not be new protected areas.

IV. Spatial conflicts

- 1. Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

There is a conflict between mining and environment – but new regulations leads to improvement that situation (eg. new filters). Previously the influence of the industry was affecting big areas – together with rains the pollutions were deposit on large areas. Another conflict is connected with development of tourism and environment protection. Some spatial chaos is created by the mixture of functions and investments. The biggest role in that matter is in the hands of local self-government. They are supporting the development. Delimitation of industrial zones do not always bring a success, as well sometimes investors invest in the area where they want to do it and it lead to spatial conflicts. Not so big transparency of some decisions of the local governments caused some problems. But more and more often the local society is showing the bottom-up initiatives.

- 2. What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

Competing actors: local self-government, entrepreneurships, inhabitants, ecologists. Different directions of the competing line is: local institutions and local people versus external investors, which do not have the territorial capital and only important thing is economic profit.

- 3. Which of the actors are the most dynamic and successful in obtaining new land?**

It is differentiated, but most often the winning actors are those, which offer the more intensive utilization of land. But also important are the national or European regulations which help the actors presented the more extensive land use and less intensive functions (eg. national park).

- 4. What are the most likely conflicts related to land use in future and what could be its impact on land use?**

Creation of flood tanks – there are many problems connected with that topic. The main is connected with vertical agreement between central government and local self-governments – there are not good co-operation on that line. Also there are social problems – building flood tanks needs liquidation of some settlements. Another possible conflict is between tourism and environment. In the regional strategy of development there is stressed, that the extraction industry will return to that region – so it could be in conflict with development of housing and tourism.

V. Government and policy

- 1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?**

Actually the law and institutional assets are not effective in right spatial planning. The easiest thing will be national regulations, that all settlements should have obligatory the local plans of spatial organization. Maybe generally the whole procedure is correct and transparent, but because it is not obligatory, is not effective. Fact that creation of local plans is expensive, but sometimes it is much easier for the local governments not to have plans – they can create development in much freely way, but at the same time in much more chaotic way. It should be decided on the governmental level that the plans are obligatory.

- 2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).**

Role of public administration is crucial in such planning the regional and local development, that it will not cause the spatial conflicts. There is lack of social consultancy and merit background of the local government to run some good initiatives.

- 3. Is there any monitoring of land cover changes in the region? (Please describe briefly).**

There is lack of any spatial monitoring. If something is not causing any „media” problems, than nobody is checking the results of investors activity.

VI. Localization (depending on the region)

- 1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?**

Location near the state border has real and important influence on the spatial organization and human activities. First, there is development of infrastructure (transport, anti-flood systems), than development of common tourism products – creation of integrated tourism market.

VII. Land use in general

- 1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.**

See above.

Region: JELENIOGÓRSKI SUBREGION

Place: WROCLAW

Person interviewed: Dr HELENA DOBROWOLSKA-KANIEWSKA

Head of the regional analysis units in Dolnośląska Agency for Economic Cooperation (DAWG) – agency running European and regional projects and co-operate with the Marshal Office of Dolnośląskie Region.

Interviewer: Konrad Ł. Czapiewski

Date: 06/03/2012

I. Socio-economic factors of land use change

1. Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?

There are processes of depopulation – especially in the mountain part of the subregion. Especially young people are migrating from that area. We can observe such a relationship – young people from Jelenia Góra or other big towns mainly are going to study in Wrocław, while people from the smaller towns and rural areas are going to study in Jelenia Góra – there are some branches of the universities located in Wrocław.

2. What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?

Many industrial activities collapsed during the transformation period – this affected negatively the population processes but also the deprivation of some built-up areas. Jelenia Góra is “vital” town – it is the subregional centre of development. Also that town has some problems connected with restructuring, but not so big as in other parts of the region. Development of tourism function leads to development of recreational housing.

3. What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?

There are not so big chances for development of agriculture activities.

4. Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.

Not asked.

- 5. What are the main processes in the field of industry and technical infrastructure (new plants, industry centres, roads, railways etc.)? How would you assess its influence on land use?**

There was a big decrease in the number of industrial plants in that subregion during the transformation period. Many big state industrial plants collapsed in that period – that affect also some tourist enterprises, which were directly connected with the big industrial companies.

- 6. What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centres, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?**

Development of different forms of tourism activities. There are some isolated areas where the tourism has chances to developed (mainly mountain part and a few settlements in the rest of the subregion).

- 7. How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.**

Subregion is very active in promotion and marketing on some fairs, meetings, conferences organized on regional or national level. There are many applications for the external funds, mainly from the European Union. High level of unemployment. General socio-economic situation in that region is on much lower level than average in the Dolnośląskie Region.

II. Environmental issues

- 1. Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?**

Previously that area had big ecological problems – so-called Black Triangle. But now the situation is much better. There is much less air pollution, but the forest areas for a long time will be regenerated their quality. Generally that subregion has big environment values – eg. national and landscape parks.

- 2. Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?**

Not asked.

- 3. Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?**

Not asked

III. Multi-functionality

1. Please name socio-economic and environmental functions of land use in the region.
2. Multifunctional land use - which of the functions in your region co-exist?
3. Which of the functions are the most important in the context of land use?
4. Is the number of functions of land use increasing or decreasing?
5. To which extent is the land in your region used in multifunctional way?
6. What kind of functions co-existence is:
 - a) the most effective?
 - b) the most desirable?
 - c) the most common?
 - d) the most difficult?
7. Which of the functions of land use are the most important for the future regional development?

Definitely tourism is dominating functions in that subregion and in that direction the development of that area should be programming. Region has big industrial traditions (mining, breweries, other factories). There should be stimulation of the endogenous factors of development, but this subregion is located very peripherally, is a problem area, that is why the development is more difficult here. It is difficult from the perspective of regional capital to show and decide what kind of functions will be developed there. Generally in the regional strategy it is written the development of tourism function in that subregion. Because of the outmigration of young people, there is lack of young and active people who would stimulate the multifunctional development of that area. Problem of lack of multifunctional development is also connected with the poor accessibility of that subregion.

IV. Spatial conflicts

1. **Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).**

In the areas with high quality of landscape, attractive for many functions, the spatial conflicts are normal things. Many functions and many actors want to developed their own conception. The high quality of environment leads to development of touristic functions. But there are conflicts of the touristic function with industry. Actually there are conflicts on such line: environment versus housing function, recreation and some kinds of tourism (skiing, quads).

2. **What are the “competing” actors and functions (environmental, agricultural, industrial, settlement etc.)?**

The most important role is in the hands of local government, much lower role play the regional government.

3. Which of the actors are the most dynamic and successful in obtaining new land?

Not asked.

4. What are the most likely conflicts related to land use in future and what could be its impact on land use?

Not asked.

V. Government and policy

1. Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational management of land?

There are some regulations (law and financial) on the regional level (eg. way of transfer of European Union payments). But it is local initiatives and activity, what amount of external finance and which kind of initiatives will be running in the communes. So the local development results almost directly only from the activity of local leaders. Regional government is not responsible for that on such spatial level. Many of the activities on the local level depends from the cooperation of many municipalities (or communes with counties) and the result of that cooperation lead to realization or not the common initiatives.

2. Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).

Regional government in generally can support the development of parts of its territory, but this is the responsibility of the local government to utilize in maximum the endogenous potential and exogenous sources. This local units has to have the initiative. Role of regional government in creation of new functions of some parts, changes in the spatial organization and land use is very small. Of course there is some general vision of development of the whole region, but it do not stop and do not replace the local initiatives. For example there is some regional division of the European Union funds into the priorities, but that priorities were partly build upon the bottom-up initiatives and suggestions made by the local governments and local leaders and through the social consultancy. The local initiative is very important – because some rational decision made from the regional level do not always have to fit to the local conditions.

3. Is there any monitoring of land cover changes in the region? (Please describe briefly).

For sure there is very detailed monitoring of the investments financed partly by the European Union – there are very detailed reports of results and taking care of the products within five years. There is a question if this five years is enough or it should be longer period. Such monitoring can be treated as a part of spatial monitoring.

VI. Localization (depending on the region)

- 1. How land use changes are resulting from vicinity of state border (how the state border influence land use in your region)?**

Region is located peripherally and with the poor accessibility. Border is not any important factor of development or creation the new functions. The important element is relief which in some way influence the possibilities of development.

VII. Land use in general

- 1. Please describe and summarize the major processes and trends of land use changes in the region over a last 50 years.**

Jeleniogórski subregion has for sure big endogenous potential, but if it will be utilized properly depend on the activity of local government. That activity is the most important, form the regional level is only possible the general support of development.

Case studies impact

1. Case studies reports – 4 reports + interviews
2. “Floating boxes” – in the final project report we will propose the frames with some sentences from case studies confirming the results from the tasks research.
3. Identification of the factors and drivers of land use change in case studies areas (macroscale).

Case study area	Type of area	Change <i>E- ekstensification; S – stabilization; I - intensification</i>	Dynamics +++ - high ++ - medium + - small	Factors ++ - most important; + - less important
Oresund	Arable land Pastures with annual/permanent crops Forests Natural Grassland Transitional woodland – shrub areas Sparsely vegetated areas Marshes, coastal areas and inland waters Core urban areas Urban areas in transition Urban areas in intensive transition Urban areas in arable land Urban areas in pastures with annual and permanent crops Urban areas in forested areas Urban areas in transitional woodland areas Urban in marshes, coastal areas and inland waters			
San Sebastian	Arable land Pastures with annual/permanent crops Forests Natural Grassland Transitional woodland – shrub areas Sparsely vegetated areas Marshes, coastal areas and inland waters Core urban areas Urban areas in transition Urban areas in intensive transition			

	<p>Urban areas in arable land</p> <p>Urban areas in pastures with annual and permanent crops</p> <p>Urban areas in forested areas</p> <p>Urban areas in transitional woodland areas</p> <p>Urban in marshes, coastal areas and inland waters</p>			
Chelmsko-zamojski	<p>Arable land</p> <p>Pastures with annual/permanent crops</p> <p>Forests</p> <p>Natural Grassland</p> <p>Transitional woodland – shrub areas</p> <p>Sparsely vegetated areas</p> <p>Marshes, coastal areas and inland waters</p> <p>Core urban areas</p> <p>Urban areas in transition</p> <p>Urban areas in intensive transition</p> <p>Urban areas in arable land</p> <p>Urban areas in pastures with annual and permanent crops</p> <p>Urban areas in forested areas</p> <p>Urban areas in transitional woodland areas</p> <p>Urban in marshes, coastal areas and inland waters</p>			
Jeleniogórski	<p>Arable land</p> <p>Pastures with annual/permanent crops</p> <p>Forests</p> <p>Natural Grassland</p> <p>Transitional woodland – shrub areas</p> <p>Sparsely vegetated areas</p> <p>Marshes, coastal areas and inland waters</p> <p>Core urban areas</p> <p>Urban areas in transition</p> <p>Urban areas in intensive transition</p> <p>Urban areas in arable land</p> <p>Urban areas in pastures with annual and permanent crops</p> <p>Urban areas in forested areas</p> <p>Urban areas in transitional</p>			

	woodland areas			
	Urban in marshes, coastal areas and inland waters			

4. Identification of the factors and drivers of land use change in case studies areas (microscale)

Case study area	Name of investigated point	Type of land use	Change <i>E- ekstensification; S – stabilization; I - intensification</i>	Dynamics +++ - high ++ - medium + - small	Change direction ^a	Factors ++ - most important; + - less important
Oresund	1. 2. 3.					
San Sebastian						
Chelmsko-zamojski						
Jeleniogórski						

5. Identification of the challenges of land use change in case studies areas and proposed recommendations

Case study area	Challenges	Recommendations
Oresund		
San Sebastian		
Chelmsko-zamojski		
Jeleniogórski		

6. Land use function changes (under construction)

Case study area	Land use function			
Oresund	Provision of work Provision of leisure and recreation Provision of food and energy Provision of housing and transport and energy infrastructure Provision of abiotic resources Provision of biotic resources			
San Sebastian	Provision of work Provision of leisure and recreation Provision of food and energy Provision of housing and transport and energy infrastructure Provision of abiotic			

	resources Provision of biotic resources			
Chelmsko-zamojski	Provision of work Provision of leisure and recreation Provision of food and energy Provision of housing and transport and energy infrastructure Provision of abiotic resources Provision of biotic resources			
Jeleniogórski	Provision of work Provision of leisure and recreation Provision of food and energy Provision of housing and transport and energy infrastructure Provision of abiotic resources Provision of biotic resources			