Acropolis under snowstorm on 17 February 2021

STRENGTHENING CULTURAL HERITAGE RESILIENCE FOR CLIMATE CHANGE - WHERE THE GREEN DEAL MEETS CULTURAL HERITAGE

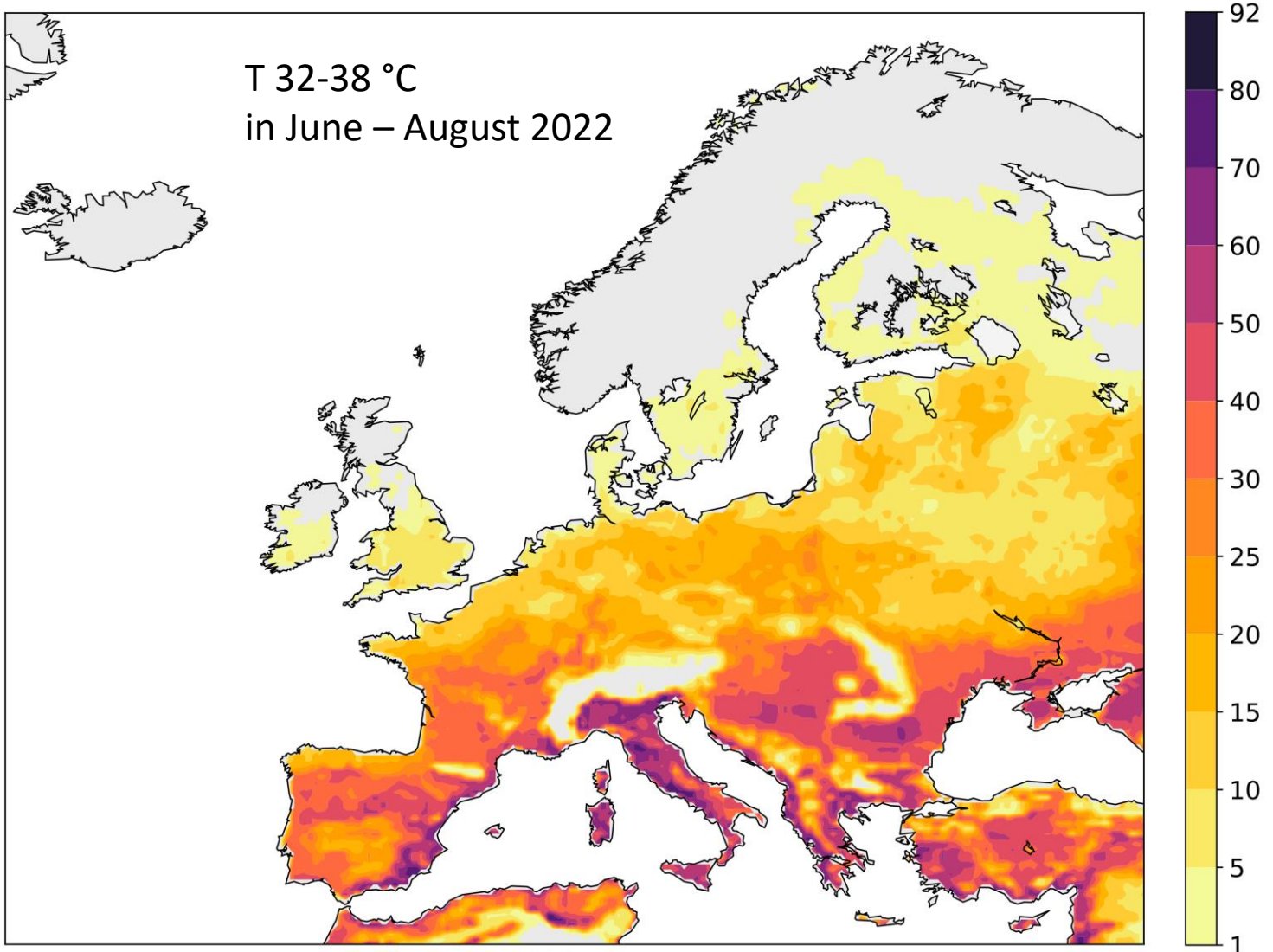
EU OMC Member States` expert group

Chair: Johanna Leissner (Fraunhofer, Germany)

/ ESPON 2030 Knowledge development activity, Vienna, 06-07 June 2023

Report released on
23 April 2023

Number of days that experienced strong heat stress - JJA 2022



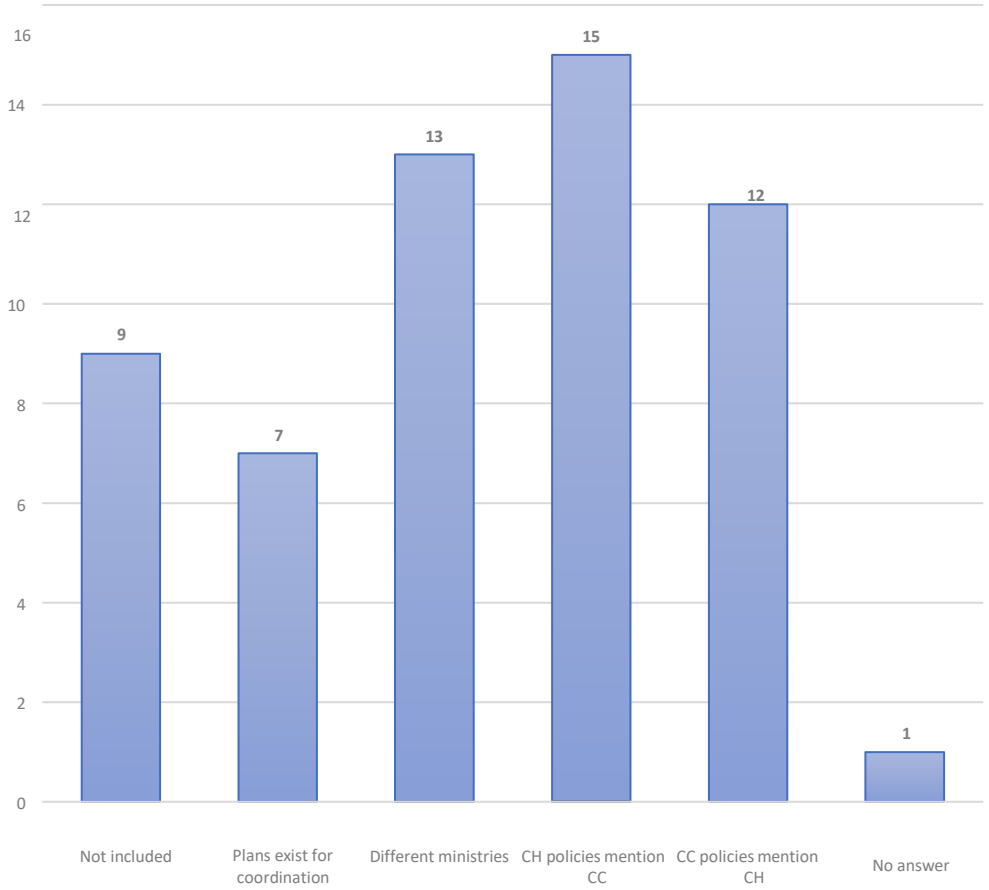
Data source: ERA5-HEAT, Credit: ECMWF/C3S

EU OMC Expert Group of Member States "Cultural Heritage Resilience for Climate Change"

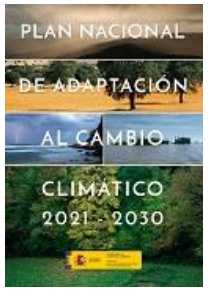
- 25 EU Member States and 3 associated countries have sent delegates
- The **first time a political mandate** was given to this topic
- Tasks
  - Identify the **state of play in EU and Member States** regarding **policies**
  - Identify **emerging threats of climate change** on cultural heritage
  - Collection of **Good Practice examples**
  - Identify what cultural heritage **can contribute** to solve climate crisis
  - **Awareness raising** for the topics in society, **political decision making and arts and creative** sectors
  - Output: a **report and 10 recommendations** for **EU** and its **Member States**

Situation cultural heritage / climate change in policies

1) Cultural heritage not included in policies – 9 countries
2) Some plans exist for coordination of climate change and cultural heritage – 7 countries
3) Different ministries responsible
4) Cultural Heritage policies mention Climate Change – 15 countries
5) Climate Change policies mention Cultural Heritage – 12 countries
6) No answer – one country



Examples: Spain and Italy



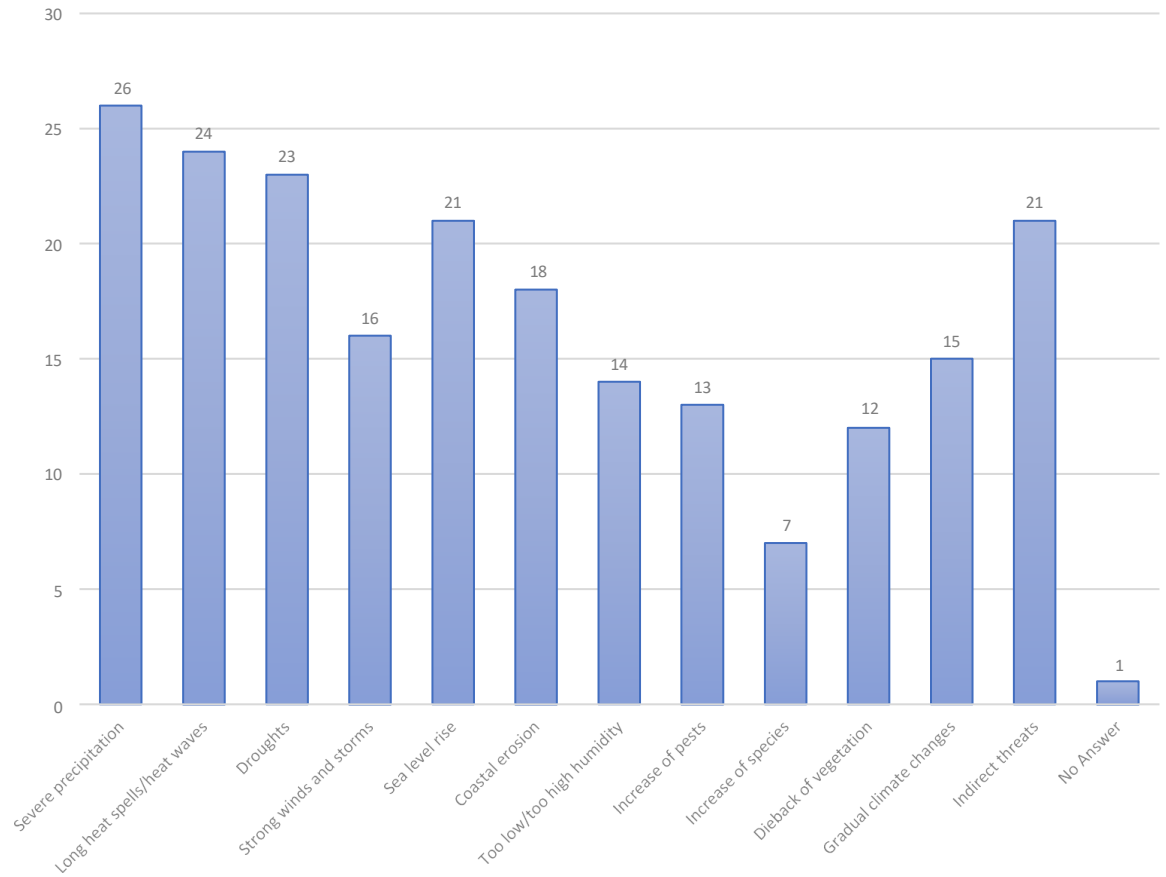
2015 National Strategy of Adaptation to Climate Change
2018 National Plan of Adaptation to Climate Change

Overview of national policies that mention cultural heritage in Europe

Country code	Country	National sustainability strategy	National climate adaptation plan	National recovery and resilience plan
AT	Austria	Yes	Yes	Yes
BE	Belgium	No	No	Yes
CH	Switzerland	No	No	No
CY	Cyprus	Yes	Yes	No
CZ	Czechia	Yes	Yes	Yes
DE	Germany	Yes	No	No
EE	Estonia	No	Yes	No
EL	Greece	Yes	Yes	Yes
ES	Spain	Yes	Yes	Yes
FI	Finland	No ([1])	Yes	No
FR	France	No	No	No
HR	Croatia	Yes	Yes	Yes
IE	Ireland	Yes	Yes	No
IS	Iceland	No	No	No
IT	Italy	Yes	Yes	Yes
LT	Lithuania	No	Yes	Yes
LV	Latvia	Yes	Yes	Yes
MT	Malta	No	No	No
NL	Netherlands	Yes	No	Yes
NO	Norway	Yes	Yes	Yes
PL	Poland	No	Yes	Yes
PT	Portugal	Yes	Yes	Yes
RO	Romania	Yes	Yes	Yes
SE	Sweden	No ([2])	Yes	Yes
SI	Slovenia	Yes	Yes	Yes
SK	Slovakia	Yes	Yes	Yes

Threats to cultural heritage from climate change

1) Severe precipitation
2) Long heat waves
3) Droughts
4) Seal level rise
5) Indirect threats
6) Coastal erosion
7) Strong winds
8) Gradual climate change
9) Too low/high humidity
10) Increase of pests
11) Dieback of vegetation
12) Migration of foreign species



Strong winds

Severe precipitation

Increase of pests

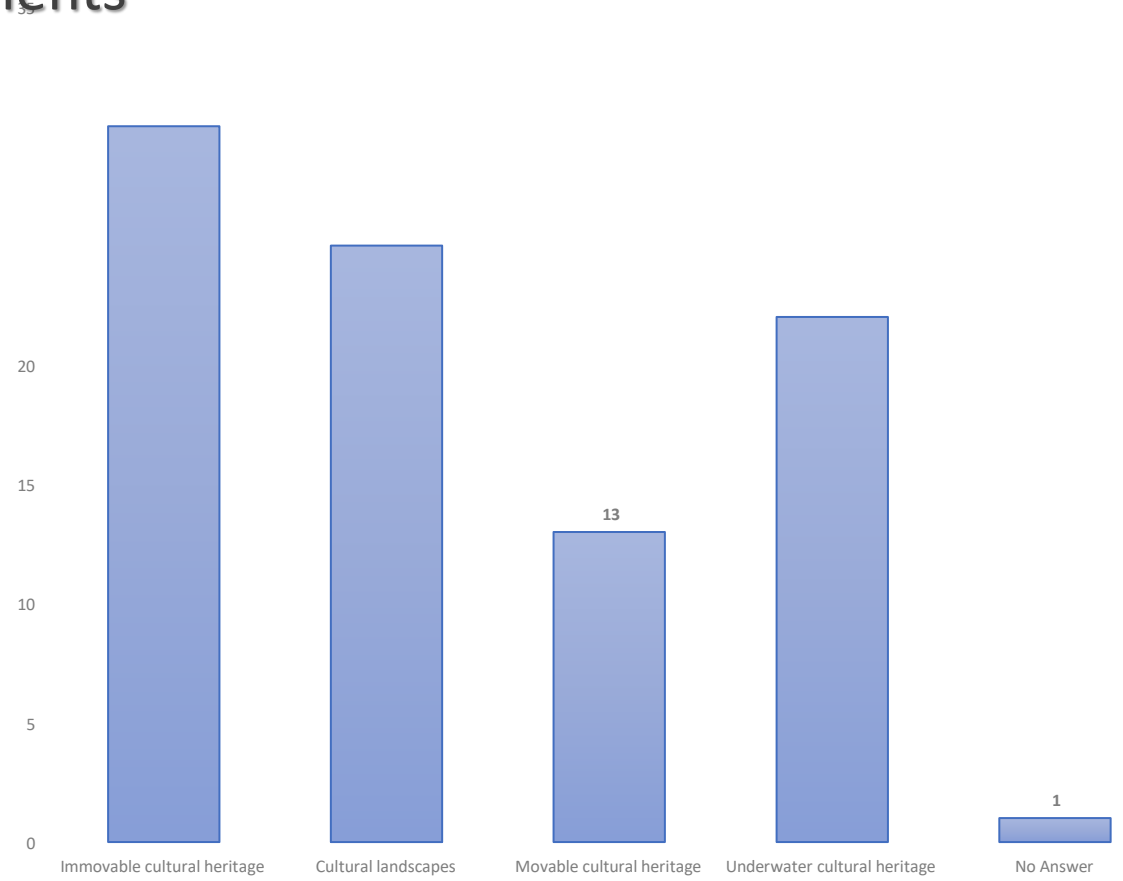
Risk potential by type of heritage

1. Buildings and monuments
2. Cultural landscapes
3. Underwater heritage
4. Movable heritage
5. No answer

Karlštejn Castle, CZ

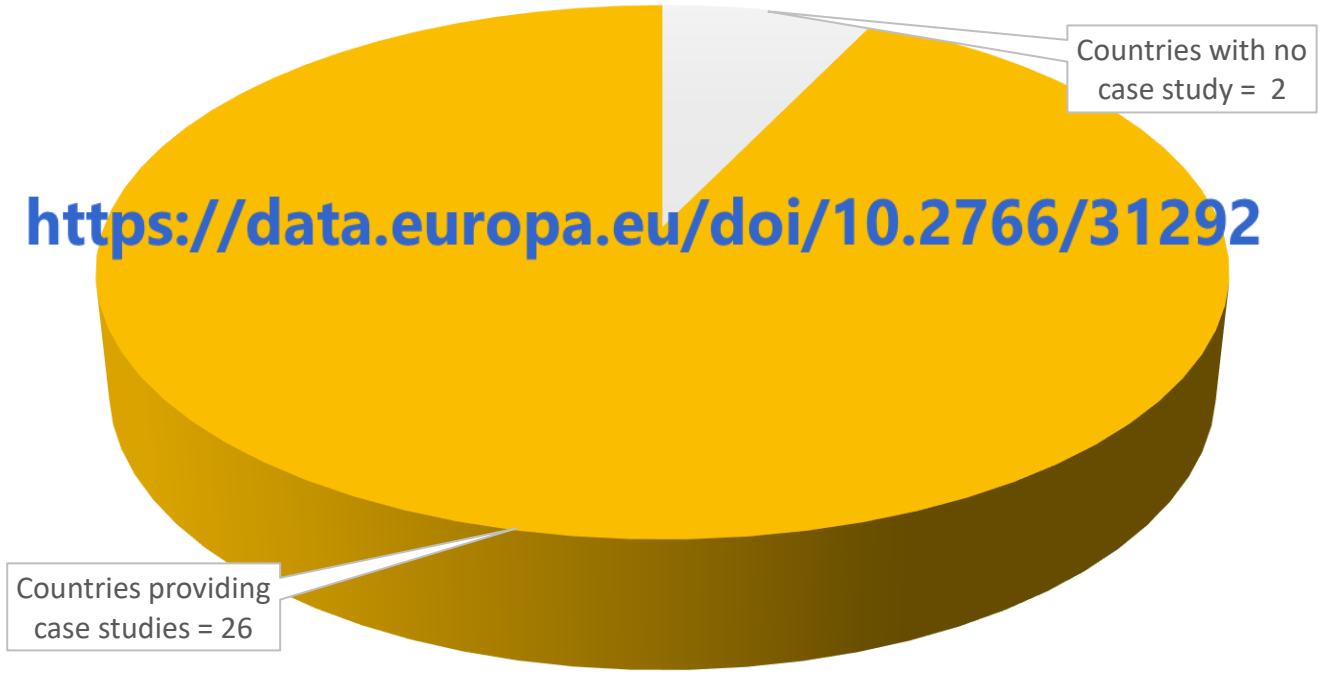
Cultural landscape

Indoor and movable heritage



83 Good practice examples from Europe what cultural heritage can contribute to fight against the climate crisis!

- a source of inspiration and for up-scaling and economic development of handcraft SMEs – that will not disappear with Artificial intelligence
  - driven by research projects
  - extremely difficult to collect the information



https://data.europa.eu/doi/10.2766/31292

Adaptation and Mitigation – traditional knowledge and regulation

- **TRADITIONAL AIR WELL SYSTEM – AT.**

EVALUATION OF AN AIR COOLING SYSTEM FROM 19TH CENTURY.

To evaluate the effectiveness of the 'old' air well system. To evaluate minimal-invasive options to optimize the reduction of heat in the auditorium and CO_2 saving

Roof of the Burgtheater in Vienna

- **SAFEGUARD AND ENHANCEMENT PLAN – FR.**

City of Bordeaux: URBAN PLANNING REGULATIONS - CHANGES IN THE CITY TO COMBAT CC, WHILE MAINTAINING THE REQUIREMENTS OF THE URBAN HERITAGE

Practical measures:
thermal insulation of buildings and revegetation of court yards to fight urban heat, maintaining biodiversity, wellbeing and health improved, incorporating the needs of the residents. Further example Strasbourg, whose completion is scheduled for 2022. The objective is to no longer pit architectural heritage against sustainable development and to combine its preservation with climatic issues.

https://www.youtube.com/watch?v=CNKSwTTbVWg (in French)

Greening in World Heritage City Bordeaux

Adaptation and mitigation – cultural landscapes and intangible heritage

- **Alpe Pedroria and Alpe Madrera – IT.**

Restoration agricultural landscapes and traditional huts in the Alpine region of Lombardia to increase the resilience and function as carbon sinks

Measures:

- Recovery of pastureland began in 2014 (7 % of the original pastureland),
- Restoration of wooden huts, stone houses and paths
- Revitalisation of traditional production of Bitto cheese by returning of pasture and livestock
- Repopulation of animal species in danger of extinction

Impact:

- Renewed awareness in the local community, starting with the youngest, of the importance of the pastoral activity and culture and of the recovery of abandoned pastures.
- Promotion and enhancement of the intangible heritage
- Original Alpine Brown and the Orobica goats were reintroduced.
- **Grasslands (pastures) act again as net carbon dioxide**
- **Grasslands continue to store carbon even during extreme drought simulations.**

Alpe Pedroria, restored stone house in the mountains

Adaptation and mitigation – solving both climate crisis and housing crisis

- **Green is not only a colour – sustainable buildings already exist - NO.**

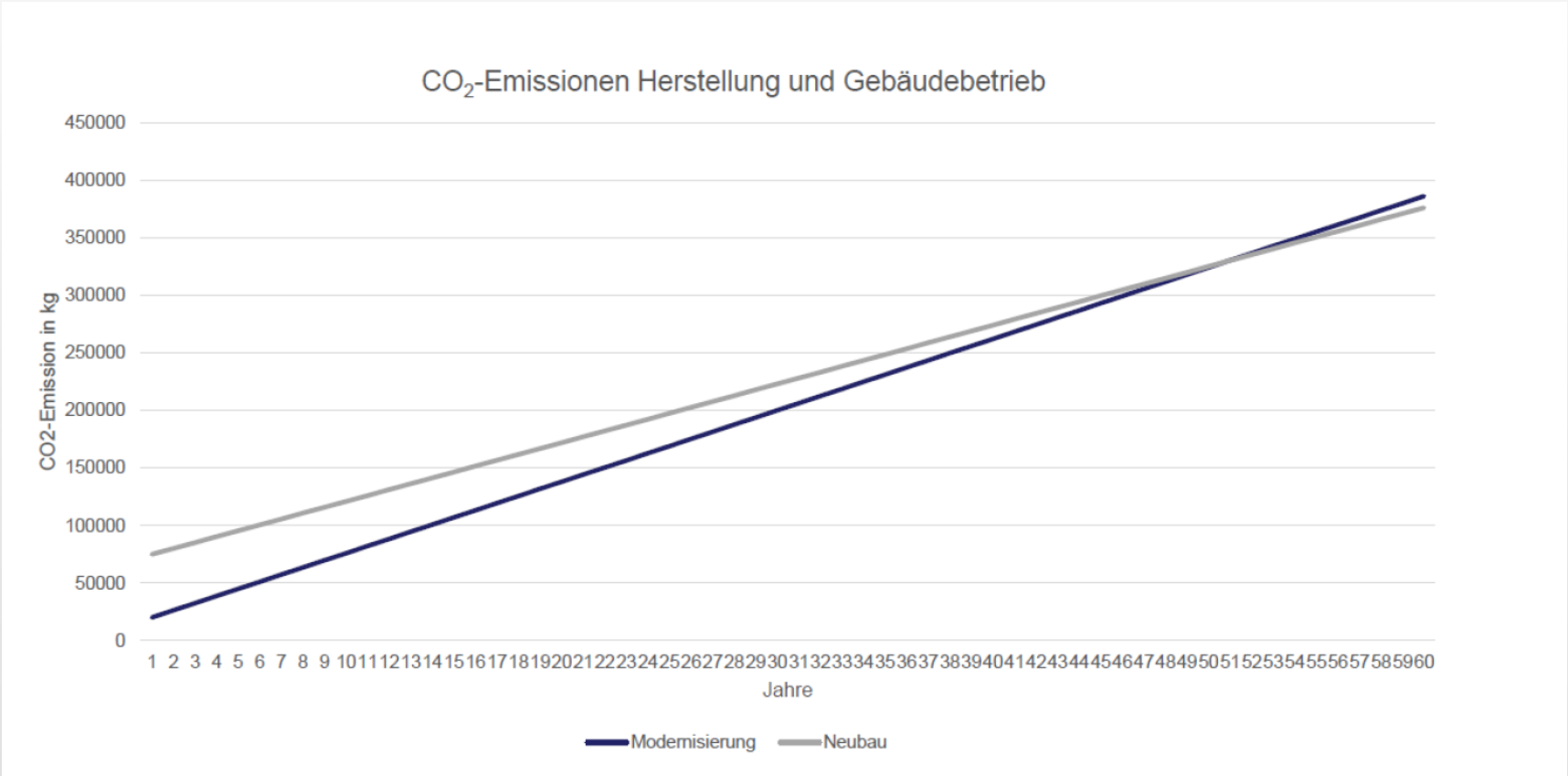
EXPLORE WHETHER AND HOW CLIMATE GOALS CORRESPOND TO GOALS FOR THE PROTECTION OF CH BUILDINGS AND WHAT ROLE BUILDINGS AND PROTECTION CAN HAVE AS CC MITIGATION MEASURE.

14 assessed buildings are of varying age, size, architecture and construction method. All have different conservation values based on age, representativeness, architectural design and cultural heritage context.
A comparison of investment costs for the various scenarios shows that the cost of upgrading is lower than of constructing a new building for 20 of the 24 building cases, and significantly lower for 15 of 24 cases. Looking at emissions reductions per invested amount, the results indicate that upgrading is more cost-effective than new construction, if the aim is to reduce greenhouse gas emissions.

A residential building originally from the 18th century.
@Innlandet fylkeskommune

Upgrading old buildings vs demolition and new energy efficient buildings

One example from Bavaria (Dipl.Ing Klaus-Jürgen Edelhäuser)



- Break even point only reached after 52 years

Adaptation and mitigation – natural and cultural heritage in one hand

- **CLIMATE NEUTRAL CASTLE DYCK AND HISTORIC PARKS – DE.**

DEVELOPMENT AND TESTING OF INNOVATIVE AND TRANSFERABLE SOLUTIONS FOR PARKS AND GREEN SPACES AFFECTED BY CLIMATE CHANGE AND FOR THE CLIMATE-NEUTRAL OPERATION OF LISTED BUILDING COMPLEXES

Castle Dyck surrounded by an English Landscape Park, created 200 years ago and covers around 50 hectares
Hit by heat and drought and decrease of groundwater level – 200 trees had to be felled

Measures:
the testing of climate-resilient tree species,
innovative maintenance of trees and soil improvement,
new irrigation systems and the promotion of biodiversity
Castle building complex will be climate-neutral by 2025 by:
the use of Chinese reed as a renewable raw material in a glass heating plant, photovoltaic systems and the electrical operation of machinery and equipment

Goal:
around 80 % of the heating capacity is to be operated using self-produced renewable raw materials and
around 20 % of the electricity is to be self-produced by 2025

Castle Dyck and historic park @Jens Spanjer

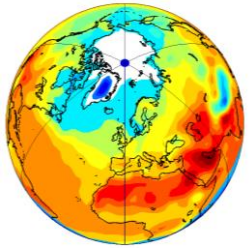
Examples from Research

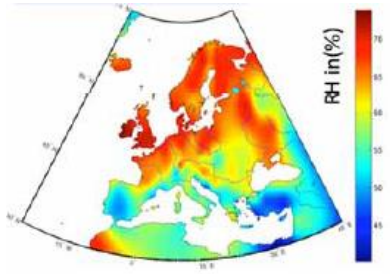
Climate for Culture

2009 – 2014 / 29 partners from 16 EU countries

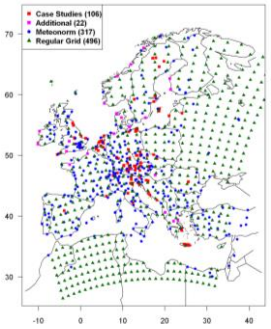
High resolution regional climate model 10 x10 km coupled with whole building simulation

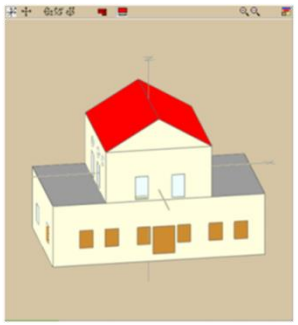
Impacts on **indoor heritage** and future energy demand





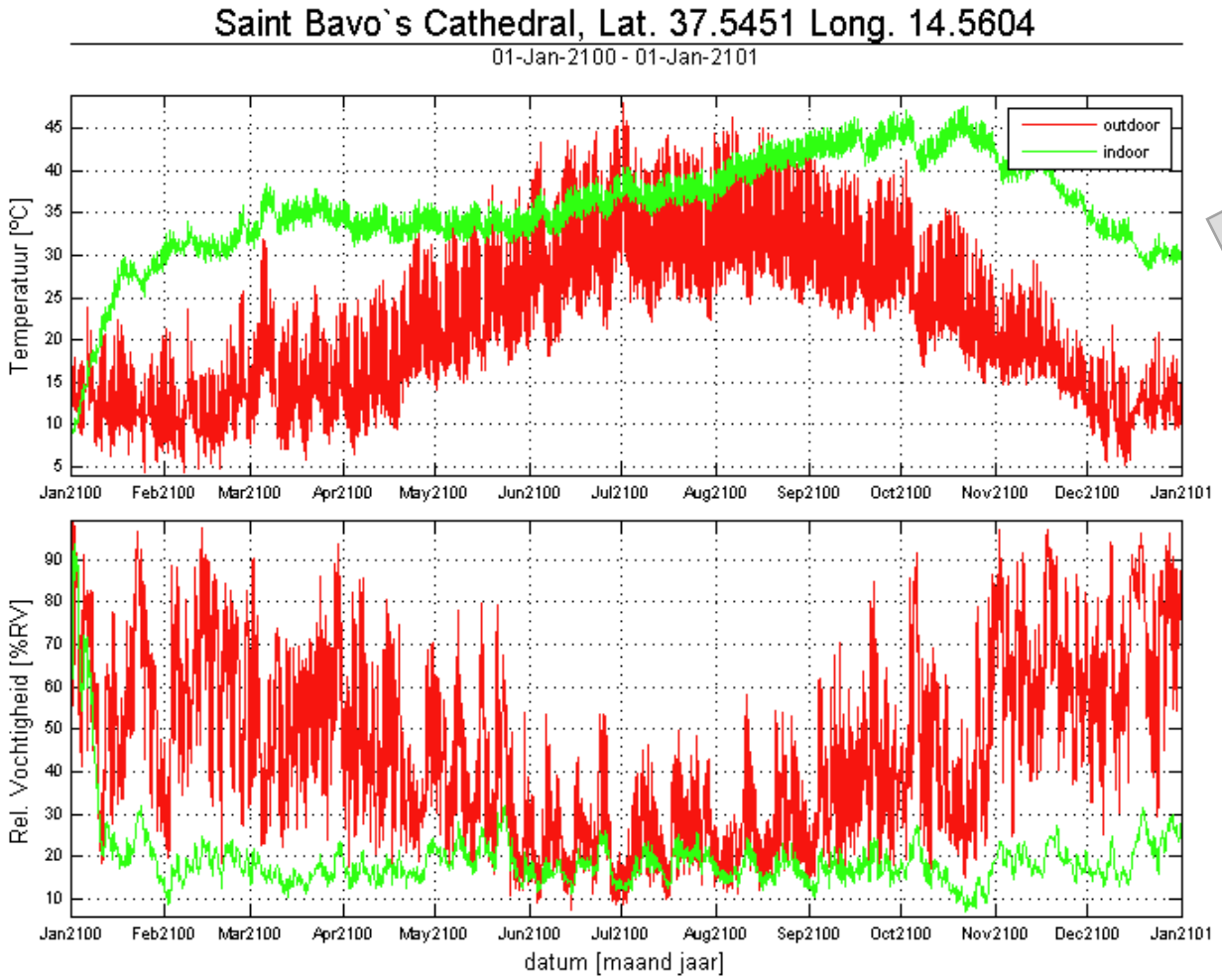
2100
?





Indoor climate in St. Bavo, Ghent, Belgium in 2100

Moderate emission scenario RCP 4.5



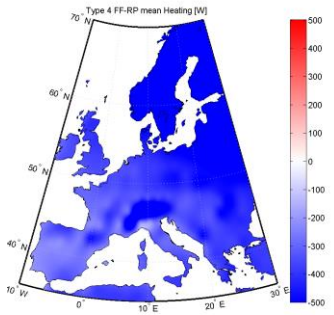
40 - 45 °C
in summer
Inside the
building

Climate for Culture

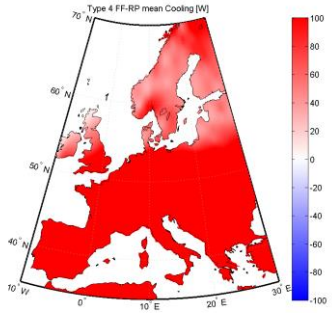
Contribution to Green Deal – Renovation wave
Future energy demand for heritage buildings

changes from Recent Past (1960-1990) to Far Future (2070-2100)

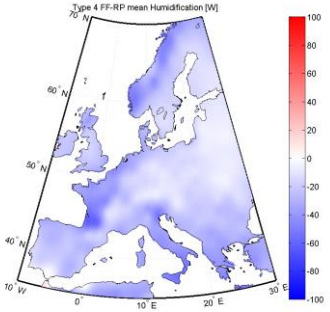
Heating



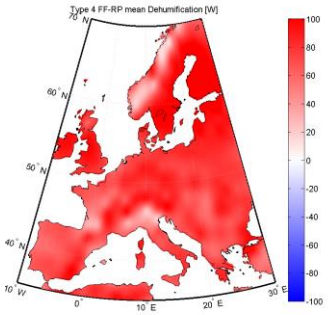
Cooling



Humidification



Dehumidification



Expensive and not yet climate neutral

Climate for Culture

Some key messages from the 10 recommendations

- **Cultural Heritage is threatened by climate change in an unprecedented speed and scale**.
- Adaptation and mitigation must be implemented
- Maladaptation to climate change impacts are a new threat to cultural heritage
- At the same time **cultural heritage offers solutions and inspirations to the climate crisis**
- **Cultural Heritage and Climate Change** needs to be considered in **all policies** and **planning decisions** (ministries of finances, economy, environment, spatial planning, mobility and culture) on all levels
- **Cross-sectorial cooperation on all levels** needs to be enhanced
- **Research** programmes are **the indispensable drivers** for implementation and are **missing mainly on national level**
- **National authorities** must build capacities and start planning - training and **upskilling of experts** is central (will not being replaced by AI/robots)
- The collection of 83 **best practice examples** shows that traditional buildings or the art of making dry stone walls are sustainable & climate friendly. **It is more climate friendly to repair than to demolish**
- **National/regional and local level decision** makers must incentivise by **monetary and fiscal policies** – no data about the economic costs for adaptation and mitigation of cultural heritage are available
- There is a need for a **common platform (central entry point)** at EU and national level to collect all relevant information


Dry stone walling


Demolition of buildings


Traditional farm houses


Orthodox church


Skokloster Castle

Thank YOU

Protecting our Cultural Heritage will help solve the Climate Crisis

Download of report under:

doi.org/10.2766/44688

KERES – Protecting cultural heritage in Germany from extreme climate events

Source : Wiki Commons

Source : Rictor Norton, Wiki Commons

Source : Wiki Commons

Source : Freilandmuseum Bad Windsheim

Source Fraunhofer IBP, Ralf Kilian

Investigation of the effect of extreme weather events

- Heat and drought episodes
- Heavy precipitation,
- Strong winds
- Long lasting weather periods
- Sea level rise and storm floods

Use of simulations to predict future climate conditions

- Vulnerability of buildings & parks
- High-Resolution urban climate models
- Hygrothermal building simulations
- Adaptation strategies / prevention
- Ontological knowledge platform

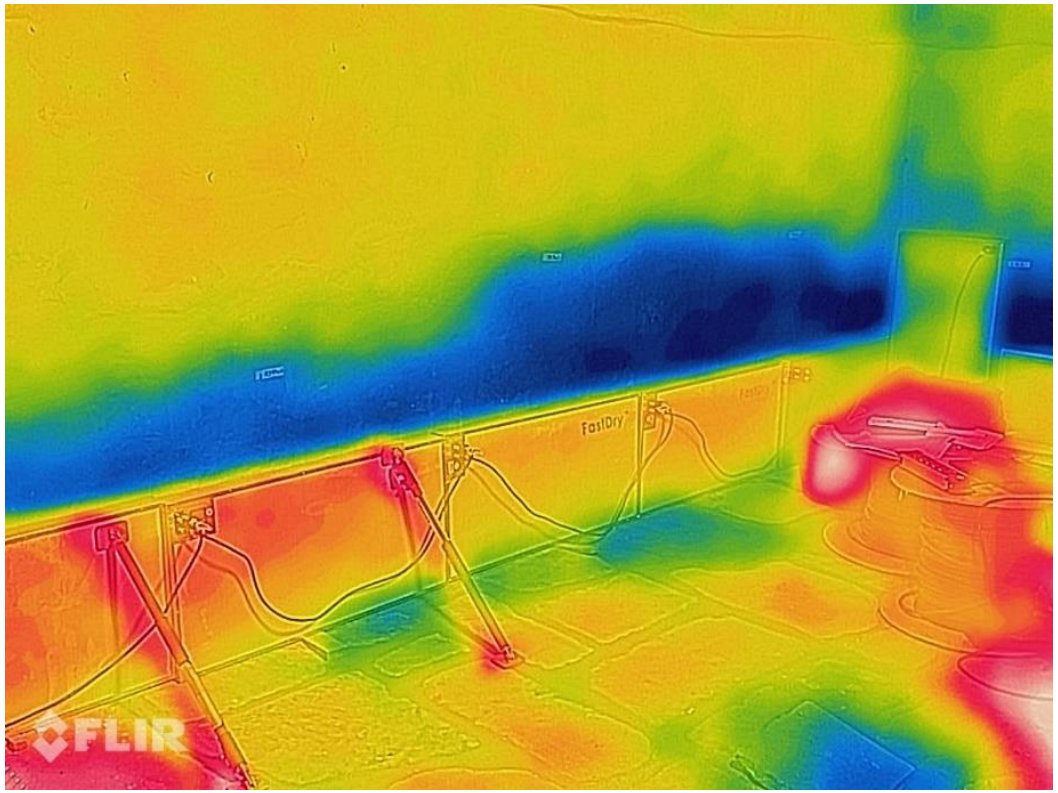
KERES

Open air museum Bad Windsheim – flooding on 9 July 2021

Open air museum Bad Windsheim – flooding on 9 July 2021

Problem: extremely wet walls, immediate mould growth
Testing of an innovation from Fraunhofer : FastDry wall systems
Advantages: 80% energy saving compared to industrial dry heat blowers, low noise production, scavenging pollutants released from the wet walls

Fast Dry wall systems by Fraunhofer – successful testing on site



Frauenberg Chapel in Sufferloh in Bavaria

Geography: Southern Bavaria, Alpine foothills

Origin: 18th century, simple stone masonry with gypsum plaster
The Frauenberg chapel in Sufferloh with its small baroque gable roof dates back to the first half of the 18th century is located in southern Germany, in the County Miesbach in Bavaria with partly original interior. It is an important pilgrimage site for the local people.

Climate: Central European transitional climate with cooler average temperatures and high rainfall in winter and spring, heavy rainfall events

Problems: extreme wetness due to wind driven rain, mould growth, Moisture problems inside and outside, shortened renovation cycles.

Frauenberg Chapel in Sufferloh

- Extremely humid indoor climate
- The moisture content of the west wall is higher in the upper area than at the base below
  - The source of humidity is rain, not rising damp!

    Resulting in extremely high indoor air humidity.
  - Summer condensation contributes to algae formation inside.
  - High moisture absorption of the exterior plaster (W-value)
- Renewed renovation (2019)
  - New plaster and paint on the facade with low W-value
  - **The original historic plaster material was not suitable for the future climate conditions!**
  - Electrical pedestral tempering – now high energy costs
- Continuous monitoring since August 2021

Source Fraunhofer IBP, Ralf Kilian