

Interreg

CENTRAL EUROPE

ProteCHt2save



European Union
European Regional
Development Fund

TAKING
COOPERATION
FORWARD



Managing the Protection of Cultural Heritage in Changing Environment
Prague, Municipal House, 27 June 2019



ProteCHt2save - Risk Assessment and Sustainable Protection of Cultural Heritage in Changing Environment



Alessandra Bonazza/Institute of Atmospheric Sciences and Climate (ISAC-CNR)

Cultural Heritage at Risk

Black crust on Carrara
Marble - Milan
Cathedral



Flooding due to heavy
rain - Ferrara
Cathedral



Flood – Troja - Prague



Megalithic Temples,
Malta



Risk Assessment and sustainable protection of Cultural Heritage in changing environment



The degree of equality in a society may also be treated as a value that belongs to a society as a whole, rather than to any of the individuals who make up the society. Various measures of this value are available, including the Gini coefficient and the Atkinson measure (Gini, 1912; Atkinson, 1970); for an assessment see (Sen, 1973). Section 3.5 explains that the value of equality can alternatively be treated as a feature of the aggregation of individual people's wellbeings, rather than as social value separate from wellbeing.

3.4.3 Wellbeing

Most policy concerned with climate change aims ultimately at making the world better for people to live in. That is to say, it aims to promote people's wellbeing. A person's wellbeing, as the term is used here, includes everything that is good or bad for the person—everything that contributes to making their life go well or badly. What things are those—what constitutes a person's wellbeing? This question has been the subject of an extensive literature since ancient times.⁸ One view is that a person's wellbeing is the satisfaction of their preferences. Another is that it consists in good feelings such as pleasure. A third is that wellbeing consists in possessing the ordinary good things of life, such as health, wealth, a long life, and participating well in a

too (Dervis and Klugman, 2011). In the context of climate change, many different metrics of value are intended to measure particular components of wellbeing: among them are the numbers of people at risk from hunger, infectious diseases, coastal flooding, or water scarcity. These metrics may be combined to create a more general measure. Schneider et al. (2000) advocates the use of a suite of five metrics: (1) monetary loss, (2) loss of life, (3) **quality of life (taking account of forced migration, conflict over resources, cultural diversity, and loss of cultural heritage sites)**, (4) species or biodiversity loss, and (5) distribution and equity.

3.4.4 Aggregation of wellbeing

Whatever wellbeing consists of, policy-making must take into account the wellbeing of everyone in the society. So the wellbeings of different people have somehow to be aggregated together. How do they combine to make up an aggregate value of wellbeing for a society as a whole? Social choice theory takes up this problem (Arrow, 1963; Sen, 1970). Section 3.6 will explain that the aim of economic valuation is to measure aggregate wellbeing.

Assume that each person has a level of wellbeing at each time they are alive, and call this their 'temporal wellbeing' at that time. In a society, temporal wellbeing is distributed across times and across the people.



This text is the version of the final government draft from June 2018

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

Climate Change - Resilience strengthening and risk management

International Level

Hyogo Framework for Action 2005 – 2015

The disaster risks for the cultural heritage was mentioned for the first time, in section 3, “Use knowledge, innovation and education to build a culture of safety and resilience at all levels”, “Key activities”.

Strategy for Risk Reduction at World Heritage Properties

Presented by UNESCO and approved by the World Heritage Committee in 2007 . According to the five main objectives defined by the Hyogo Framework for Action, the priority measures of the Strategy have been structured.

Sendai Framework for Action 2015 – 2030

The new international Disaster Risk Reduction policy includes several important references for the protection of culture and heritage from disaster risks.

Cultural heritage as an incentive for enhancing the reduction of the impact of catastrophic events

Protection and enhancement of natural and cultural heritage in support of socio-economic development and sustainable tourism

Priority 1. Understanding disaster risk

KNOWLEDGE (National and local levels)

Paragraph 24(d)**understand****cultural heritage impacts**, in the context of event-specific hazard-exposure and vulnerability information.

Priority 2. Strengthening disaster risk governance

Priority 3. Investing in disaster risk reduction for resilience

PUBLIC/PRIVATE STRUCTURAL/NON MEASURES (National and local levels)

Paragraph 30 (d) To **protect or support the protection** of cultural and collecting institutions and other sites of historical, **cultural heritage** and religious interest.

Priority 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction

Action Plan: Key Area 4 – Supporting the development of a holistic disasters risk management approach

Develop good practices on the integration of **cultural heritage in the national disaster risk reduction strategies** to be developed by EU Member States.



Resilience strengthening and risk management – National/LOCAL Level

FRANCE

National Climate Change Adaptation - Emerging Practices in Monitoring and Evaluation, the French National Adaptation Strategy, adopted in 2006, identifies four overarching goals to be considered in national planning processes. The 4th is *to preserve French natural heritage*. Plan national d'adaptation de la France aux effets du changement climatique 2011 – 2015.

ITALY

In 2014 three technical-scientific documents were published supporting the “Strategia Nazionale di Adattamento ai Cambiamenti Climatici (SNAC)” adopted by the Ministry of Environment and including cultural heritage as one of the priority sectors.



MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

Stones/Bricks/Mortars
(Out)

- Surface Recession
- Blackening/ Soiling
- Thermal Stress
- Frost Weathering
- Salt Crystallization
- Biodegradation

Wood
(In/Out)

- Mechanical Damage
- Fungal Growth

Metals
(Out)

- Corrosion (T+SO₂, Steel/Bronze)
- Corrosion (T+Cl⁻, Zinc/Lead/Copper)

GUARDING HERITAGE FROM NATURAL HAZARDS



Climate change and other natural hazards pose a risk for cultural heritage assets and the people around them. ProteCHt2save is a project that works to protect the heritage and nearby populations - especially against the risk of floods. ProteCHt2save produces tools to help local officials manage risks and develop action plans for emergencies.

www.interreg-central.eu/culture



AUSTRIA	Niederösterreich
CROATIA	Jadranska Hrvatska
CZECH REPUBLIC	Praha
HUNGARY	Dél-Dunántúl
ITALY	Emilia-Romagna
POLAND	Śląskie
SLOVENIA	Vzhodna Slovenija



PROJECT BUDGET
2.15
MILLION €

ERDF FUNDING
1.79
MILLION €

- *Defining risk areas for an improved protection and sustainable use of CH in Central Europe susceptible to disasters and climate change impacts.*
- *Determining critical elements for CH vulnerability in the resilience and risk management process.*
- *Setting up of transnational best practices and common strategies for sustainable use and protection of CH to be integrated in joint action plans in a changing environment.*

Extreme Events
Flood
Heavy Rain
Drought periods (Fire)

**Cultural Heritage
Categories**
*Monumental complexes with
related collections located in
urban areas*



PROJECT STRUCTURE



photos: Miloš Drdácý, Danube University Krems, Mein Bezirk



Climate models and downscaling

General Framework

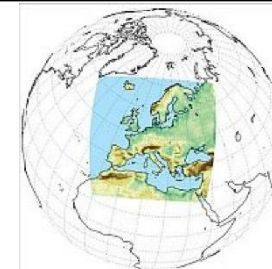
Regional Climate Models (RCMs)

10-50 km

ProteCHt2save

Euro-CORDEX (Coordinated Downscaling Experiment - European Domain) RCMs

- 0.11° lat-lon resolution (~12 km)
- Historical and future simulations
- Two future scenarios (RCP4.5 and RCP8.5)



Bias correction

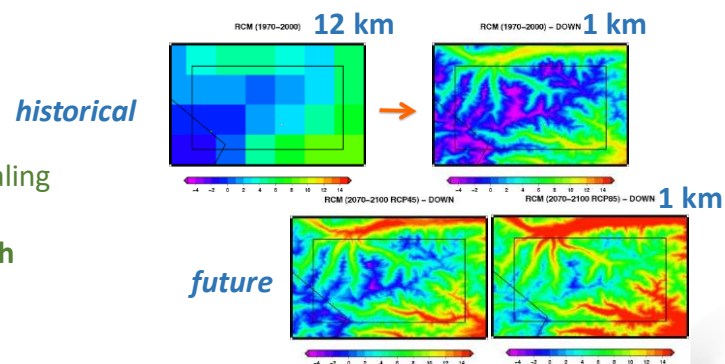
Station based reference dataset E-OBS (25 km), used for correcting the temperature and precipitation provided by the RCMs.

Downscaling

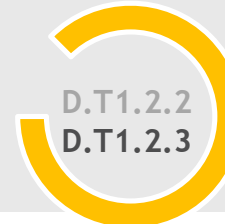
Statistic/Stochastic Downscaling

1 km

Use of the RainFARM downscaling technique: temperature and precipitation downscaling with orographic correction



Elaboration of maps with hot spots of extreme potential impacts on CH

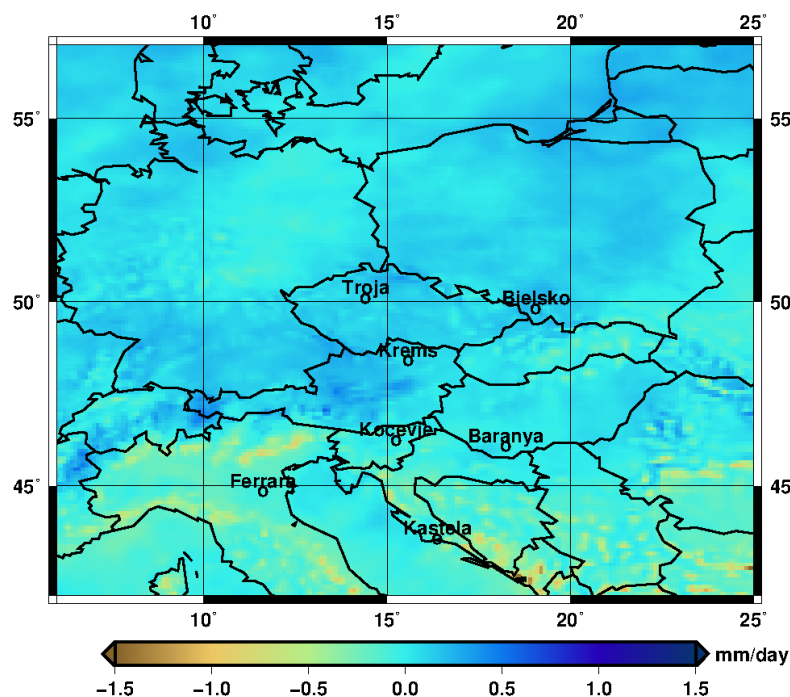


Changes in precipitation in (2071-2100) wrt (1976-2005) in Central Europe

RCP 4.5

Data source: RCA4 RCM (Euro-CORDEX)

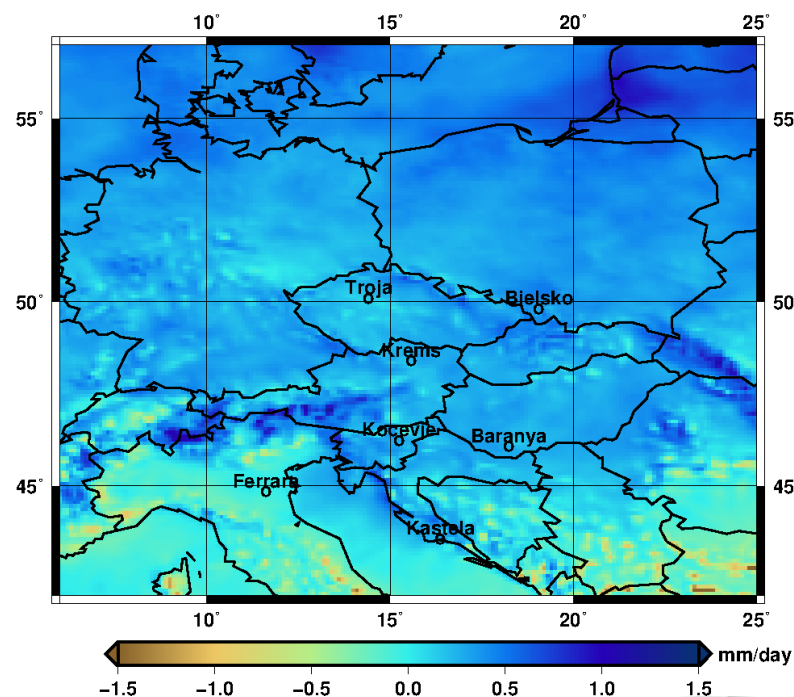
MPI-ESM-LR-RCA4 RR [2071-2100]-[1976-2005] RCP4.5



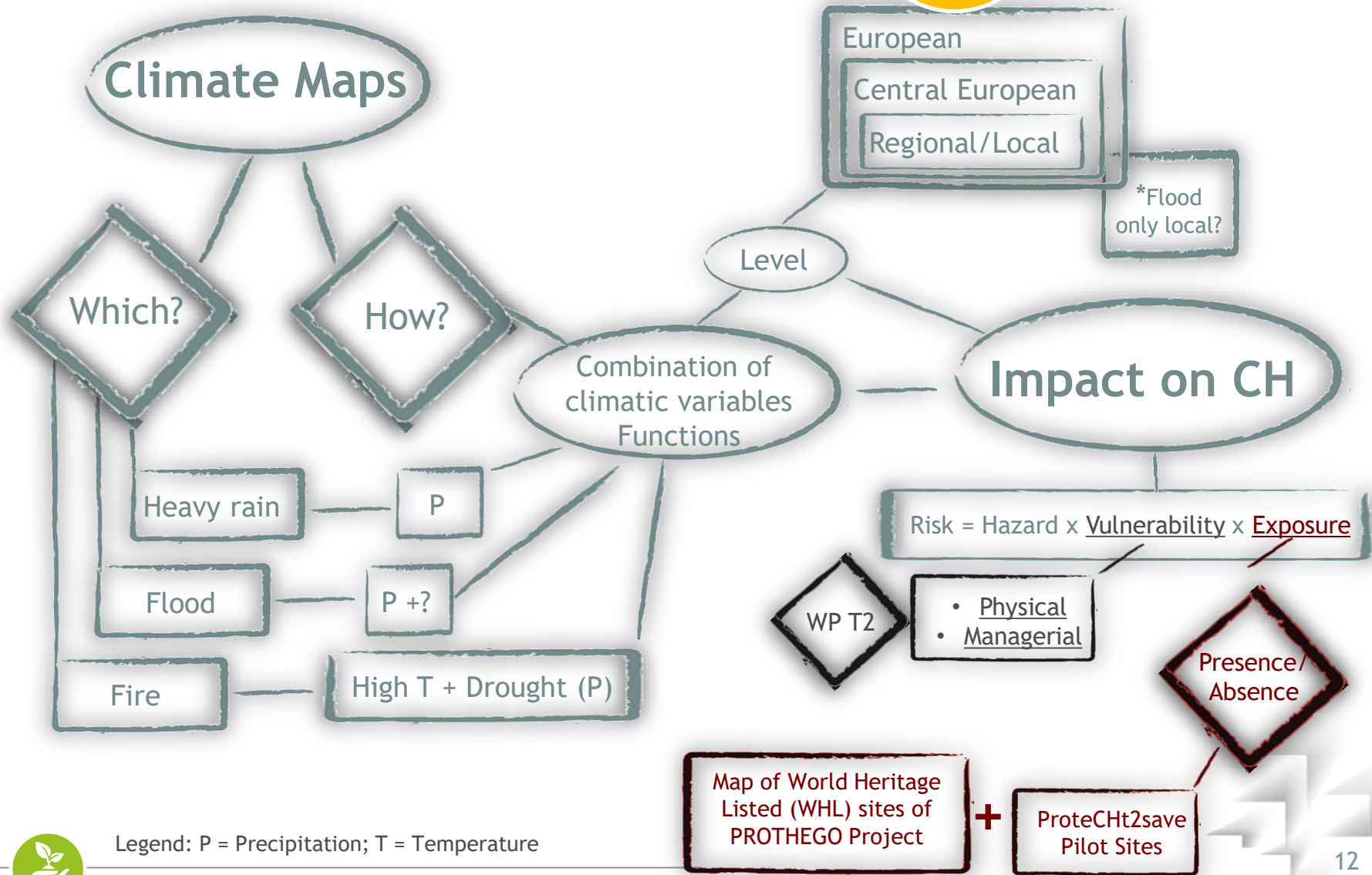
RCP 8.5

Data source: RCA4 RCM (Euro-CORDEX)

MPI-ESM-LR-RCA4 RR [2071-2100]-[1976-2005] RCP8.5



Development of map creator tool



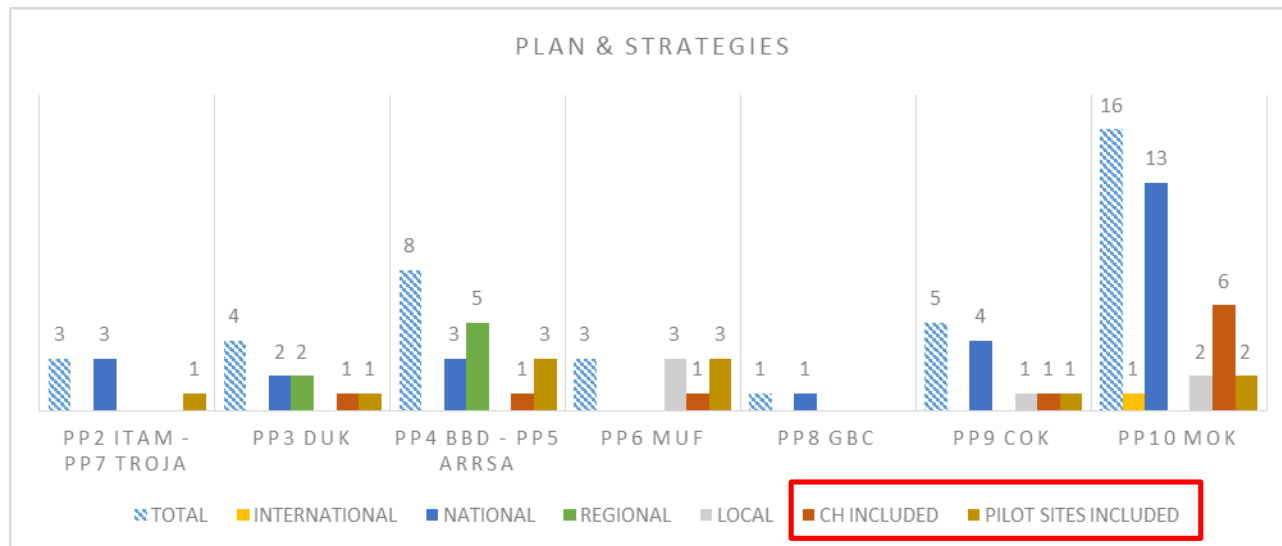
Legend: P = Precipitation; T = Temperature

Map of World Heritage Listed (WHL) sites of PROTHEGO Project + ProteCHt2save Pilot Sites
 (Files formats, readable by GIS: wms; shp; Google Earth)

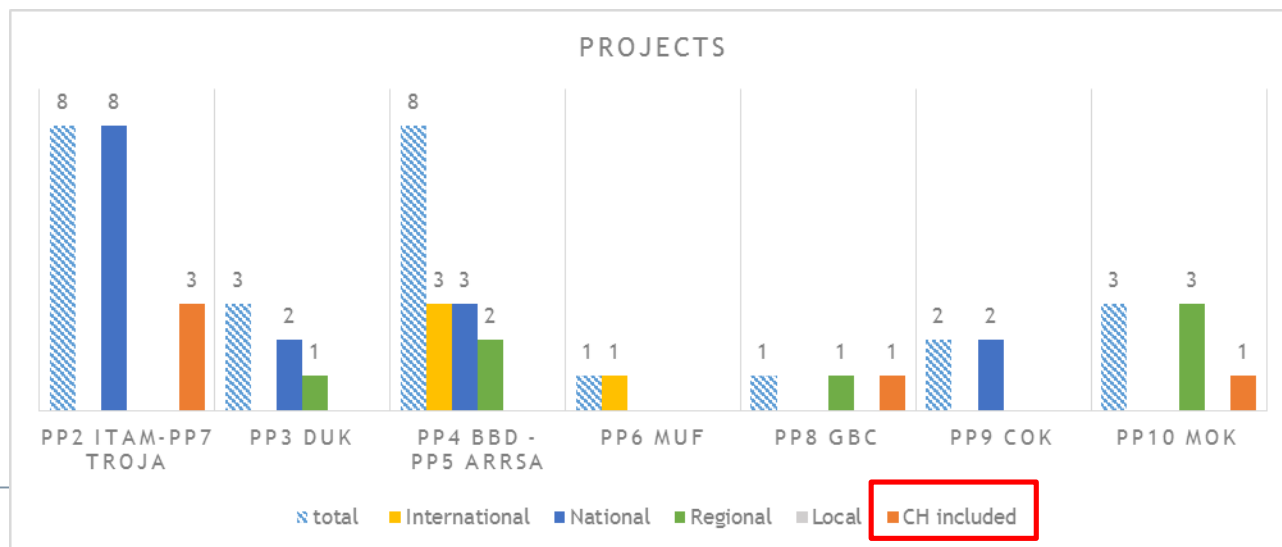
WP T1 - T2. CULTURAL HERITAGE VULNERABILITY PLANS/STRATEGIES

Plan & strategies

The number of plans and strategies including ProteCHt2save pilot sites are highlighted as well as those taking into consideration built heritage (Krems, Bielsko-Biala, Ferrara, Kastela and Kocevje)



Protection and recovery of built CH almost not included



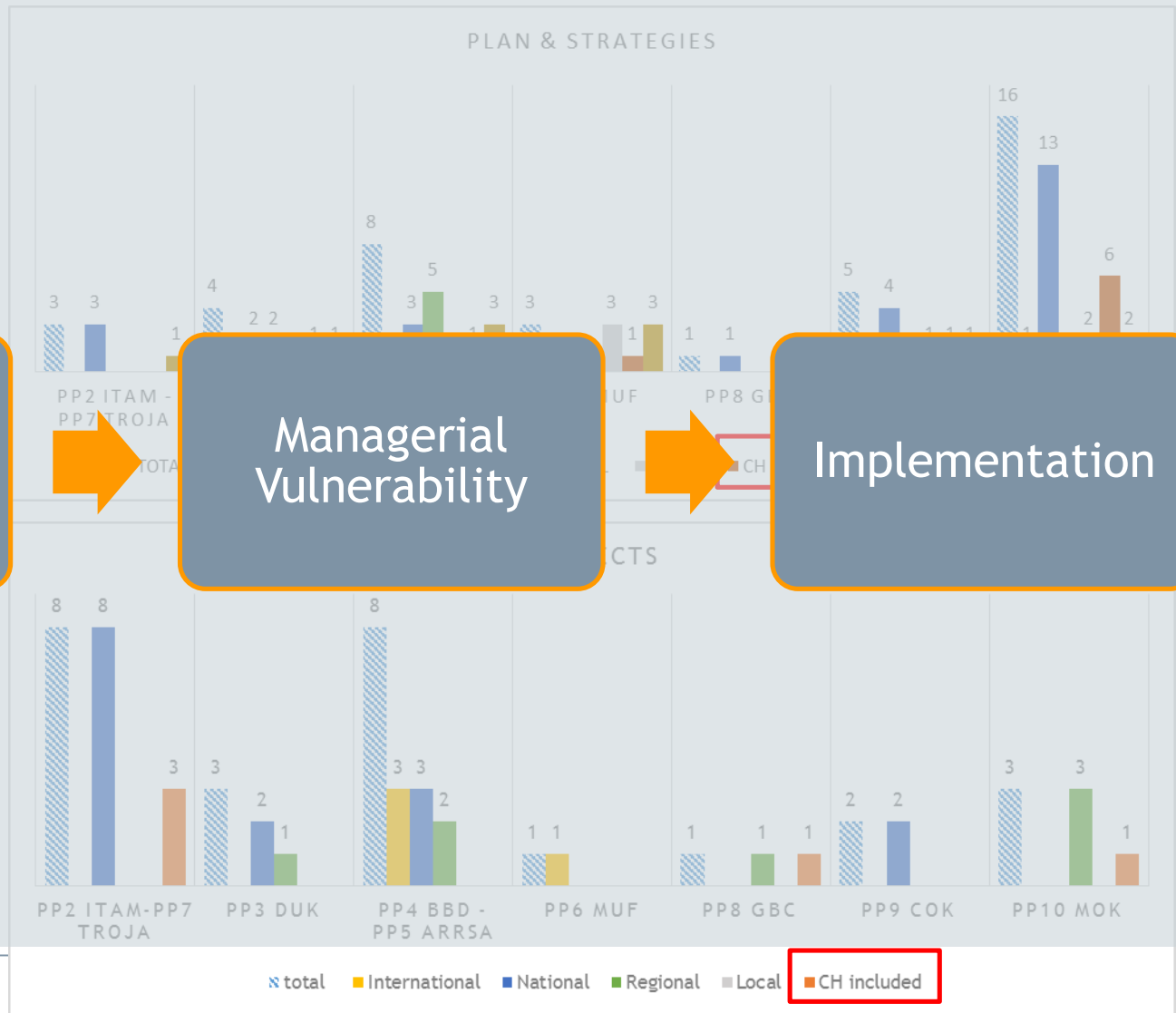
WPT1 - T2. CULTURAL HERITAGE VULNERABILITY PLANS/STRATEGIES

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Managerial Vulnerability

Implementation



CONTENTS

A. T2.1 Identification of the critical elements in the resilience and risk management of cultural heritage.

- Deliverable D.T2.1.1: Identification of barriers/challenges.
- Deliverable D.T2.1.2: Definition of transnational concept.
- Deliverable D.T2.1.3: Decision support tool.

A. T2.2 Critical analysis of local vulnerability and measures in emergency situations for cultural heritage.

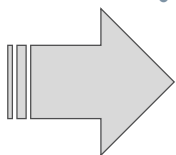
- Deliverable D.T2.2.1: Manual of good and bad practices.
- Deliverable D.T2.2.2: Resilience controllable criticalities.



FINDINGS

➤ Concept of CRITICALITY (managerial & physical)

- Definition based on transnational challenges and barriers.
- Assessment and evaluation criteria.



❖ Guide for managers (Decision Support Tool) **OUTPUT**

➤ RESILIENCE BUILDING measures

- Specific to Central Europe CH assests.
- Selected hazards (heavy rain, fire due to drought and floods)
- Emergency situations

❖ Manual of good and bad practices **OUTPUT**





Rank	Type	Vulnerability	Examples	Preventive measures and priorities
Inf0	Complete description of CH asset exists and is available to all stakeholders involved	No major vulnerability issues. Comprehensive risk management plans can be developed and appropriately shared	Data concerning CH assets are complete (maps, condition assessment of objects and records of contents), accessible to all relevant stakeholders and up-to-date	Regular inspection of assets is required on periodic basis to keep risk management plan up-to-date; Regular maintenance is also necessary to ensure conditions of the asset
Inf1	Partial or complete data existing but not available to stakeholders	Loss might be expected particularly during rescue activities when handling, transportation and storage requirements are not accessible	Examples include information concerning moveable heritage such as collections and artefacts in a museum are not available to rescue units	Records of moveable heritage stored in buildings with data on their location and description for evacuation purposes; Digitalization of CH related data; Integration of existing databases
Inf2	Only partial, not up-to-date or incomplete information exist	Damage is expected to the CH object and its contents. Failure of structural components and loss of moveable objects can occur due to incorrect, missing or not valid information	Maps and databases related to CH assets present in a specific area exist however significant information is missing or invalid due to changes in time of asset vulnerability or hazard level	Regular inspection identifying and marking stock at risk through mapping; Damage assessment and evaluation; Records of moveable heritage stored in buildings
Inf3	No information about cultural heritage assets (all or one of the following: location, conditions, contents)	Different levels of damage from minor to collapse can occur even in the case of actions of minor intensity. Lack of information can seriously affect the proper determination of safety against natural disaster or weather effects (e.g. in case of weather induced degradation of mechanical properties of material load bearing capacity might be overestimated)	No mapping of CH assets present in a risk-prone area is available. Unknown structural and material conditions of assets. No data concerning valuable contents of buildings are known.	Regular inspection and repair of found deficiencies; Identifying and marking stock at risk through mapping; Damage assessment and evaluation; Records of moveable heritage stored in buildings; Digitalization of CH related data; Integration of existing databases

SPECIFIC RECOMMENDATIONS & GUIDELINES

GENERAL MANAGERIAL CRITICAL ELEMENTS

Produced utilizing the works developed within the “Deliverable D.T2.1.3 Decision support tool” by ITAM, the Deliverable D.T1.2.1 1. Risk Assessment of Cultural Heritage in Central Europe in Facing Extreme Events” and the EU publication “Safeguarding Cultural Heritage from Natural and Man-Made Disasters”



It is recommended that Regional and local Authorities be reminded that:



Promoting the **POLITICAL, SOCIAL, ECONOMIC AND CULTURAL RESILIENCE** of local communities facing the impact of climate

GOOD PRACTICES and **REGIONAL GUIDELINES** in Disaster Risk Reduction (DRR) and Management for Culture Heritage should be exchanged across all countries and regions (e.g. Historic Environment Scotland guides).

Cultural institutions should be encouraged to adopt **INTEGRATED CLIMATE MONITORING** with commonly agreed prioritised parameters.



To enhance the **SOCIAL AWARENESS** on DRR

Encourage municipalities, in collaboration with competent authorities (e.g. Civil Protection, Fire Dept., Police), to organize and deliver easily understood **DISASTER PREPAREDNESS SEMINARS** for citizens.

IMPROVE CIVIL EDUCATION through specific programmes to inform school children.

TRANSLATE the **RESULTS** of **ACADEMIC RESEARCH** on climate change impact into pragmatic guidelines for stakeholders, including urban planners, conservation practitioners, cultural heritage owners and managers.

Enable the translation of academic research on climate change impact into **PRAGMATIC GUIDANCE** for use by urban planners, the full range of conservation practitioners, cultural heritage owners and managers.

EVALUATION AND MANAGEMENT OF EXTREME EVENTS EFFECTS

Climate Change

Produced utilizing the works developed within the “Deliverable D.T2.1.3 Decision support tool” by ITAM, the Deliverable D.T1.2.1 1. Risk Assessment of Cultural Heritage in Central Europe in Facing Extreme Events” and the EU publication “Safeguarding Cultural Heritage from Natural and Man-Made Disasters”

It is recommended that Operational Bodies and Owners be reminded that:



DEALING with identified **CLIMATE DRIVERS** causing deterioration is also dependant upon understanding the **SENSITIVITY** of the **MATERIALS** under attack, and the environmental context in which the heritage asset is located.



In the **ASSESSMENT PROCESS**:

ESTABLISHING **PRIORITIES** in relation to the **CONSERVATION NEEDS** of artefacts and assets should be considered in response to understanding the full effects of related climate change influences.

Any **CONSERVATION ACTIONS** also need to be considered in relation to prevalent climate conditions.



Adopting **CONTINUOUS ENVIRONMENTAL MONITORING** of prioritised climatic parameters close to the historic asset, and/or **PLANNING SPECIFIC CHECKING** of monthly or seasonal frequencies, can assist in defining risks in consequence of changing climatic effects.

EVALUATION AND MANAGEMENT OF EXTREME EVENTS EFFECTS

Climate Change

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MANUAL FOR CULTURAL HERITAGE MANAGERS MITIGATION AND ADAPTATION STRATEGIES



Fire

It is recommended that Regional and local Authorities be reminded that:



SECURING full **FIRE PROTECTION MEASURES** requires all involved to **UNDERSTAND** what constitutes **HISTORIC VALUE** and **SIGNIFICANCE**.



CENTRALLY PROVIDED pools of **POST-DISASTER PROTECTIVE EQUIPMENT** for preserving residual values and for preventing further collapsing should be accumulated.



Working with others could **REDUCE** the **NUMBER OF ABANDONED** or **VACANT HISTORIC BUILDINGS**, at specific risk from arson and to help **ENSURE RENOVATION** or **DEVELOPMENT WORK** takes into account their historic nature.



Affording greater powers to **ENFORCING BUILDING OWNERS** to carry out **RENOVATION WORK** could ensure empty buildings at risk from fire are returned to the market place.



Partial, as well as total **RECONSTRUCTION WORK**, should preferably be carried out with the **SAME MATERIALS** and **CONSTRUCTION TECHNOLOGIES** as the original.



FIRE RISK ANALYSIS of historic buildings should **DESCRIBE**, **ANALYSE** and **PROMOTE** their special characteristics, to specifically **EXPLORE** their **POTENTIAL WEAKNESS** to firespread through lack of compartmentation, interlinked voids and spaces.



Flood

It is recommended that Operational Bodies and Owners be reminded that:



Simple compliance with current legislation will not sufficiently protect buildings.



More can be achieved in a **PRE-PLANNED RISK ANALYSIS** and **PREVENTATIVE APPROACH** to ameliorate the consequences of a flood incident from occurring, by involving the production of:

A **MAINTENANCE HANDBOOK**



A **RISK MANAGEMENT PLAN**



APPROPRIATE INSURANCE COVERAGE



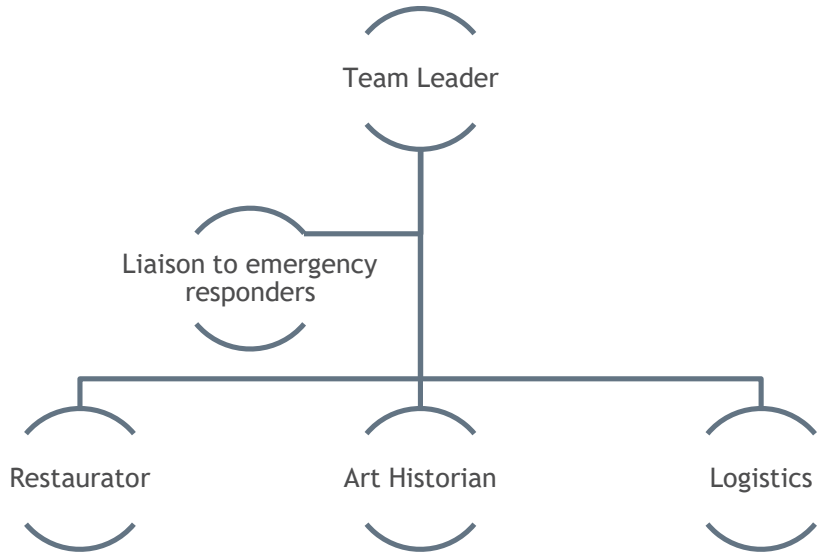
STAFF AND OCCUPANCY TRAINING



ADDITIONAL ACHIEVABLE PRACTICAL MEASURES



WP T3. CULTURAL HERITAGE RESCUE TEAM



WP T3. CHRT: VLTAVA RISING

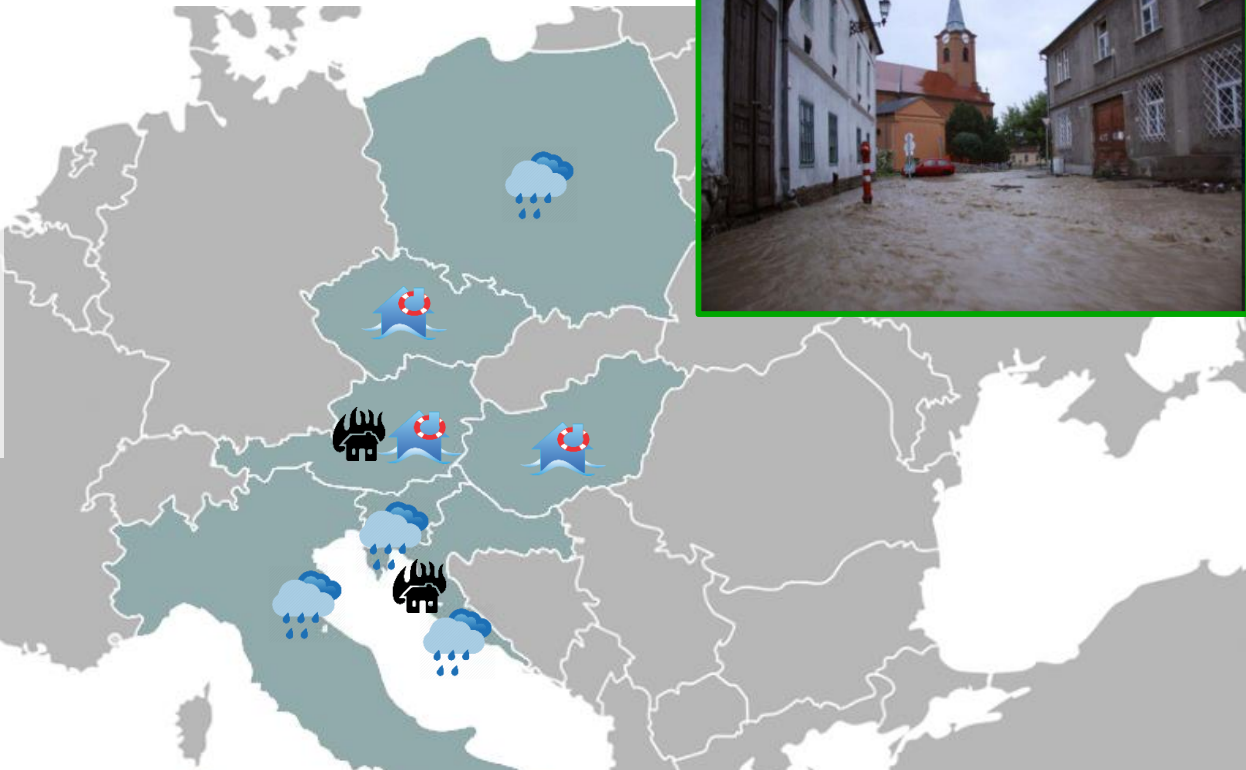





WPT4. PILOT SITES

7 pilot actions will be conducted linked to climate change and variability associated with hydrometeorological and climate extremes

Monumental Complexes/Museums

Preparedness strategies
Evacuation in emergency



-  Flood events in large basin
-  Fire due to drought
-  Extreme events of heavy rain





Thanks



Safeguarding Cultural Heritage from Natural and Man-Made Disasters

A comparative analysis of risk management in the EU



Creative Europe

<https://publications.europa.eu/>



UNISDR
United Nations Office for Disaster Risk Reduction

Connect and convince to reduce disaster impacts

WHO WE ARE | WHAT WE DO | WHERE WE WORK | WHO WE WORK WITH

HOME | WHAT WE DO | WE COORDINATE | SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION

Sendai Framework for Disaster Risk Reduction

MAKING THE DIFFERENCE FOR POVERTY, HEALTH AND RESILIENCE
The Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) is the first major agreement of the post-2015 development agenda, with seven targets and four priorities for action. It was endorsed by the UN General Assembly following the 2015 Third UN World Conference on Disaster Risk Reduction (WCDRR).

Download the full text of the Sendai Framework: [AR] [CH] [EN] [FR] [RU] [SP]

Third UN World Conference on Disaster Risk Reduction
The Sendai Framework was adopted by UN Member States on 18 March 2015 at the Third UN World Conference on Disaster Risk Reduction in Sendai City, Miyagi Prefecture, Japan. [Learn more](#)

The Sendai Framework is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders. It aims for the following outcome:
The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

The Sendai Framework is the successor instrument to the Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters. It is the outcome of stakeholder consultations initiated in March 2012 and inter-governmental negotiations held from July 2014 to March 2015, which were supported by the UNISDR upon the request of the UN General Assembly.

UNISDR has been tasked to support the following:

Download Chart of the Sendai Framework The Seven Global Targets

- (a) Substantially reduce global disaster mortality rate in the decade 2020-2030
- (b) Substantially reduce the number of people affected by disasters per 100,000 in the decade 2020 -2030
- (c) Reduce direct disaster economic loss in relation to global GDP
- (d) Substantially reduce disaster damage to critical infrastructure, including health and educational facilities, and essential services
- (e) Substantially increase the number of disaster risk reduction and emergency preparedness and response plans
- (f) Substantially enhance international support to complement their national disaster risk reduction strategies
- (g) Substantially increase the availability of disaster risk information and assessments to people, organizations and decision makers

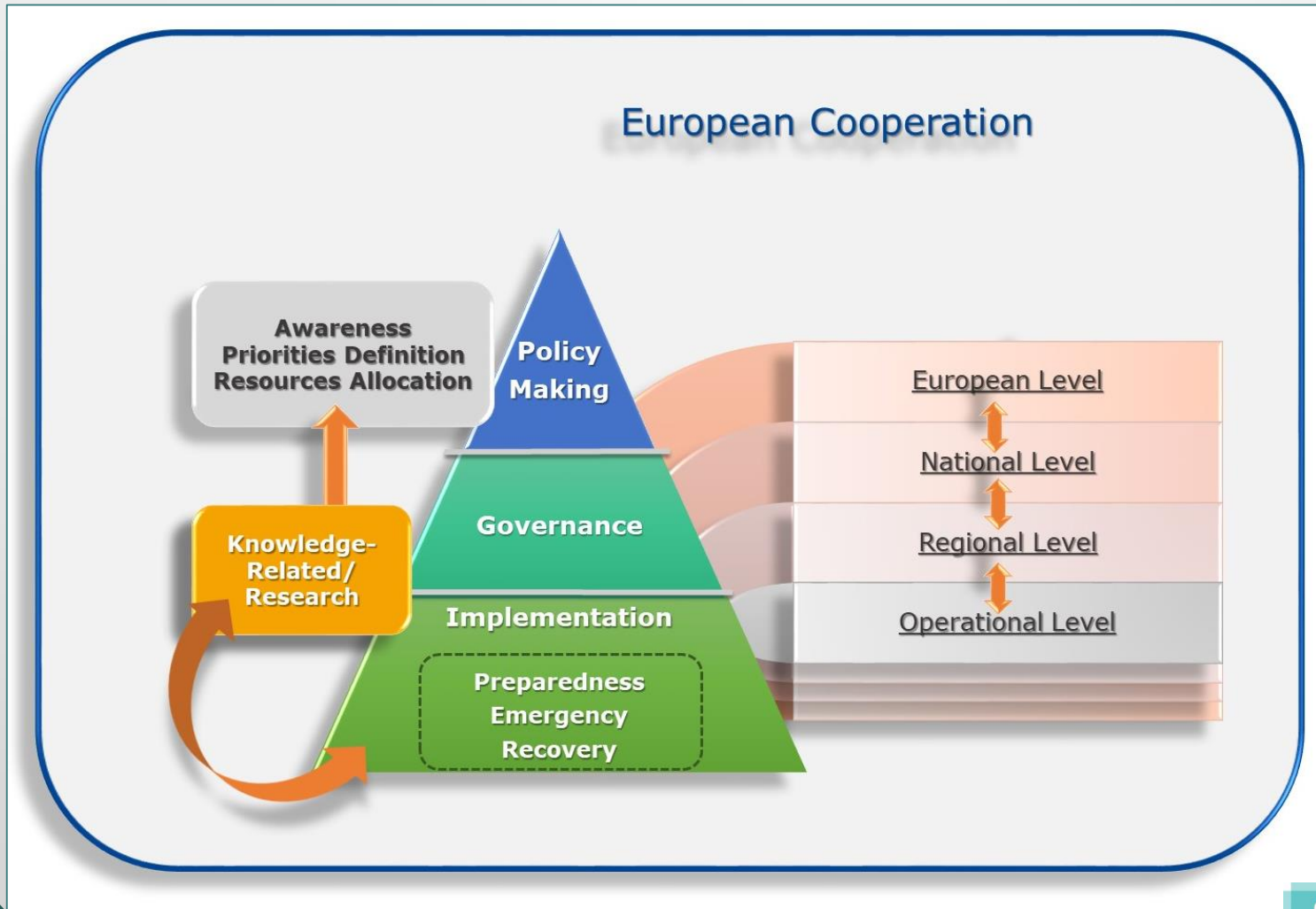
The Four Priorities for Action

Adopted by United Nations Member States in March 2015: is the basis for a *disasters risk-informed approach* to policy-making, offering a **coherent agenda** across different EU policies to strengthen resilience to risks and shocks and supporting the EU priorities of investment, competitiveness, research and innovation.

There is **need for focused action within and across sectors** by States at local, national, regional and global levels in the following four priority areas:



To maximise synergies between the political, administrative and operational levels in the field of disaster awareness an integrated approach is required.



Capitalisation of results/optimisation of resources/efficient communication flow

The analysis of changes in climate extremes, such as **dry spells or intense precipitation**, will exploit software tools which are being developed in the framework of the Copernicus C3S project MAGIC (C3S 34a lot2) by ISAC-CNR (<http://portal.c3s-magic.eu/>).

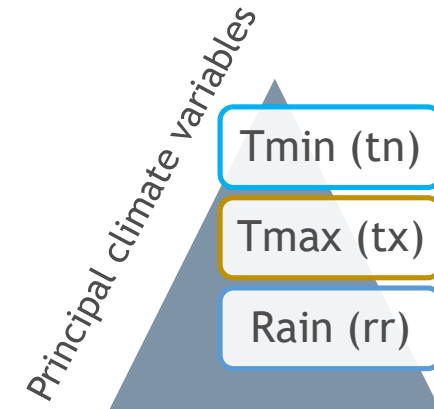
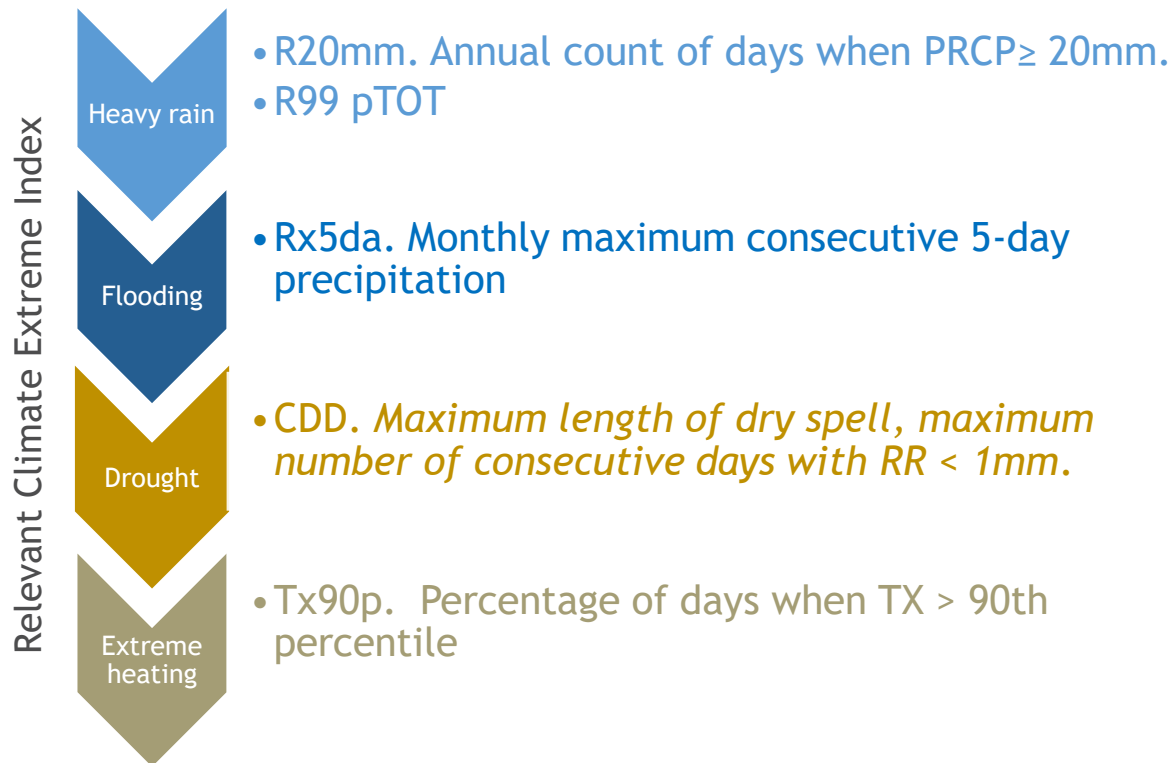
The tools are collected in an integrated software tool (ESMValTool) and provide indices to evaluate **statistics of extreme events for temperature and precipitation** and to compare with observed extremes. They implement standard indices defined by the Expert Team on Climate Change Detection Indices (**ETCCDI**) and other indices measuring hydroclimatic intensity.

Data from models will be used for the production of :

- i) maps of changes of principal climate variables (temperature and precipitation)
- ii) maps related to climate extremes by using indexes selected among those defined by the CCI/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) (<http://www.climdex.org/indices.html>)



Indexes selected to evaluate statistics of extreme events for temperature and precipitation and to compare with observed extremes



<https://www.climdex.org/learn/indices>
<https://portal.c3s-magic.eu/#/diagnostics>

