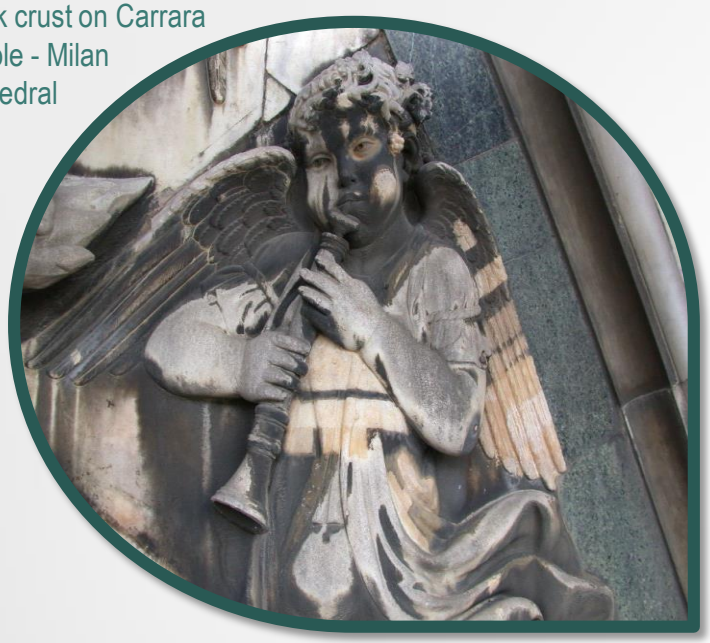
Managing the Protection of Cultural Heritage in Changing Environment
Prague, Municipal House, 27 June 2019

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

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Risk Assesment 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

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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

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Sendai Framework for Disasters Risk Reduction, 2015-2030

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)	Wood (In/Out)	Metals (Out)
• Surface Recession • Blackening/ Soiling • Thermal Stress • Frost Weathering • Salt Crystallization • Biodegradation	• Mechanical Damage • Fungal Growth	• Corrosion ($T+SO_2$, Steel/Bronze) • Corrosion ($T+Cl^-$, Zinc/Lead/Cupper)

GUARDING HERITAGE FROM NATURAL HAZARDS

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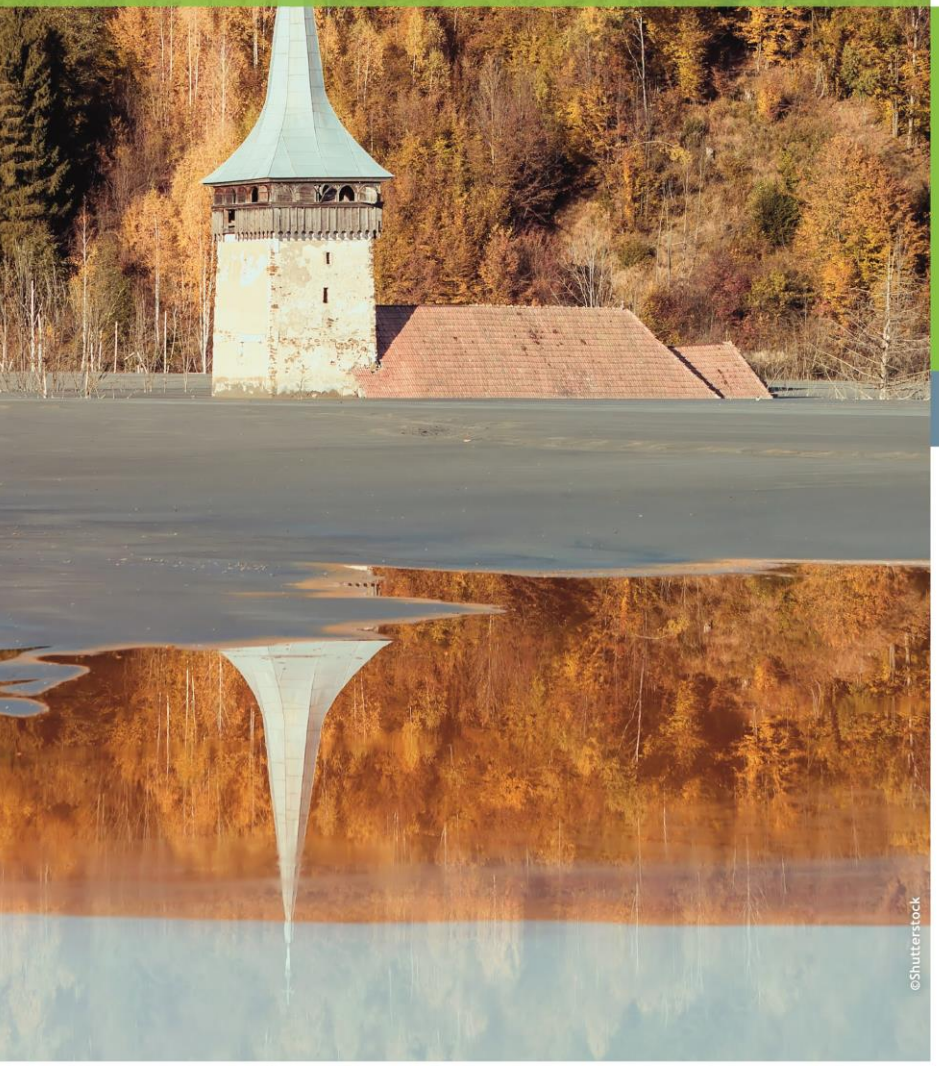
ProteCHt2save



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 €

Information based on application form | July 2017

OBJECTIVES

- *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

Interreg CENTRAL EUROPE
European Union
European Regional Development Fund
ProteCHt2save

WP T1
Risk prone areas & Priorities

WP T2
Emergency & CH Vulnerability

WP T3
Protection plans in emergency

WP T4
Implementation at pilot sites

WP C Communication

WP M Project Management

photos: Miloš Drdácký, Danube University Krems, Mein Bezirk

Climate models and downscaling

General Framework

ProteCHt2save

Regional Climate Models (RCMs) — **10-50 km**

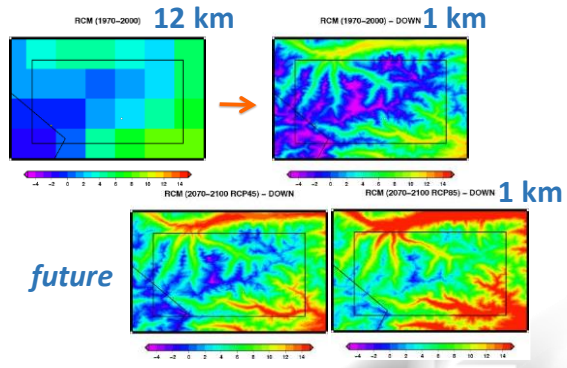
Downscaling

Bias correction

Statistic/Stochastic Downscaling — **1 km**

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)**

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



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

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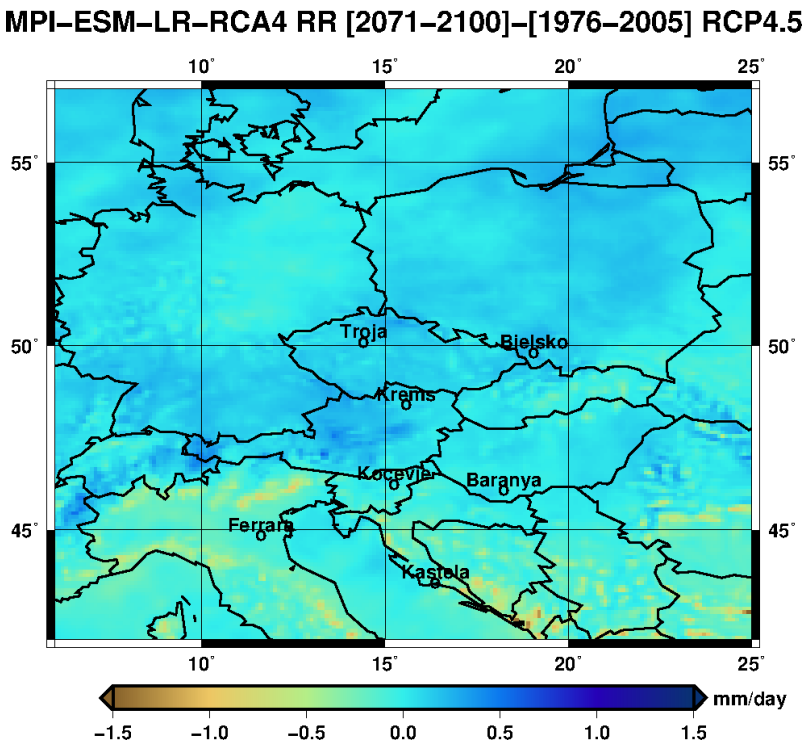
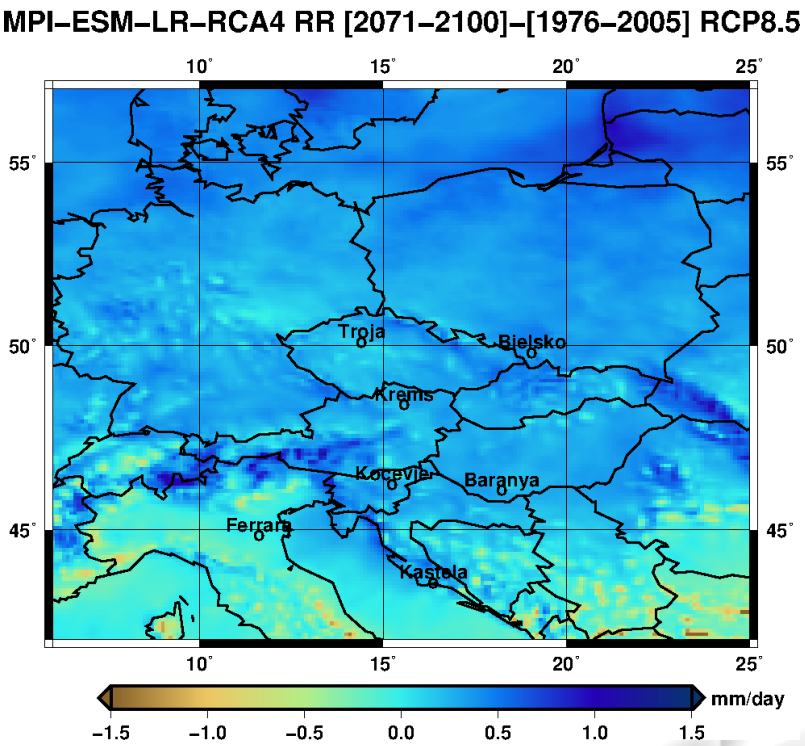
Changes in precipitation in (2071-2100) wrt (1976-2005) in Central Europe

RCP 4.5
Data source: RCA4 RCM (Euro-CORDEX)



RCP 8.5
Data source: RCA4 RCM (Euro-CORDEX)



Development of map creator tool

D.T1.2.2
D.T1.2.3

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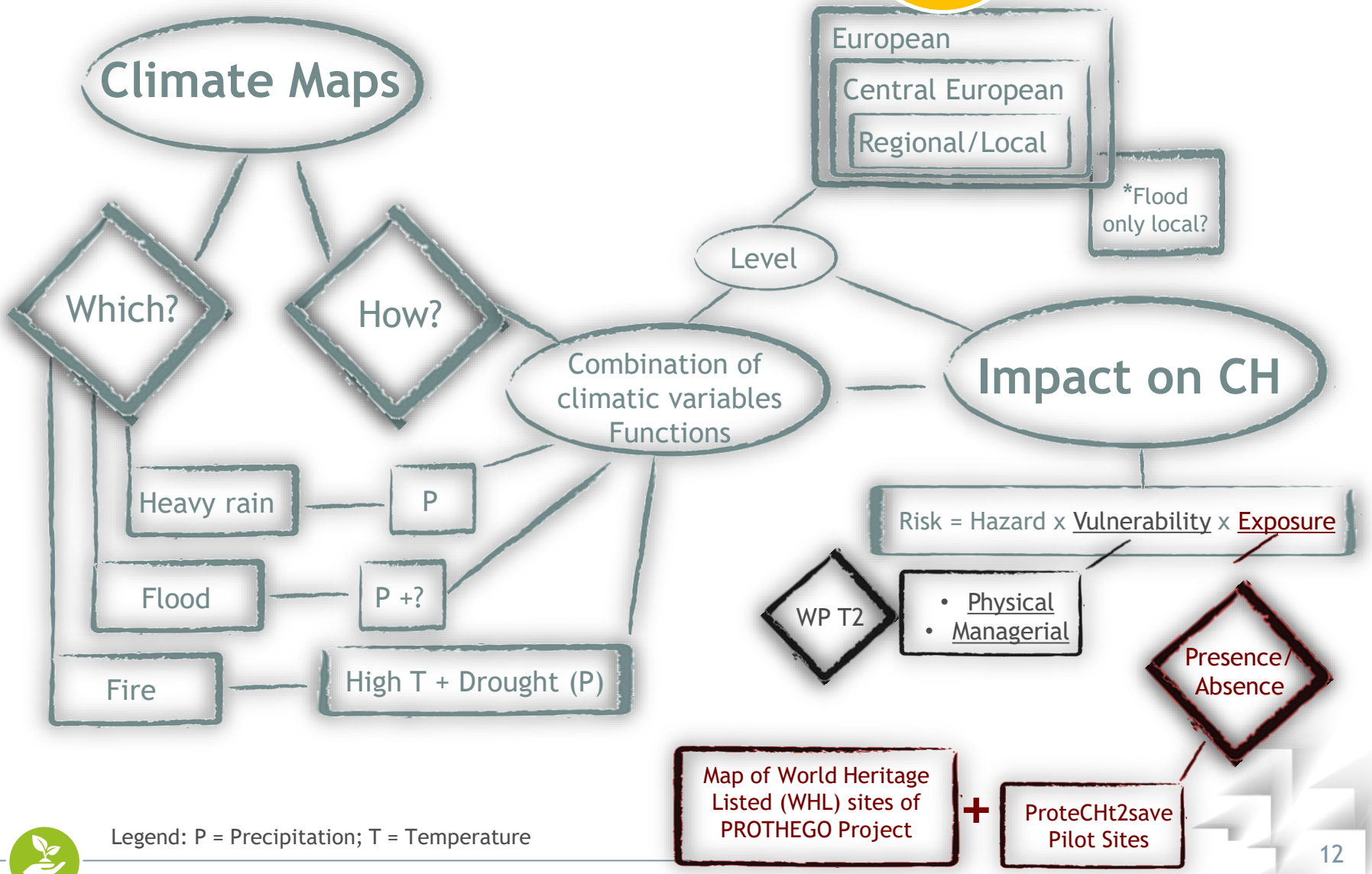
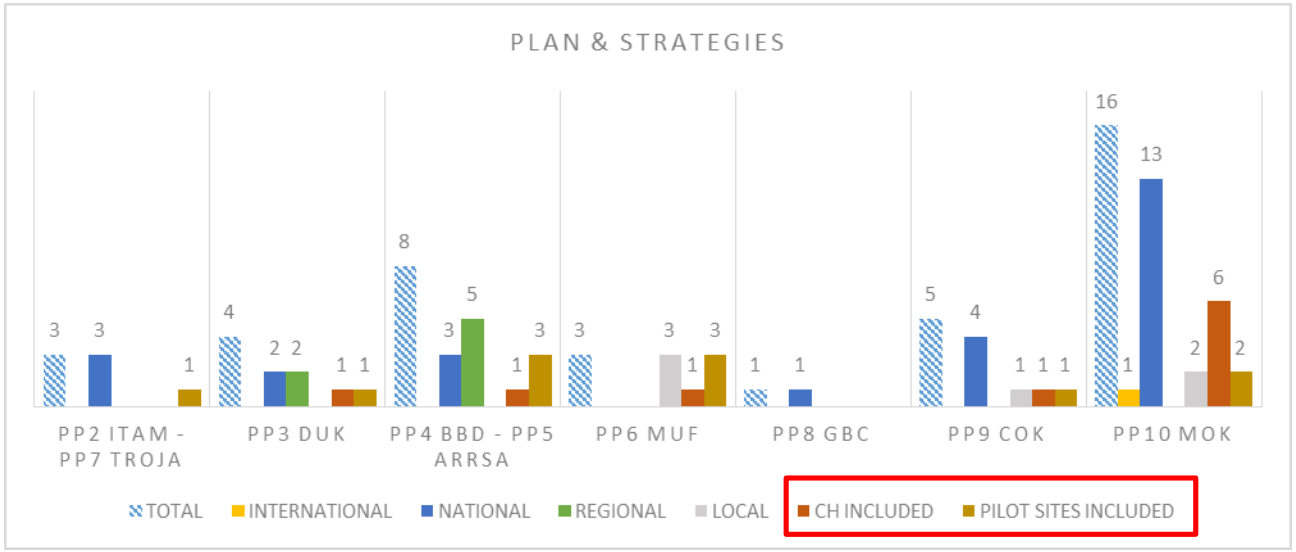


Legend: P = Precipitation; T = Temperature

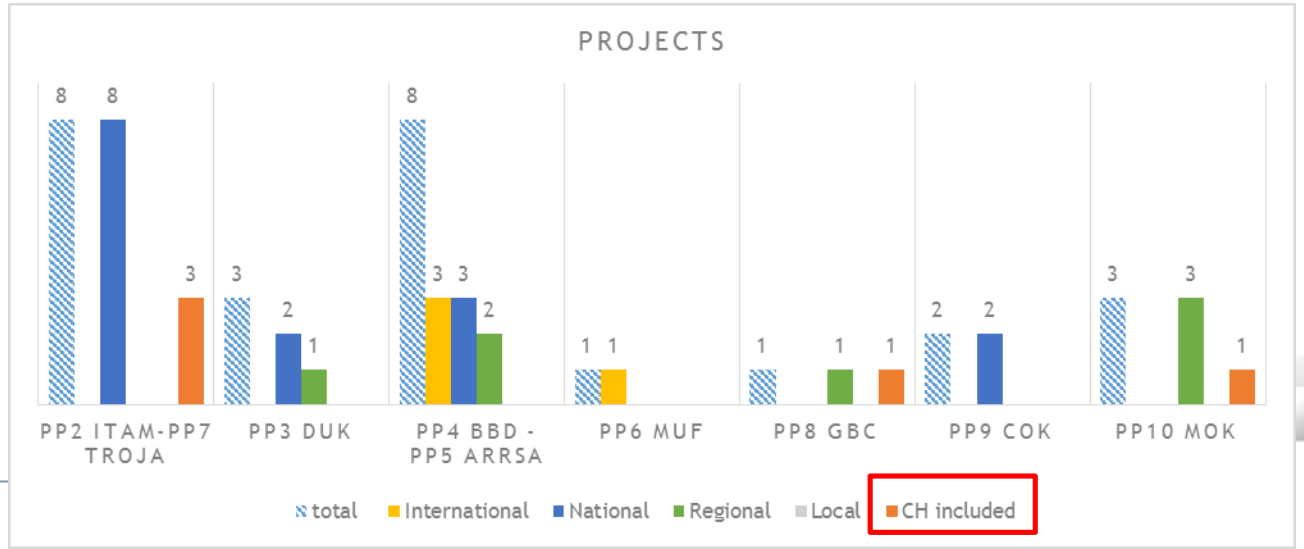
WP T1 - T2. CULTURAL HERITAGE VULNERABILITY PLANS/STRATEGIES

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



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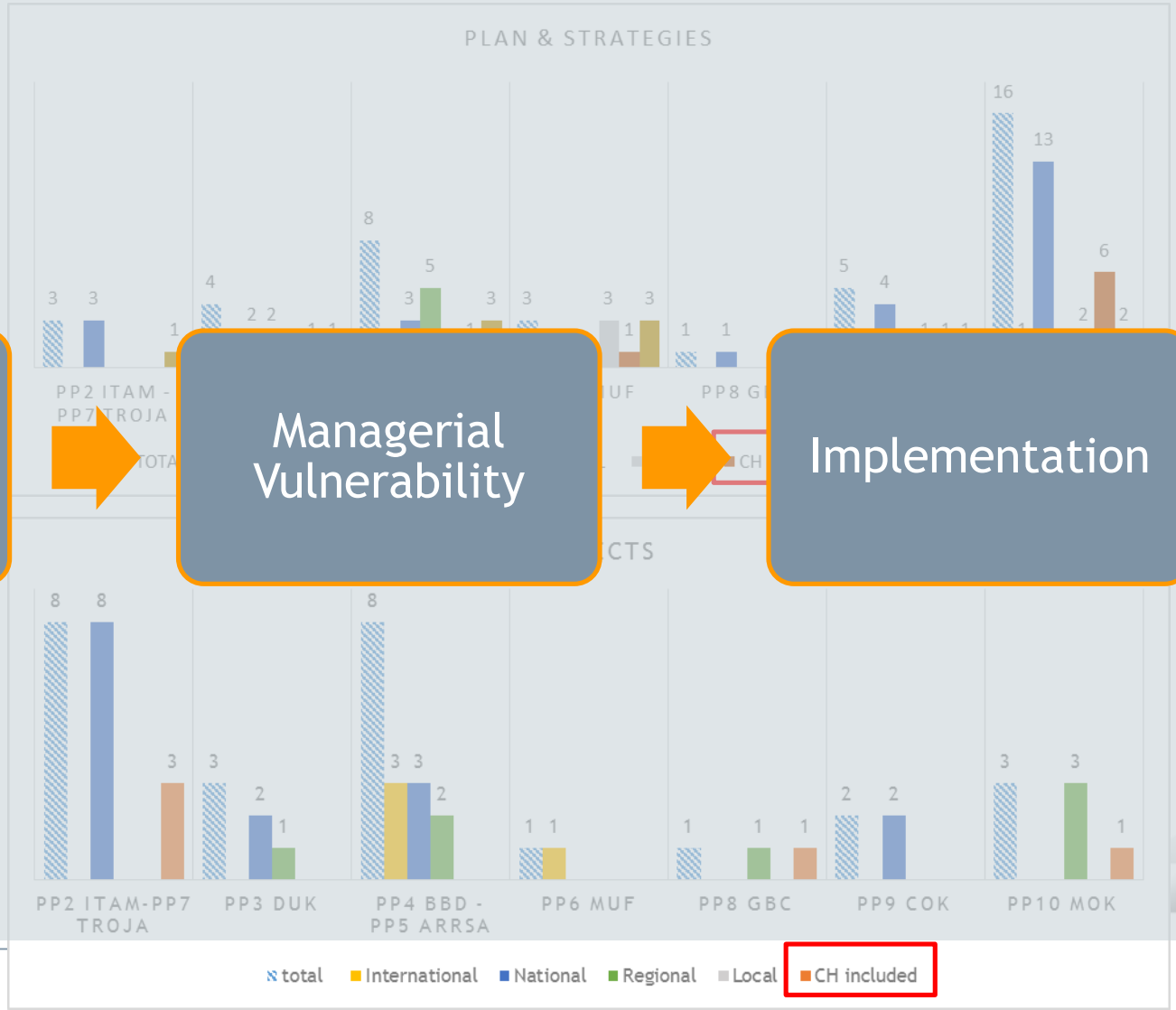


Protection and recovery of built CH almost not included

Managerial Vulnerability

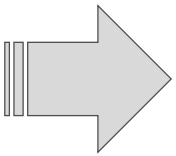
Implementation

Protection and recovery of built CH almost not included

CONTENTS

FINDINGS

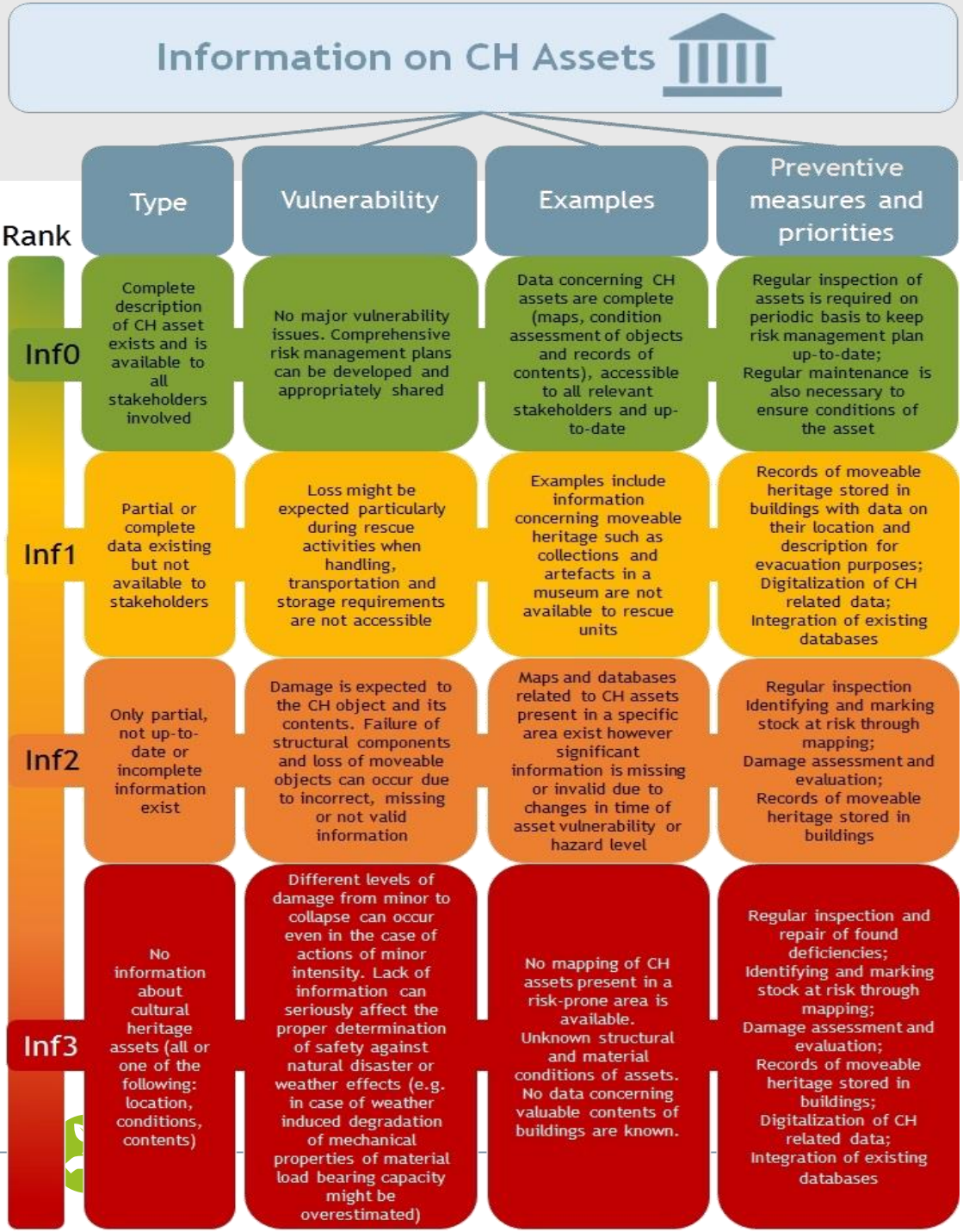
- **Concept of CRITICALITY (managerial & physical)**
  - Definition based on transnational challenges and barriers.
  - Assessment and evaluation criteria.



❖ 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**

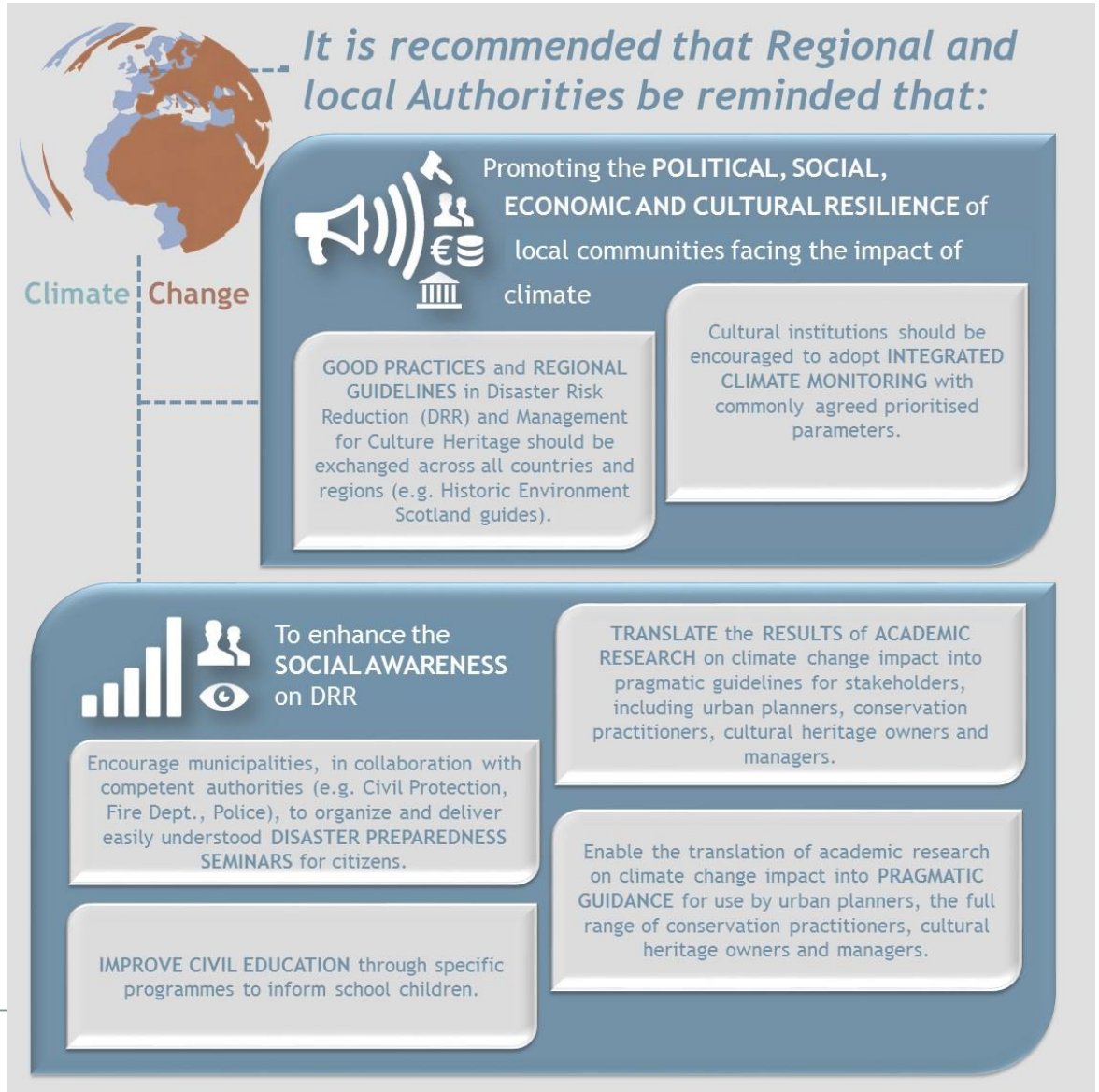


SPECIFIC RECOMMENDATIONS & GUIDELINES

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”

SPECIFIC RECOMMENDATIONS & GUIDELINES



EVALUATION AND MANAGEMENT OF EXTREME EVENTS EFFECTS

Climate Change

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Fire

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

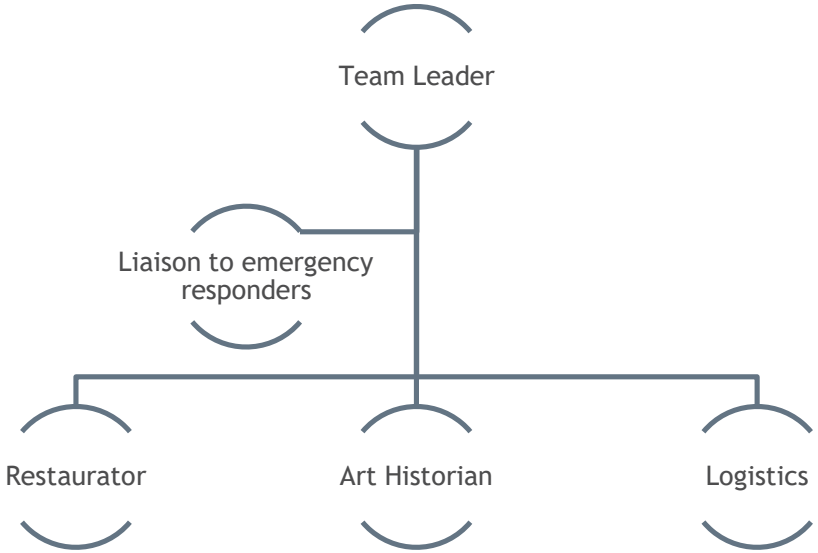
- **SECURING** full **FIRE PROTECTION MEASURES** requires all involved to **UNDERSTAND** what constitutes **HISTORIC VALUE** and **SIGNIFICANCE**.
- **CENTRALLY PROVIDED** pools of **POST-DISASTER PROTECTIVE EQUIPMENT** for preserving residual values and for preventing further collapsing should be accumulated.
- 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



DBU/Schramm 2018.

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

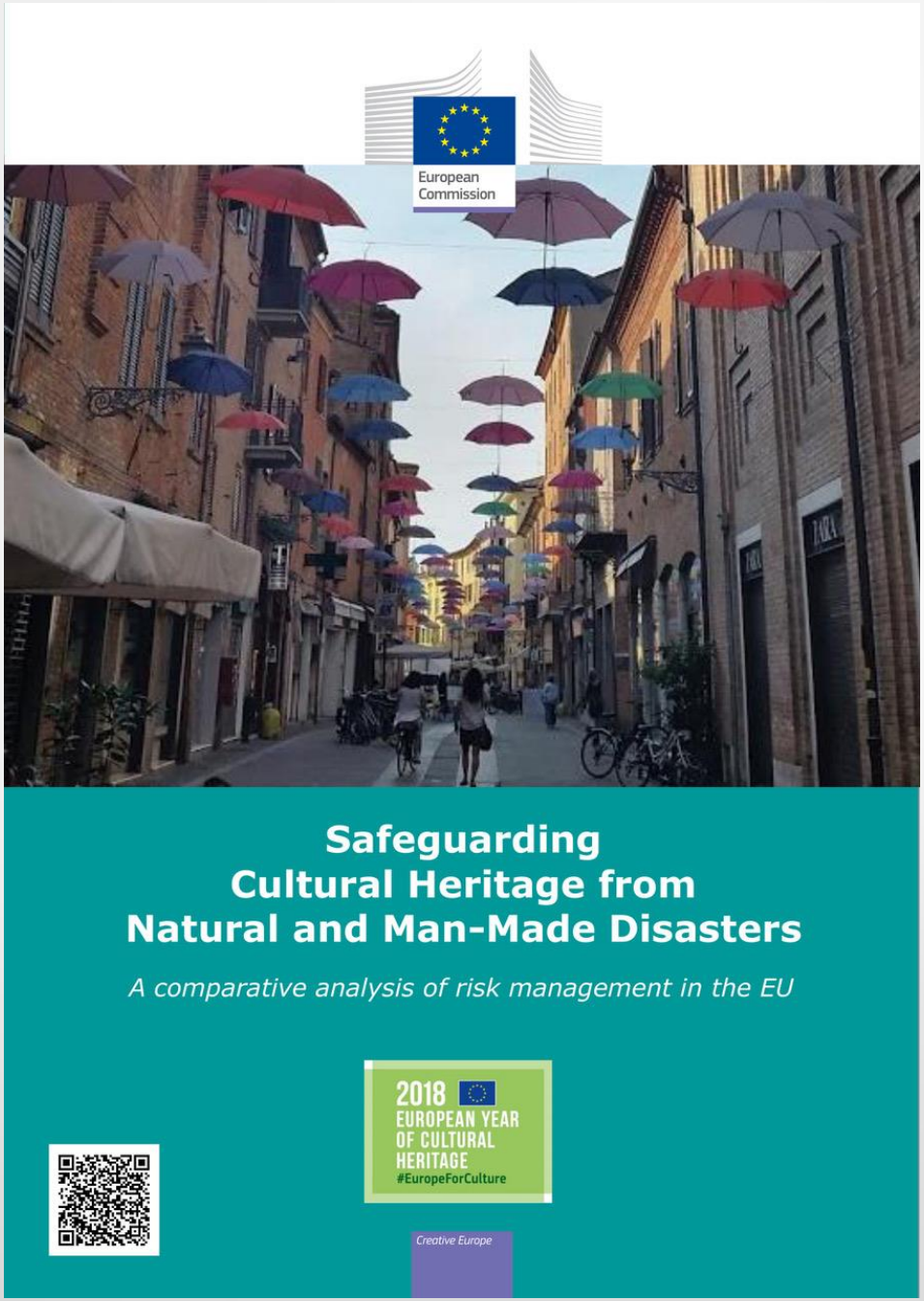
Flood events in large basin

Fire due to drought

Extreme events of heavy rain

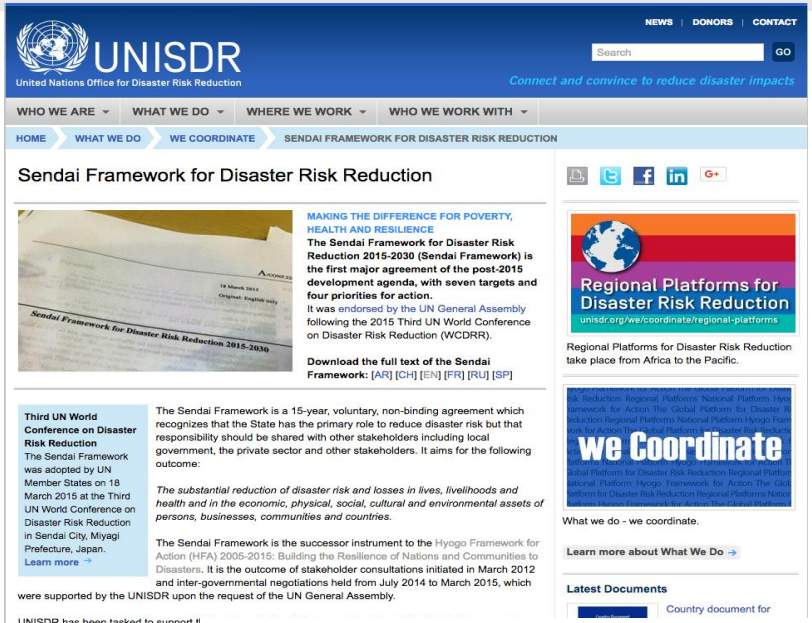

Consiglio Nazionale delle Ricerche
Area della Ricerca di Bologna

Thanks



https://publications.europa.eu/

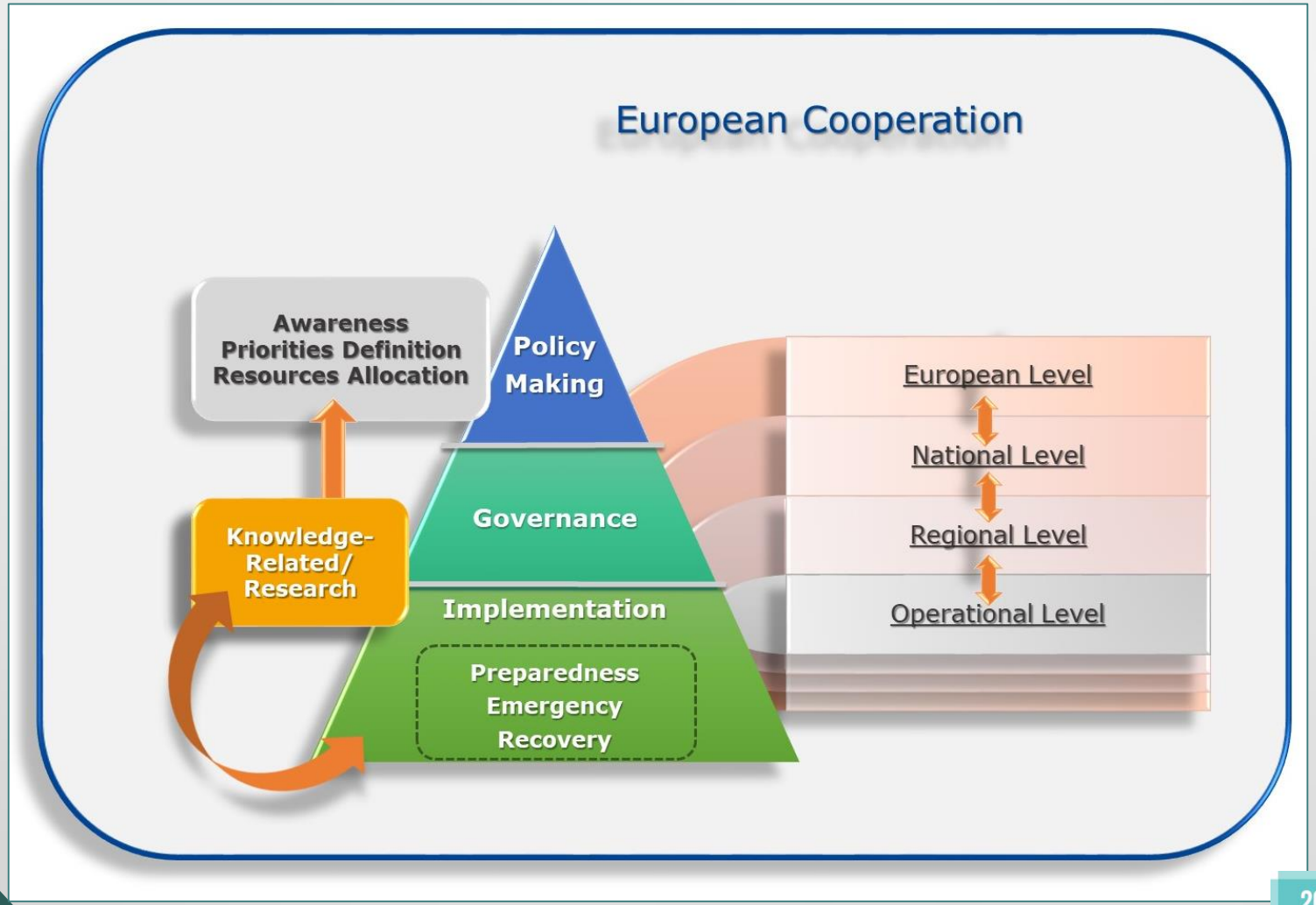
Sendai Framework for Disasters Risk Reduction, 2015-2030



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

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Climate extremes and metrics

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 CCl/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) (http://www.climdex.org/indices.html)

Climate extremes and metrics

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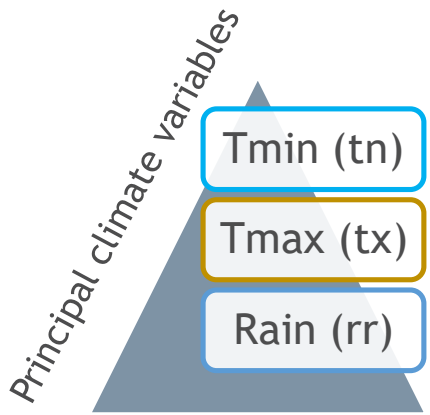
Indexes selected to evaluate statistics of extreme events for temperature and precipitation and to compare with observed extremes

Relevant Climate Extreme Index

- **Heavy rain**
  - R20mm. Annual count of days when PRCP≥ 20mm.
  - R99 pTOT
- **Flooding**
  - Rx5da. Monthly maximum consecutive 5-day precipitation
- **Drought**
  - CDD. *Maximum length of dry spell, maximum number of consecutive days with RR < 1mm.*
- **Extreme heating**
  - Tx90p. Percentage of days when TX > 90th percentile



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