LIFE FRANCA
anticipiamo le alluvioni

FRANCA. *Flood Risk anticipation and communication in the Alps*

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PROVINCIA AUTONOMA DI TRENTO

Flooding scenario of the Adige River in the territory of Trento: operational approaches for protection and securing of Cultural Heritage

University of Trento. *Department of Sociology and social research*. **21-22 October 2019**

International Conference «Anticipation and communication of natural risks»

WHO WE ARE

Catholic University of the Sacred Heart

Ecometrics srl (*spin-off company* of the Catholic University of the Sacred Heart)

Risk Analysis and **Emergency Planning**

During the last years, we have developed or updated **Emergency Plans** over a large number of **Municipalities**: Bernareggio (MB), Gorgonzola (MI), **Unione Comunale dei Colli di Bergamo** (Comuni di Albano Sant'Alessandro, Bagnatica, Gorlago, Brusaporto, Cenate Sopra, Cenate Sotto, San Paolo d'Argon, Torre de' Roveri), Albino (BG), Calcio (BS), Casirate d'Adda (BG), Curno (BG), Seriate (BG), **Treviglio** (BG), **Comunità Montana di Valle Trompia** (Comuni di Bovegno, Brione, Caino, Collio, Concesio, Irma, Gardone Val Trompia, Lumezzane, Marcheno, Marmentino, Nave, Pezzaze, Polaveno, Sarezzo, Tavernole sul Mella, Villa Carcina), Carpenedolo (BS), Cazzago San Martino (BS), Chiari (BS), Erbusco (BS), Arluno (MI), Bagnolo Cremasco (CR), **Seveso** (MB), **Palmi** (RC), Melissa (KR), San Nicola dell'Alto (KR), Limbadi (VV), **Città Metropolitana di Napoli** (NA), **Città di Livorno** (LI), Galbiate (LC), Marmirolo (MN) e Lazise (VR)

CHEERS PROJECT. STARTING POINT

Preliminary **hints**:

- nowadays, **Civil Protection Plans** rarely address the issue of estimating the exposure of Cultural Heritage to risks (→ consequent lack of **Operating Procedures** aimed at planning safeguarding interventions, in alert or emergency scenarios)

- even if strongly recommended by Government Agencies and non-Governmental, **Disaster Risk Management Plans** for Cultural Heritage sites (to be integrated in Civil Protection Plans) are often missing

- Civil Protection structures (mainly at Municipality level) seldom integrate a **reference person** who is responsible for planning and coordinating interventions for the safeguard of Cultural Heritage in alert or emergency phases

→ a **general problem** in the large majority of Alpine Space countries

CHEERS PROJECT. PARTNESHIP

To deal with this topic a **partnership** has been built, comprising **research institutes** and **institutions** (from Italy, Austria, Germany, Slovenia, France and Switzerland) which integrate expertise on **Civil Protection**, **emergency planning** and **Cultural Heritage management** and **protection**

To partners more than **30 Observers** are added.
For **Italy**: Autonomous Province of Trento (Department of Civil Protection and Superintendence for Cultural Heritage), ICOMOS Italia, Ministry of the Environment, Land and Sea, Lombardy Region, Ministry of Cultural Heritage and Activities, Piedmont Region, UNCEM, Dolomiti UNESCO Foundation, Wikimedia Italia

CHEERS PROJECT. AIMS AND STRUCTURE

WP1 - *Alpine Cultural Heritage: value and vulnerability*

development of a **tool** aimed at estimating a "*triage value*" of Cultural Heritage for the **prioritization** of safeguarding interventions in case of alert or emergency → *what should be saved first?*

WP2 - *Advancing Hazard and Exposure Assessment methodologies applicated to the field of Cultural Heritage protection*

a critical overview of tools available for estimating the **exposure** of Cultural Heritage to natural hazards and to evaluate their **vulnerability** to risk scenarios → *what are the strengths and weaknesses of available data and maps?*

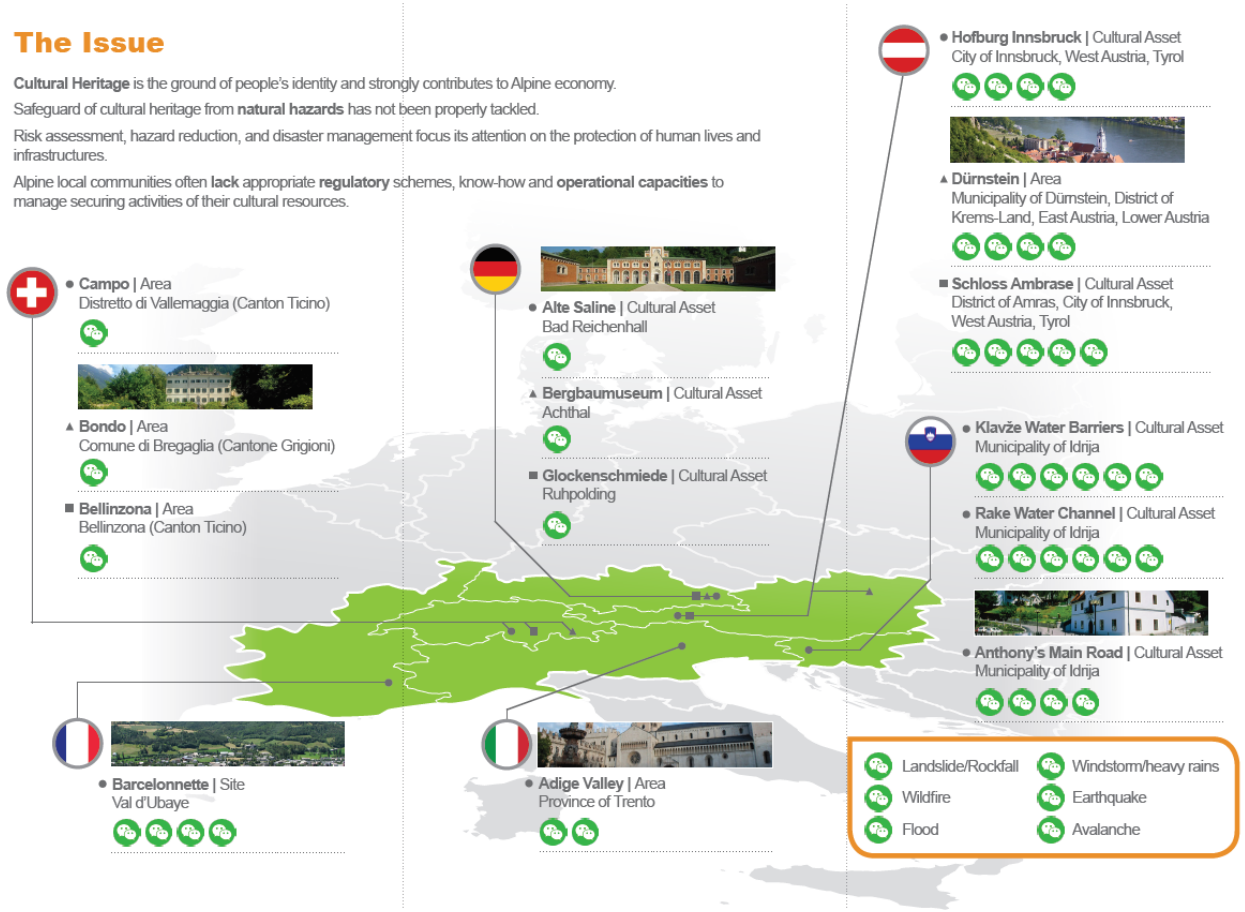
WP3 - *Alpine Cultural Heritage Protection: approaches and techniques*

first response techniques for safeguarding Cultural Heritage affected by natural disasters, with production of a reference **training module** for operators → *how to intervene?*

WP4 - *Emergency planning and salvaging*

update of **Emergency Planning** (Civil Protection Plans) on pilot areas, supported by simulation exercises → *how should Civil Protection Plans be integrated?*

CHEERS PROJECT. PILOT AREAS



The project requires from each country to identify:

1 pilot area. Where the entire methodology developed in CHEERS is applied

2 transfer areas. Where the project implements only specific activities to facilitate transfer and dissemination of knowledge and tools developed in the pilot areas

CHEERS PROJECT. PILOT AREAS

Each pilot area throughout the participant countries is characterized by one (or two) specific type of natural hazard scenarios with the aim of creating a comprehensive range of cases, which are thoroughly investigated.

Since the initial phases of the project proposal, the **Autonomous Province of Trento** has positively reacted to the request of taking part in the project as «*Observer*» and as a candidate **pilot area for CHEERS**.

PROVINCIA AUTONOMA DI TRENTO

Two **offices** of the **Autonomous Province of Trento** are **directly involved** in the project:

Protezione Civile
Provincia Autonoma di Trento

the **Department for Civil Protection** (reference person for CHEERS: dr. Alessandro Galvagni)

Trentino Cultura

the **Superintendence for Cultural Heritage** (reference person for CHEERS: arch. Luca Gabrielli)

Interreg
Alpine Space
Cheers

CHEERS PROJECT. PILOT AREA OF TRENTO

In agreement with the project *partnership* and the officials from the Autonomous Province of Trento, for the pilot area of Trento we take into consideration in particular **two natural hazard** types

Flooding

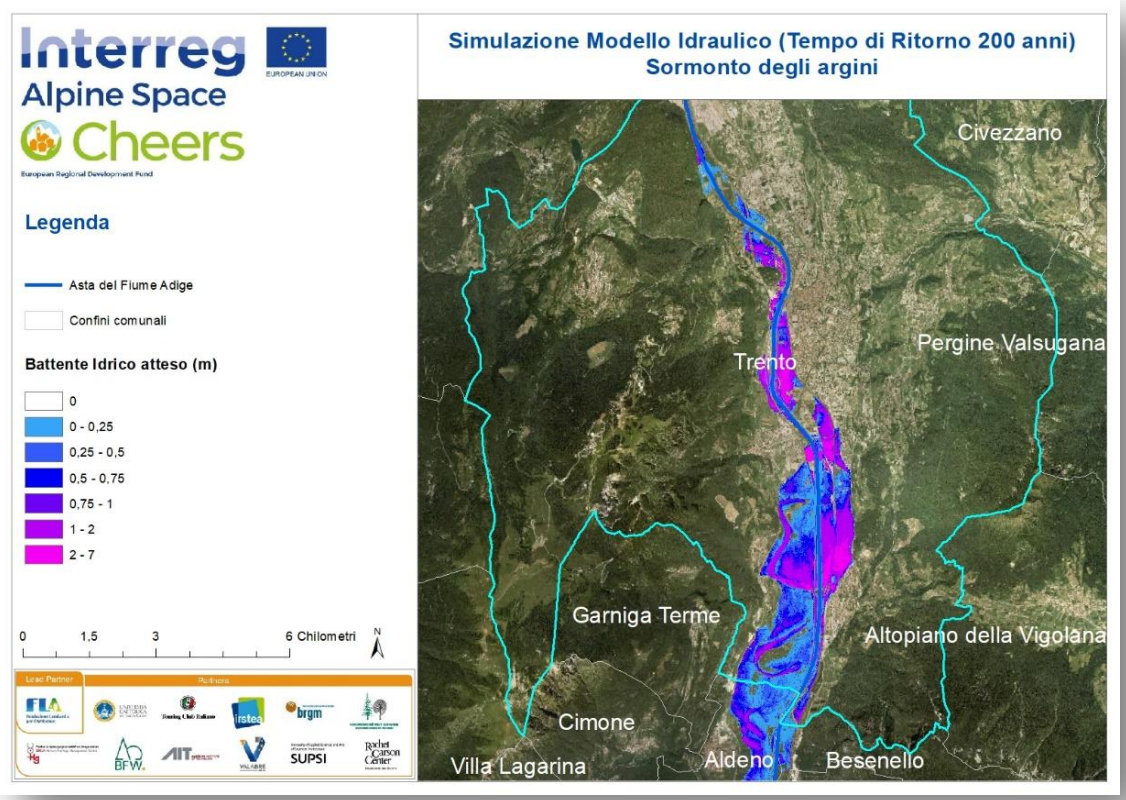
Urban/Forest interface fires

The approach:

- identification of **reference risk scenarios** («*dangerous*» areas where cultural assets potentially exposed to the specific natural hazard are located)
- **vulnerability assessment** of the identified exposed cultural assets
- development and application of a methodology to support the classification in terms of **priority of intervention** for risk mitigation or salvaging operations on the exposed cultural assets
- **capacity building** activities for Civil Protection operators
- updating of the **Municipal Civil Protection Plan**

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

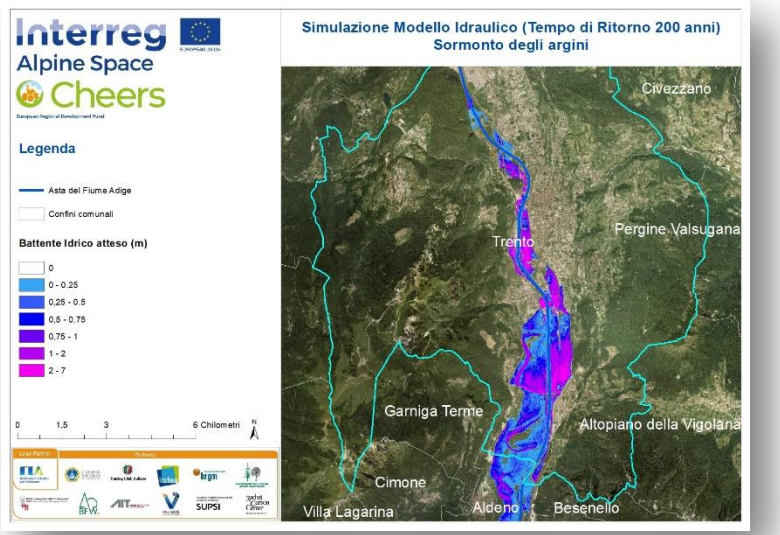


- Return period: **200 years**
- Hydraulic survey developed by the Autonomous Province of Trento: maps with information about the **expected water head**
- simulations on **2 different events**:
  - ❑ **overflowing** of the river banks
  - ❑ **breakage** of the banks
- the different types of events show different **alert timing**:
  - ❑ about **tens of hours** for the **overflowing** scenario
  - ❑ a **few hours** for the **breakage of the banks** scenario

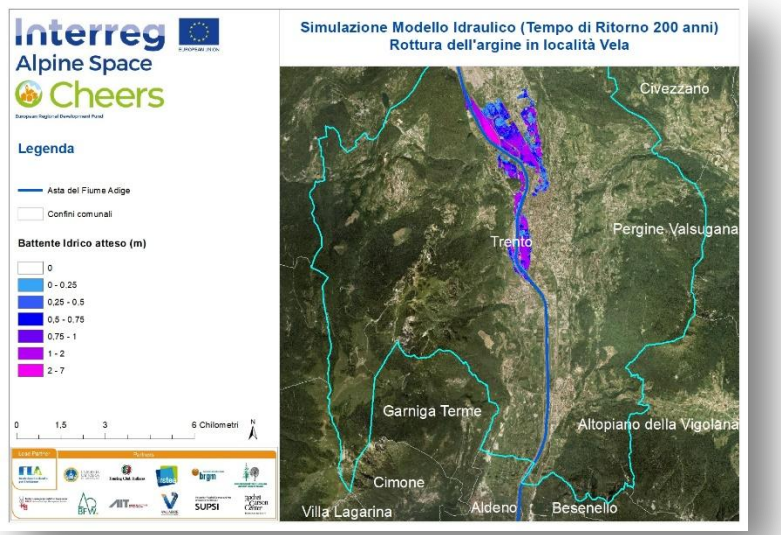
CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

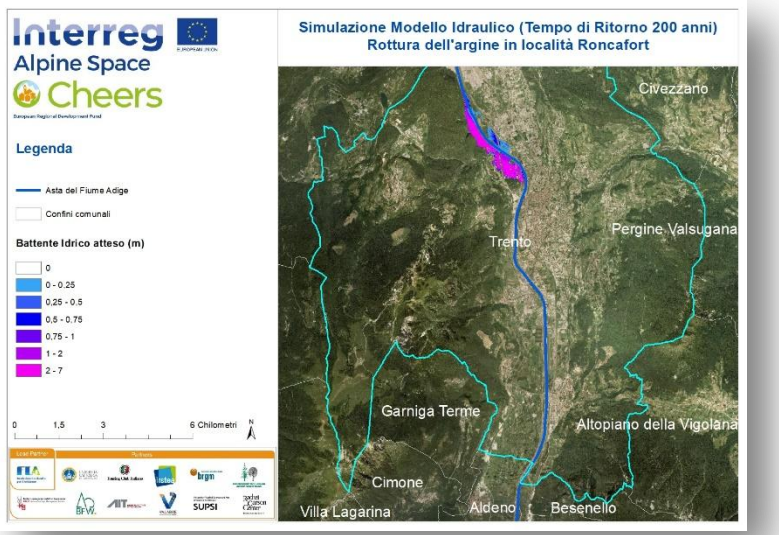
3 distinct **events investigated**:



Overflowing



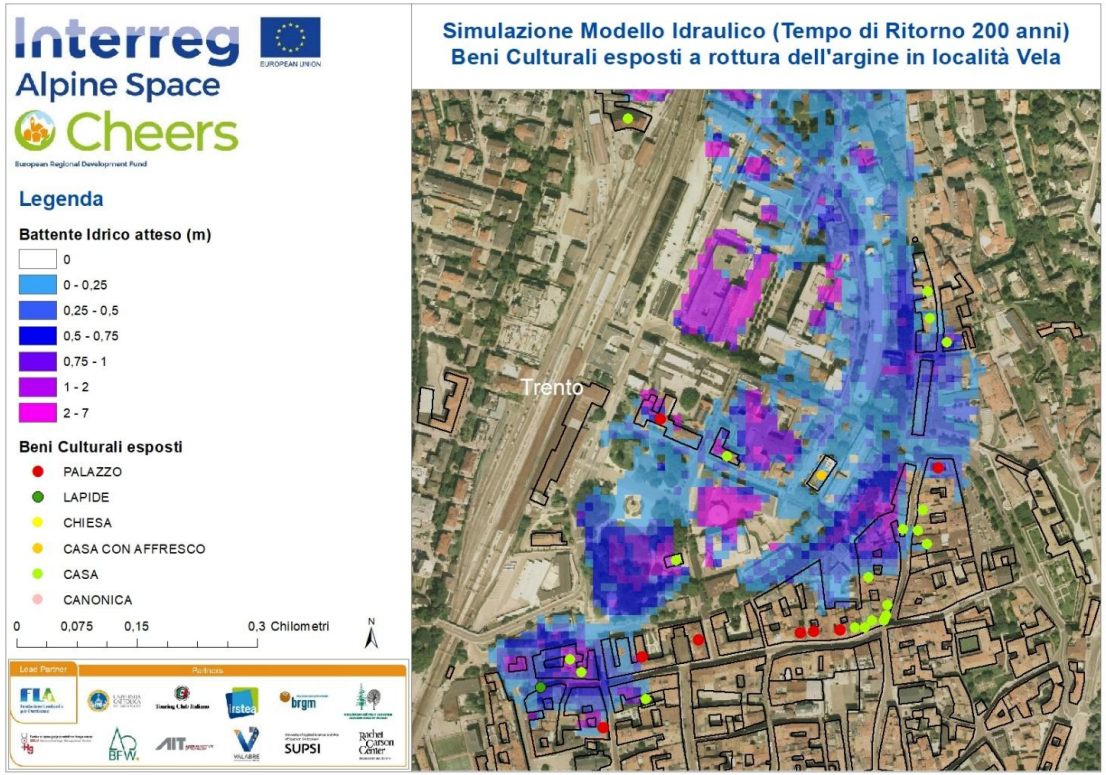
Breakage of the banks in locality *Vela*



Breakage of the banks in locality *Roncafort*

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**



- acquisition of the Superintendence for Cultural Heritage **database** that includes all assets (buildings) under restriction and protection by the law
- maps of **Museums**, **Libraries** and **Archives** (analysis still ongoing) that host protected collections
- selection of those buildings that lay **within flood-prone areas** (given a 200 years Return Period)

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento**

Exposure assessment: for all the buildings that proved exposed, we computed from the maps of the hydraulic modeling, the expected head of water

BATTENTI IDRICI **SORMONTO** (200 anni)

Edificio	Denominazione	Battente Idrico (m)	Comune
2597	*Palazzo delle Albere*	4,83	Trento
2690	*Casa p.ed. 1520 CC. Trento*	4,40	Trento
2721	*Chiesa di Sant'Apollinare*	3,05	Trento
2705	*Canonica di Sant'Apollinare*	1,67	Trento

Museo	Denominazione	Battente Idrico (m)	Comune
0	*Museo Meseo delle Scienze*	2,52	Trento
7	*Museo dell'aeronautica Gianni Caproni*	1,75	Trento

BATTENTI IDRICI **ROTTURA** RONCAFORT (200 anni)

Edificio	Denominazione	Battente Idrico (m)	Comune
2752	*Chiesa dei Ss. Cosma e Damiano*	0,60	Trento

BATTENTI IDRICI **ROTTURA** VELA (200 anni)

Edificio	Denominazione	Battente Idrico (m)	Comune
2714	*Palazzo della Provincia*	1,46	Trento
2597	*Palazzo delle Albere*	3,84	Trento
2721	*Chiesa di Sant'Apollinare*	2,91	Trento
2690	*Casa p.ed. 1520 CC. Trento*	2,17	Trento
2671	*Casa p.ed. 15 CC. Trento*	1,83	Trento
	Casa della Catena parte della P. ED: 21/1 CC: Trento		
2709	*Casa p.ed. 919 CC. Trento*	1,72	Trento
	Casa pp.ed. 887/1, 887/2, 887/3 CC. Trento		
	Casa pp.ed. 871, 873 CC. Trento		
	Casa p.ed. 869 CC. Trento		
	Casa p.ed. 868 CC. Trento		
	Casa p.ed. 861 CC. Trento		
	Casa p.ed. 858 CC. Trento		
	Casa pp.ed. 856; 857; 859; 846/2 (pp.mm. 22-23) CC. Trento		
	Palazzo Salvadori a Trento		
	Palazzo Pedrotti p.ed. 837 CC. Trento		
	Palazzo Trentini p.ed. 835 CC. Trento		
2679	*Sede provinciale I.N.P.S.*	1,66	Trento
2705	*Canonica di Sant'Apollinare*	1,62	Trento
2731	*Torre Vanga*	1,54	Trento
2675	*Collegio Tridentino della Compagnia di Gesù*	1,45	Trento
2722	*Casa parte di p.ed. 3117 CC. Trento*	1,43	Trento
2723	*Caffè Savoia*	1,25	Trento
2732	*Casa p.ed. 1022 CC. Trento*	0,95	Trento
3025	*Ex Casa Nones*	0,89	Trento
2894	*Rettorato dell'Università degli Studi di Trento*	0,88	Trento
2712	*Torre Verde*	0,76	Trento
2735	*Casa p.ed. 995/2 CC. Trento*	0,76	Trento
	Casa pp.ed. 990; 991 CC. Trento (Ex Ostello della Gioventù)		
307	*Preda della Portela su parte della p.f. 2322/1 CC. Trento*	0,56	Trento
2713	*Palazzo Trautmannsdorf Saracini*	0,55	Trento
2711	*Bassorilievo e dipinto murale p.e ed. 3747 C. C. Trento (competenza storico-artistica)*	0,17	Trento
2742	*Magazzino pp. ed. 1751, 1752, 3329 CC. Trento*	0,17	Trento

Museo	Denominazione	Battente Idrico (m)	Comune
0	*Museo Meseo delle Scienze*	1,23	Trento

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

Starting from this first identification of assets at risk, the Superintendence of Trento has produced a **note** intended to:

- make a **first description** of each asset exposed to risk
- identify the main elements of the structure which could be **vulnerable** to a flood event, with the head of water locally expected → *what interventions could be needed*?
- state whether the asset contains **mobile items**, with first assumptions on their **locations** → *is the item, in fact, exposed to risk (basement, ground floor, upper floors)*?

Rischio idraulico Adige, t.r. 200 anni (rottura argini e tracimazione)
Siti da presidiare in relazione a: CONTENITORE + CONTENUTO

PALAZZO DELLA PROVINCIA **Trento**
p.ed. **1778/1** C.C. **Trento** Vincolo **sì** proprietà: Provincia autonoma di Trento

Complesso edificiale in tre corpi di fabbrica, evolutosi dal primo nucleo dell'Hotel Trento sorto nel 1875, all'ampliamento di fine Ottocento, per arrivare alla costruzione dell'ala nuova del 1923-24.
Presenta ampie decorazioni interne del primo Novecento, opera di eminenti artisti della scena trentina; ospita altresì un'importante selezione di opere d'arte mobili del XIX e XX secolo.

***Elementi dell'immobile da proteggere in relazione al battente idrico (1,46)*: sì (apparati lapidei della sezione inferiore dei prospetti)**

***Criticità della funzione allocata:* sì (sede della Provincia autonoma di Trento)**

***Beni mobili al piano terreno*: sì (da verificare effettiva collocazione)**

CHEERS PROJECT. PILOT AREA OF TRENTO

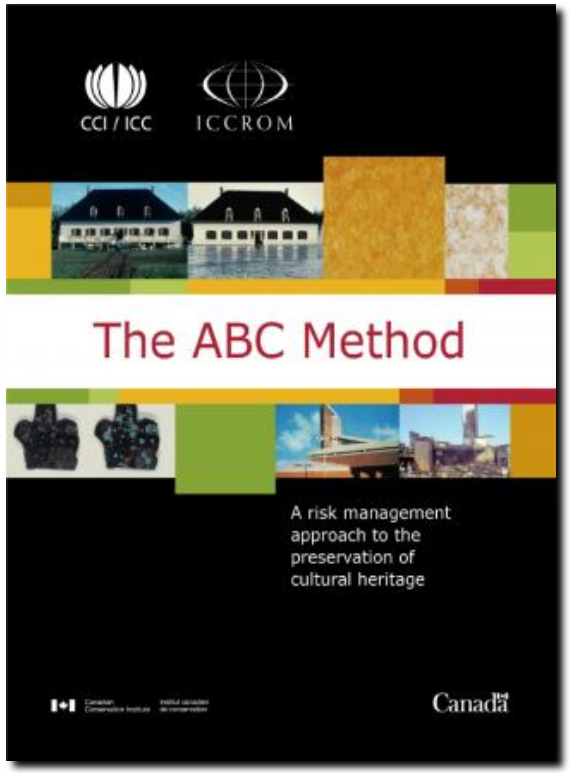
Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

What should be saved first, in alert or emergency conditions?

CHEERS partnership is developing a tool conceived as a **decision support system** to identify **priority interventions** (*triage*).

As **reference source** for the development of the tool, we are considering

«*The ABC Method. A risk management approach to the preservation of cultural heritage*»
(Government of Canada, Canadian Conservation Institute and ICCROM, 2016)



CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

The relevance of triage. Preparedness and operational capacity

A **triage procedure** is desirable and recommended both in "*peace time*" and in "*emergency time*", yet for different reasons.

In **peace time**, the triage procedure regulates the **hierarchy** of those interventions aimed at **risk mitigation**, that is all the operations carried out to prevent and minimize the risks to which items and assets may be exposed.

During an **emergency**, though, a triage is due to:

- have crucial information as to **what is to be rescued** and **where it is located**
- establish **priorities** for salvaging operations

The decision-making process required in such circumstances is often associated to the necessity of making delicate judgements in a short time and possibly in dangerous conditions

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

The relevance of triage. Legitimation and liability

An established methodology and prioritization of assets appears to be of crucial importance also for defining **clear responsibilities**: it allows operators, in emergency times, to carry out salvaging actions, with **full legitimation** on a legal base and minimizing their personal liability

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

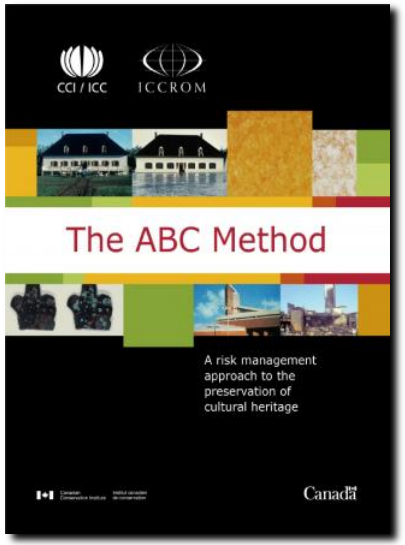
What should be saved first, in alert or emergency conditions?

The experts working in the Cultural Heritage field show the tendency to consider every cultural asset or item "*of highest importance*".

Consequently, it is not easy to convey to them the message that the need to choose **what to save first** (and, possibly, what to lose) might be unavoidable in emergency conditions.

Choices about **priority interventions** would be better planned in peacetime by experts, or else emergency operators might need to take those decisions autonomously in a limited amount of time and with little or no possibility of consultation in alert or emergency conditions

CHEERS PROJECT. PILOT AREA OF TRENTO



Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

What should be saved first, in alert or emergency conditions?

The method under development foresees:

- **definition** of the **contributing Values** (or **Categories of Values**) that determine the general significance of the Cultural Heritage

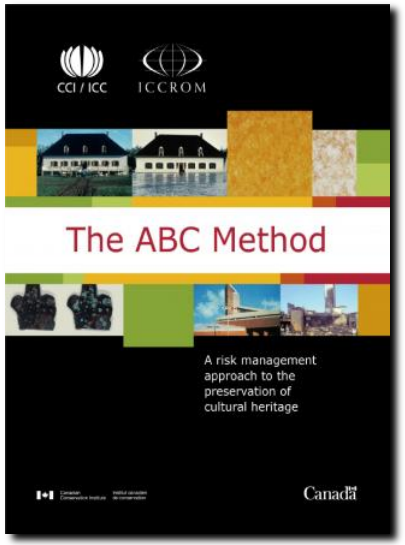
CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

Categories of Values considered for Cultural Heritage evaluation in the pilot area of Trento:

- **HISTORIC**: the asset (or item) is strictly linked with the history of a place and it contributes to a better understanding of the link between past and present of the local community
- **AESTETIC** and **ARTISTIC**: the asset (or item) is such as to stimulate its users both from a sensory and intellectual point of view; and/or it is representative of recognized artists, styles, art, or design movements
- **SCIENTIFIC**: the asset (or item) bears information or data that (might) contribute in a significant way to scientific research and academic studies
- **ECONOMIC**: the asset (or item) has an estimable value or the ability to generate real/potential financial dividends for society as a result of direct or indirect economic activities connected to its use and function
- **USE** and **FRUITION**: the asset (or item) is commonly used and open to the community
- **COMMUNAL** and **IDENTITY** (symbolic, social, spiritual): due to identity, spiritual (or religious) and social cohesion aspects, the asset (or item) bears a peculiar meaning for the community

CHEERS PROJECT. PILOT AREA OF TRENTO



Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

What should be saved first, in alert or emergency conditions?

The method under development foresees:

- **definition** of the **contributing Values** (or **Categories of Values**) that determine the general significance of the Cultural Heritage
- assigning a **Weight** (**p**) to each Category of Value («*what is the relative importance of each Category, compared to the others*?»)
- for each Category of Value, **assignation** of a **Score** (**s**) to each Cultural Heritage exposed to a risk scenario («*what is the relevance of the asset or item with respect to the different Categories of Values?*»)
- **weighted sum** of **Weights** and **Scores** (p1*S1+ p2*S2 + …. + pn*Sn) for each Cultural Heritage at risk and final computation of an **Indicator**, proxy of the **Value** of the each asset or item → decision support information for prioritizing the safeguarding interventions

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

On 7th October 2019, a **workshop** has been held at the headquarters of the Superintendence for Cultural Heritage of Trento. Besides the officials of the Autonomous Province of Trento directly involved in CHEERS project (1 from Department of Civil Protection and 1 from Superintendence for Cultural Heritage), the workshop has been attended by several officials of the **Superintendence for Cultural Heritage** of the **Autonomous Province of Trento**:

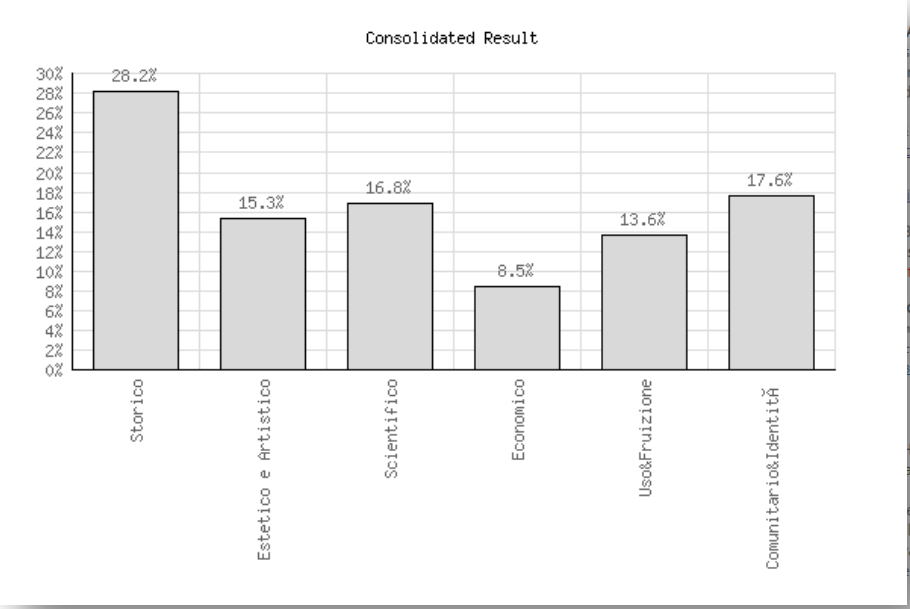
- **2** from the **Architectural Heritage Office**
- **2** from **Historic and Artistic Heritage Office**
- **1** from the **Archaeological Heritage Office**
- **1** from **the Archives and Libraries Office**
- **1** from the **Cultural Activities Service Office**

→ **group working session**, aimed at setting the **Weights** of the Categories of Values that we have decided to take into consideration in the process of setting the value of Cultural Heritage

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

Analytic Hierarchy Process (AHP)



BPMSG Home Latest News Java is enabled. Ecometrics ••••••••••• Log in (forgot?) Register

AHP Online System - AHP-OS

Language: English German

Multi-criteria Decision Making Using the Analytic Hierarchy Process

AHP solution is a supporting tool for decision making processes. The programs can be he
imple decision problems and also support complex decision making problems. Participa
ry a practical example. Download the quick reference guide or the AHP-OS manual.
to login. Please register as new user, if you don't have an account yet. It's all free!

culator

ion

you can export the results as csv files (comma separated values) for further processing in
se see our user agreement and privacy policy. If you like the program, please help and con
the website.

cite:

plementation of an Online Software Tool for the Analytic Hierarchy Process (AHP-OS). *Internationa*
Hierarchy Process, Vol. 10 Issue 3 2018, pp 469-487,
3/ijahp.v10i3.590

HP stands for *Analytic Hierarchy Process*. It is a method to support multi-criteria decision making, and
s originally developed by Prof. Thomas L. Saaty. AHP derives *ratio scales* from paired comparisons
criteria, and allows for some small inconsistencies in judgments. Inputs can be actual
easurements, but also subjective opinions. As a result, *priorities* (weightings) and a *consistency ratio*
l be calculated. Internationally AHP is used in a wide range of applications, for example for the
aluation of suppliers, in project management, in the hiring process or the evaluation of company
rformance.

CHEERS PROJECT. PILOT AREA OF TRENTO

Reference risk scenario: **Flooding** of **Adige River** over the territory of **Trento municipality**

Next steps:

- **final identification** of the stock of Cultural Heritage (building and mobile items) potentially exposed to Adige River flood
- **estimation** of the "*value*" of assets and items exposed as a support information for prioritizing the safeguarding interventions
- **capacity building** for Civil Protection operators
- updating the local **Civil Protection Plan**

CHEERS PROJECT. CATHOLIC UNIVERSITY WORKING GROUP

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