STRENGTHENING CULTURAL HERITAGE RESILIENCE FOR CLIMATE CHANGE

Venice is a resilient laboratory

Elisabetta Zendri
Department of Environmental Sciences, Informatics and Statistics, Ca' Foscari University of Venice
elizen@unive.it

Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it

The highest number of World Heritage sites at risk in the Mediterranean low elevation coastal zone can be found in Italy (87%)*

*Reimann, L., Vafeidis, A.T., Brown, S. *et al.* Mediterranean UNESCO World Heritage at risk from coastal flooding and erosion due to sea-level rise. *Nat Commun* **9**, 4161 (2018). https://doi.org/10.1038/s41467-018-06645-9

Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it

Europa Nostra, ICOMOS, the European Investment Bank Institute released the European Cultural Heritage Green Paper

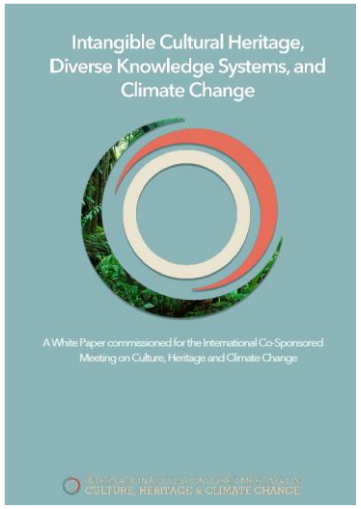
IPCC, ICOMOS, and UNESCO hosted a co-sponsored meeting on culture

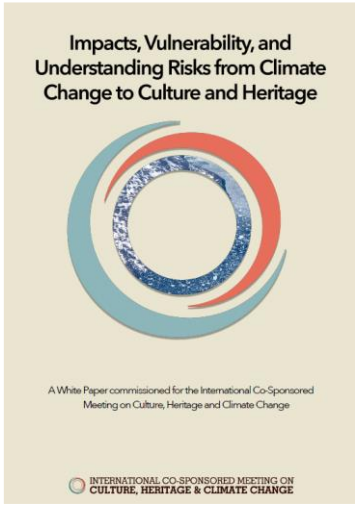
July 2021

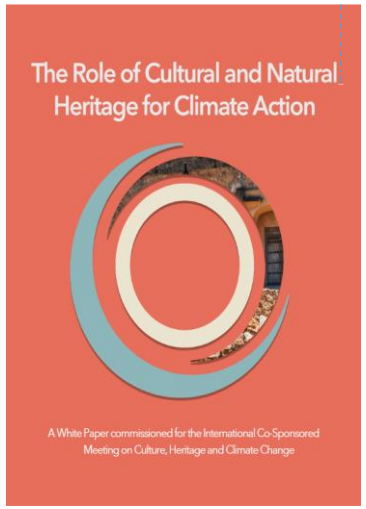
Mar. 2021

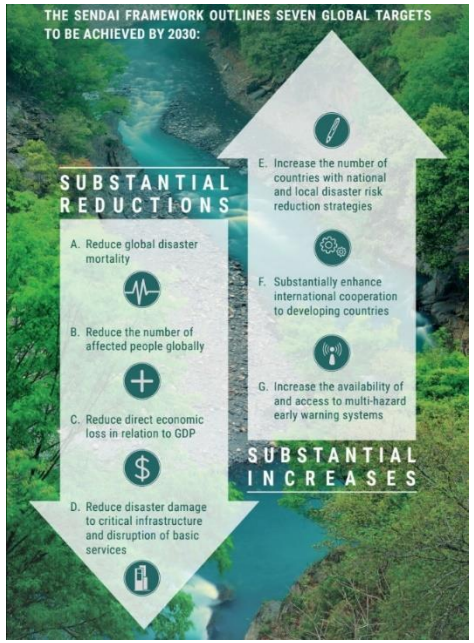
Dec. 2021

G20 Culture ministers published the Rome Declaration









White Paper from ICOMOS,UNESCO,IPCC the two Joint Programming Initiatives JPI CH and JPI Climate

The Senday fremework oulines seven global tagets to be achieved by 2030

2022

2030

elizen@unive.it

Cultural heritage - climate change - society

IPCC report 2019

- Great emphasis on THE POTENTIAL OF CULTURAL HERITAGE TO EDUCATE PEOPLE ABOUT THE CHANGES FACING US:

- *"There is immense and untapped potential for the mobilization of society through active engagement with local communities and visitors of cultural heritage sites…education is crucial for the scale of societal transformation needed to address climate change"* (Valérie Masson-Delmotte)

- Cultural heritage sites are also honey-pots for tourists, and tourism has a growing carbon footprint—in 2009-2013 from 3.9b to 4.5b tonnes of CO_2 and 8% of total emissions.

elizen@unive.it

Complexity of the cultural heritage and climate change system

Interdisciplinary (cross-disciplinary) approaches

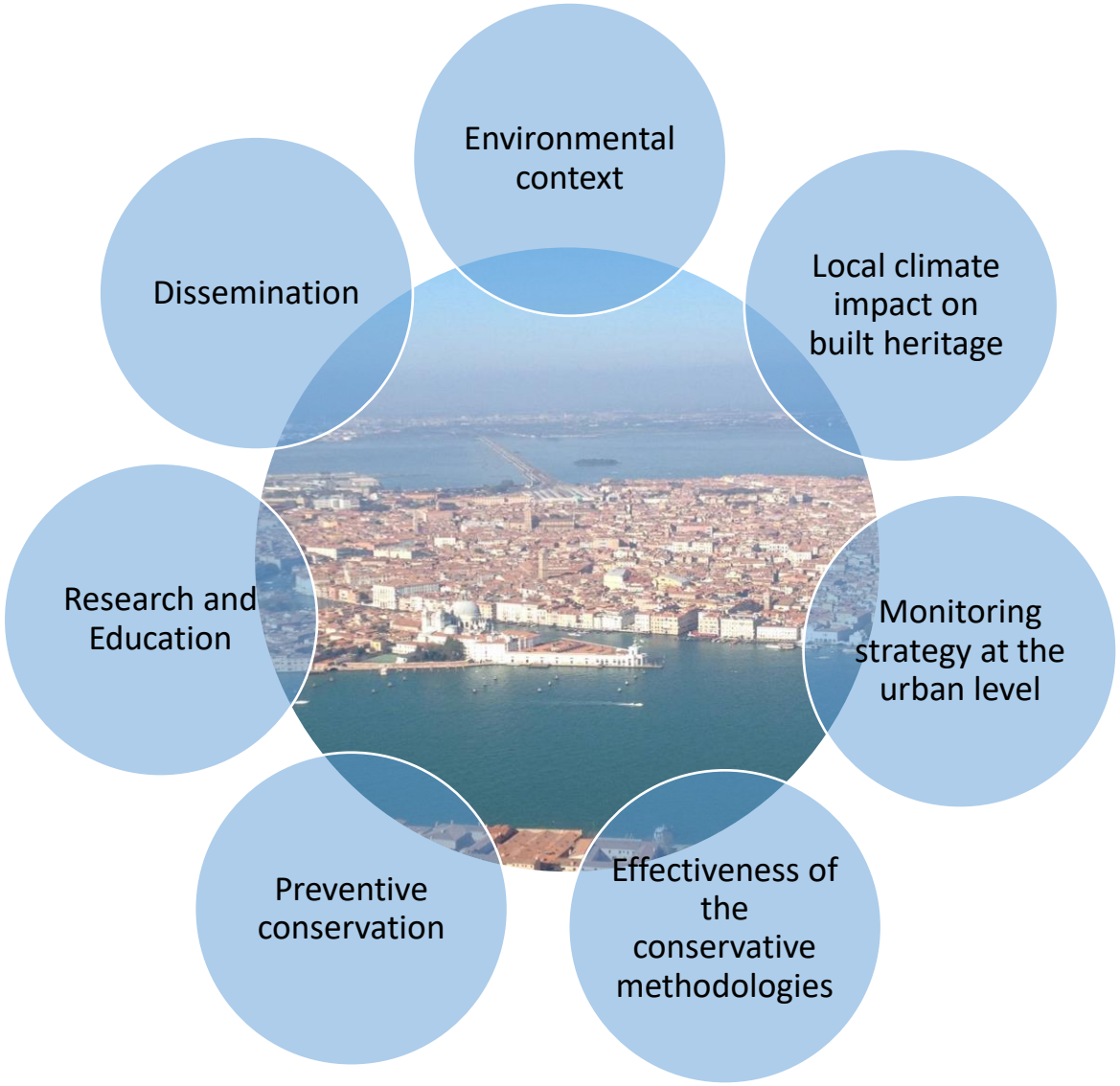
Table 2: Suggested requirements for a 'methodological toolkit."

Methodology	*Description*
Heritage Inventory	Preparing an inventory of cultural heritage provides a basis for other methodological advances. Consequently, inventory preparation is in itself a climate strategy, especially when it takes account of heritage values as climate action assets and is sensitive to climate vulnerability and adaptive capacity. The level of detail will vary with the scale, nature and complexity of the heritage resource. For example, it could include participatory cultural mapping – identifying, documenting and recording tangible and intangible cultural heritage, place-based narratives of change, and local knowledge specific to lace and the communities who live there.
Heritage Values Assessment	Taking a values-based approach and incorporating tangible and intangible heritage throughout, including but not limited to statements of Cultural Significance (or Outstanding Universal Value if a World Heritage Site). Understanding current values is a prerequisite to assessing risk from Climate Change.
Impact Assessments (HIA)	Adopting/adapting existing methodologies for assessing the Impacts of Climate Change on cultural heritage and the effects of those impacts on associated communities. A revision of the Heritage Impact Assessment (HIA) process as proposed by ICOMOS in 2011 will support the evaluation of impacts focusing on heritage and Climate Change in the circular economy perspective.
Vulnerability Matrix	A matrix of possible climate change Impacts based on the best available climate science and established Cultural Significance/heritage value.
Vulnerability Indicators	A selection of indicators, quantifiable proxies measuring aspects of vulnerability to climate change, providing reference points at multiple scales to guide policy and planning.
Heritage Documentation and Monitoring	Gathering and sharing standardized data, both nationally and internationally, presents challenges but is highly desirable. Utilizing as appropriate the full range of traditional techniques and new technical solutions to enable multi-scale analysis of the progress of climate change.
Conservation Management Planning	Should include managing, adapting and mitigating climate change for sites through integrated Policies. Requiring short, medium and long-term perspectives and actions.
Risk Assessment (macro)	Considering likelihood vs severity of a potential hazard makes it possible to undertake Risk Assessment reasonably rapidly on a national and/or regional scale. This process can often utilize data from other sectors e.g. flood management, biodiversity etc. The information this provides can be utilized in setting priorities and developing Disaster Risk Management plans.
Vulnerability Assessment (micro)	Considering sensitivity, exposure and Adaptive Capacity of tangible and intangible heritage. Requiring a holistic local scale assessment of Impacts and Resilience that is best undertaken at site level. Tangible heritage tends to be static, however when analysed as part of a human system, Adaptive Capacity (largely residing in the human element) can be assessed.
Climate Vulnerability Index (CVI)	The CVI is a rapid assessment tool that focuses on climate Impacts to the Cultural Significance of a site (and can be done for a site or for a 'thematic group' of sites). It is currently being developed by a network of partners including ICOMOS.
Adaptation Planning	Based on an informed assessment of Vulnerability, Adaptation planning can be approached at site level in order to design adaptation Pathways that best protect the identified Cultural Significance. Inputs to regional/national level adaptation strategies in response to macro assessment of Risk will be important and should follow an established multi-sectoral, interdisciplinary methodology for planning which ensures that heritage is considered within the strategies of cross-cutting sectors e.g. agriculture, tourism etc.

ICOMOS Climate Change and Cultural Heritage Working Group. 2019. The Future of Our Pasts: Engaging Cultural Heritage in Climate Action, July 1, 2019. Paris: ICOMOS.

elizen@unive.it

Venice is a resilient laboratory



Venezia2021
Programma di ricerca scientifica per una laguna "regolata"

CREST
CULTURAL RESOURCES FOR SUSTAINABLE TOURISM
CHANGES
CULTURAL HERITAGE ACTIVE INNOVATION FOR NEX-GEN SUSTAINABLE SOCIETY
EXTENDED PARTNERSHIP

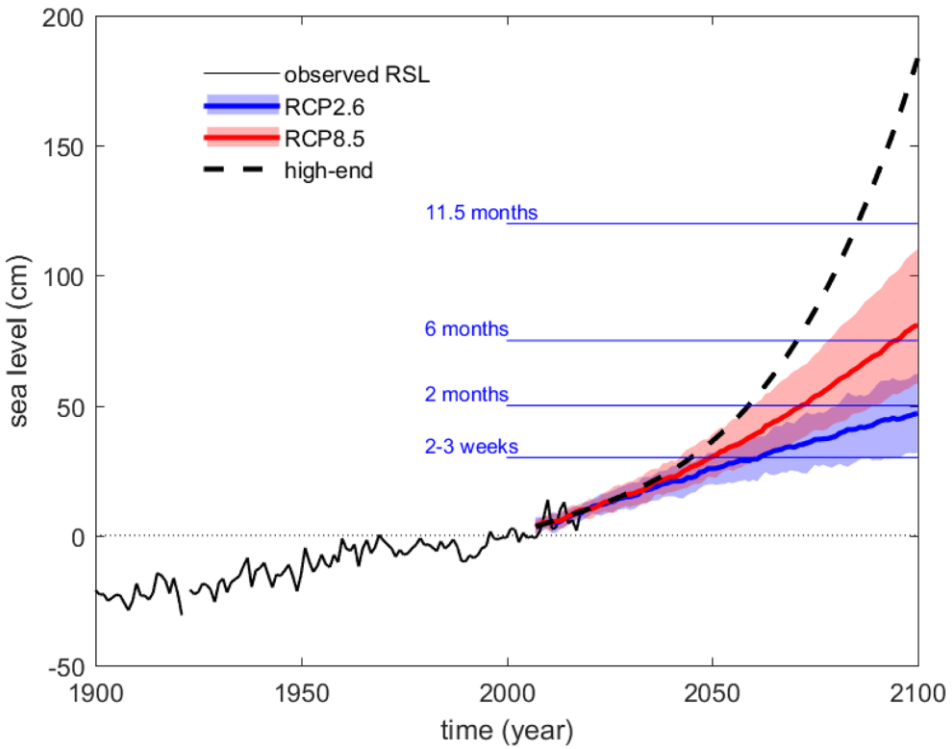
CULTURAL HERITAGE
A CHALLENGE FOR EUROPE

EMERISDA

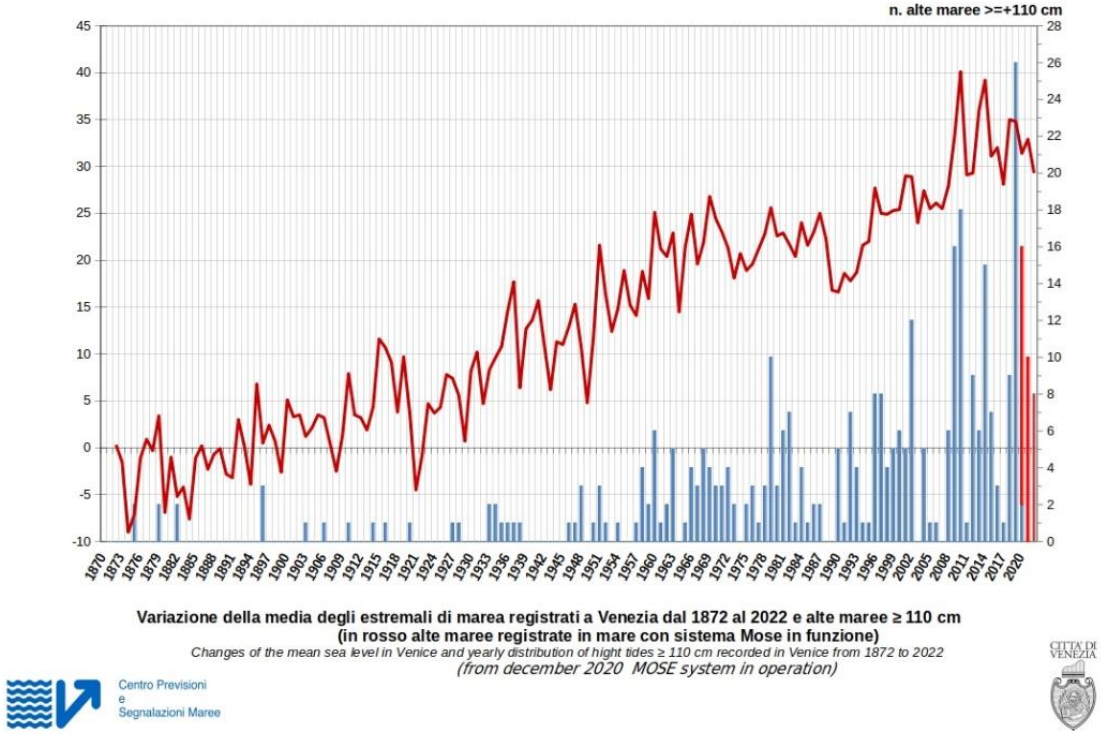
Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it

Environmental context



Projected relative sea level change in Venice in the context of historical observations.



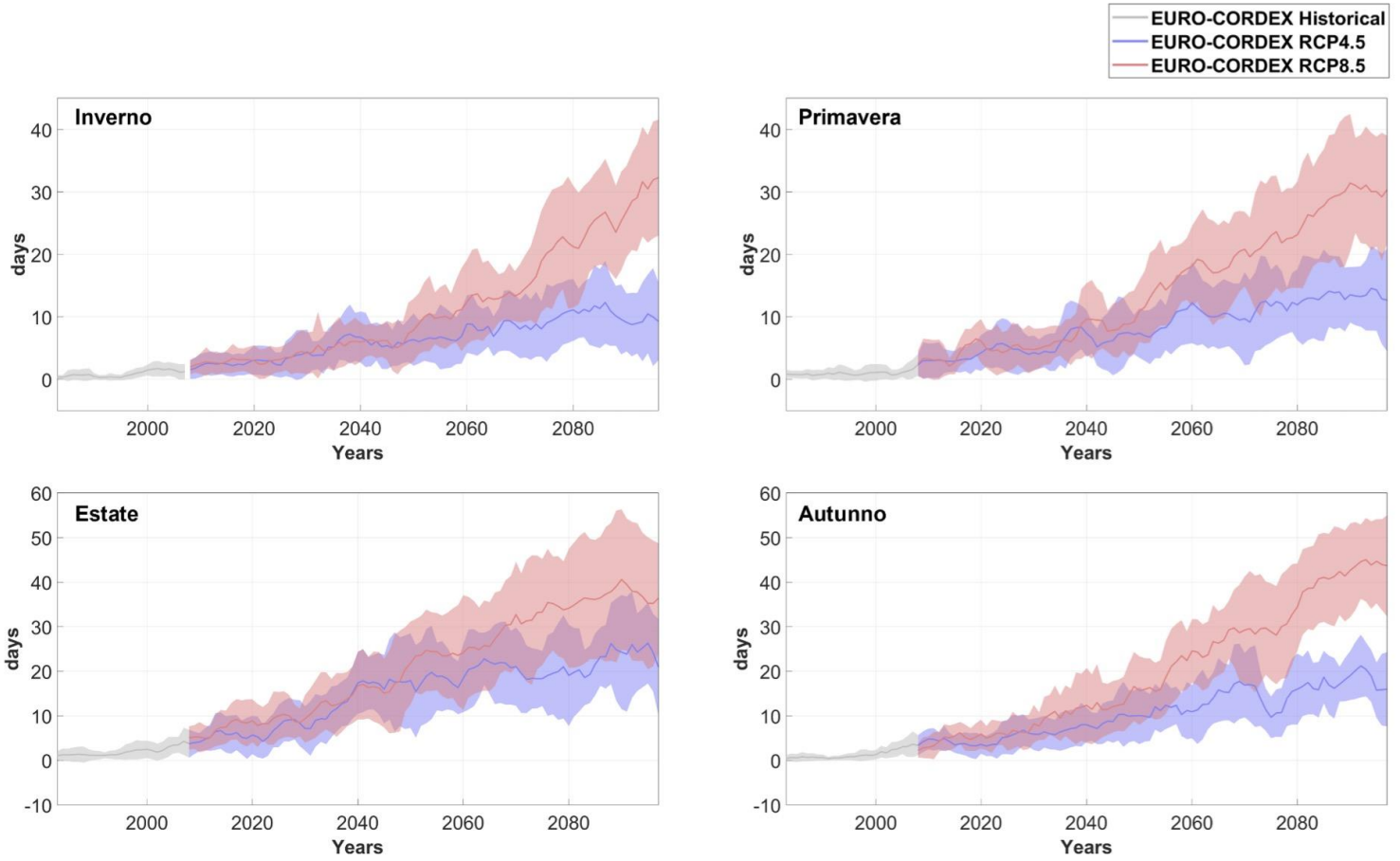
Historical evidence: subsidence temporarily dominated by the anthropic component (Venice: 1.3-1.4 mm/y)

Zanchettin D., et al.(2021), Sea-level rise in Venice: historic and future trends (review article), Nat. Hazards Earth Syst. Sci., 21, 2643-2678, https://doi.org/10.5194/nhess-21-721 2643-2021.
Lionello P., et al. (2021): Venice flooding and sea level: past evolution, present issues, and future projections (introduction to the special issue). Nat. Hazards Earth Syst. Sci., 21, 2633–2641, https://doi.org/10.5194/nhess-21-2633-2021.

Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it

Environmental context



The changes in WSDI indicator for EURO-CORDEX models. Red color: scenario without climate policies, blue color: scenario with climate policies (colored area: standard deviation around the mean value under the same scenario.

Venezia e il CLIMA: passato e futuro, Paola Mercogliano, Veronica Villani, Mario Raffa, Giuliana Barbato, https://www.cmcc.it/it/report-venezia

elizen@unive.it

Local climate impact on built heritage

Rising damp effects on the Venetian built heritage

Comparison of actual and past images (from 2000 to 2022): evaluation of the rising damp process over time

Building position and altimetry (on local sea level reference ZPMS; masonries facing canals: 0 cm)

The evidence of **maintenance intervention** on buildings

Falchi, L.; Corradini, M.; Balliana, E.; Zendri, E. Urban Scale Monitoring Approach for the Assessment of Rising Damp Effects in Venice. *Sustainability* 2023, 15, 6274. https://doi.org/10.3390/su15076274. Scientific activity performed in the Research Programme Venezia 2021, coordinated by CORILA, with the contribution of the Provveditorato for the Public Works of Veneto, Trentino Alto Adige and Friuli Venezia Giulia, Government of Italy

Monitoring strategy at the urban level

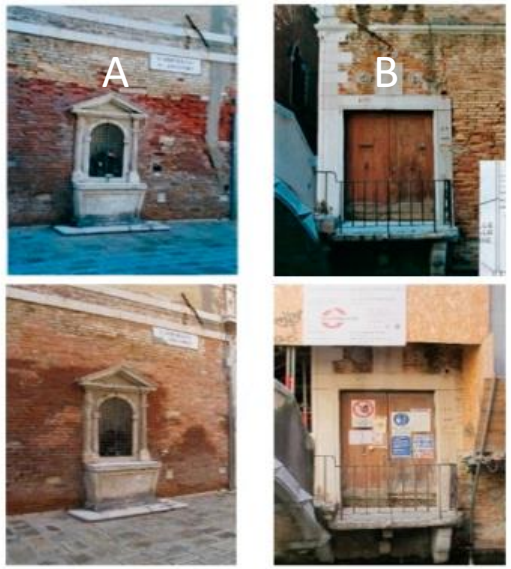
The descriptors

• Height of the rising damp sharp front of the masonry surface;

• Height, extension and distribution of brick erosion on the evaporation band due to salts;

• Height of the algal colonization, visible as a greenish band when low tides occur.

Four evaluation levels :
++ remarkable increase
+ significant increase
= similar level
- decrease
-/ non-comparable



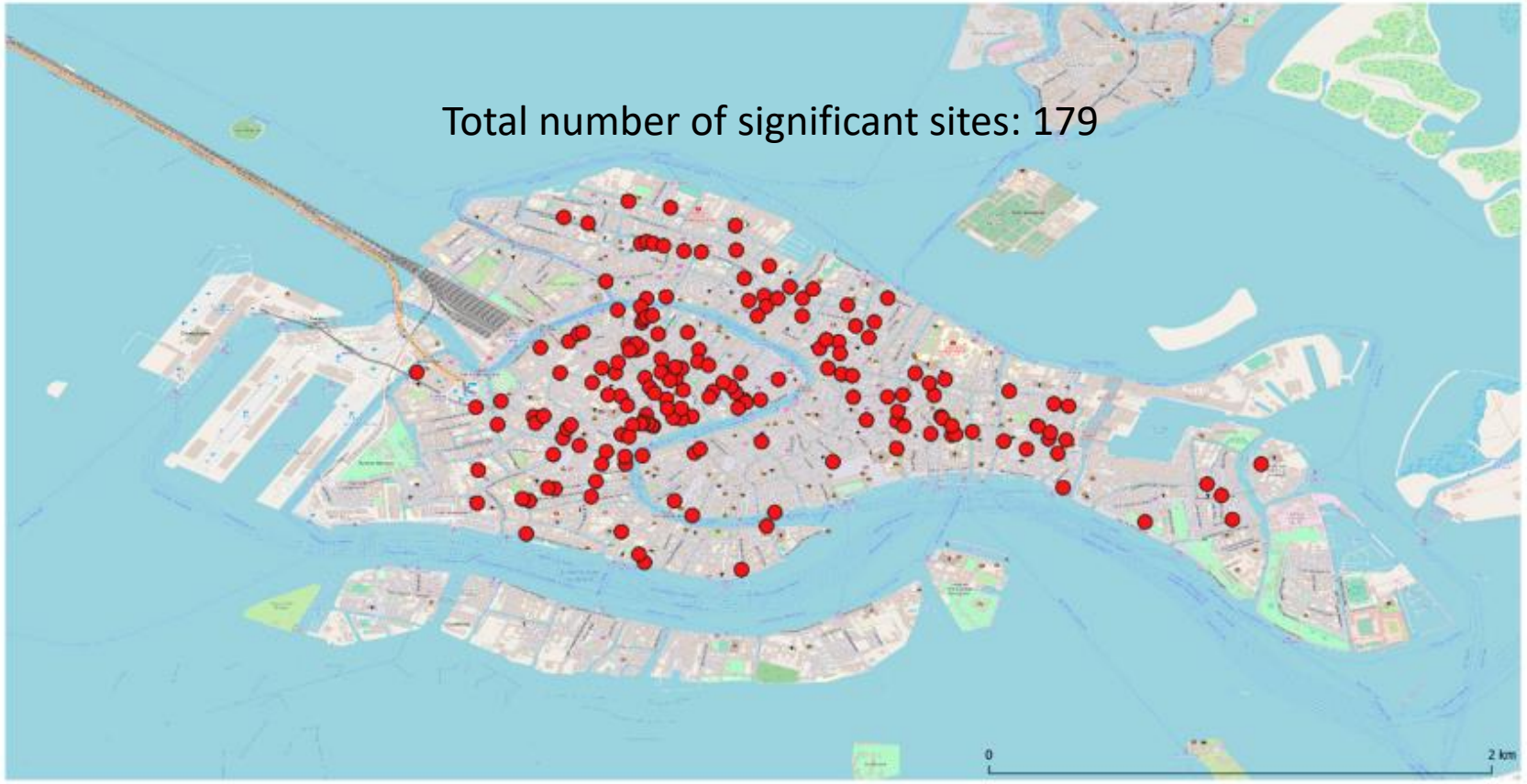
(A) a rejected site due to unknown intervention of replacement of bricks (up July 2010; down January 2021); (B) a rejected site due to works in progress covering the façade.

elizen@unive.it

Monitoring strategy at the urban level

9475 sites in the archive, 575 cases selected.

Several masonries were restored between the 2000s and 2020s (application of covering plasters, brick replacement, insertion of methods against rising damp, or covering with scaffolds)



The location of the sites selected for this study within the city of Venice

elizen@unive.it

Monitoring strategy at the urban level

Address	GPS; A* (cm)	Archive pictures (date)	Recent Pictures (date)	Capillary rise level	Algal band	Brick erosion band
2716 Calle Donà (S. Ternita, Castello	45.437056787977747, 12.349106356082054; 0	 21-08-2008	 24-03-2021	=	/	/
485 Fondamenta S. Gioachin, Castello	45.432578036982272, 12.356089440737764; 113-118	 2008	 16-11-2019	++	/	=
1085 Campo San Silvestro, Dorsoduro	45.437682357607013, 12.332865511901684; 158	 17-10-2006	 21-02-2021	+	/	=

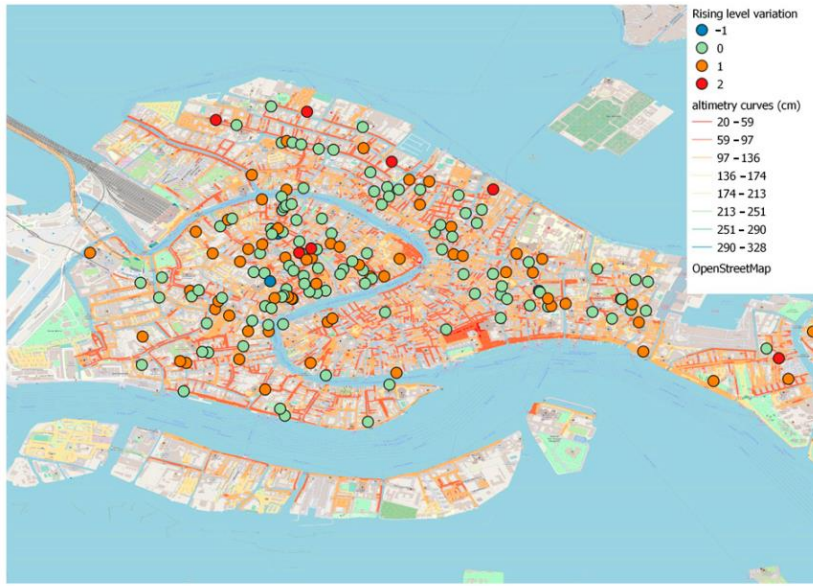
Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it

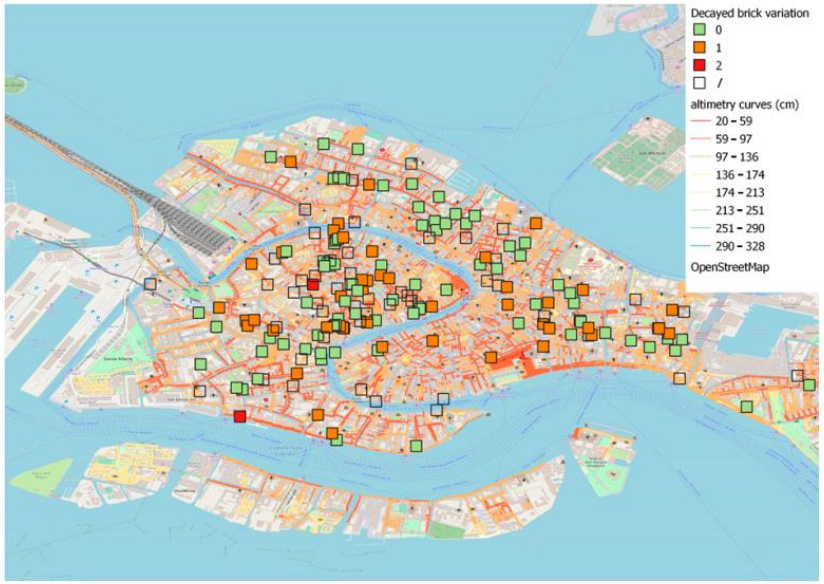
Monitoring strategy at the urban level

Capillary rise levels have not drastically changed in the last 10 years for masonry in direct contact with canal water.

Variations in the degraded brick areas are visible in masonries at +120 - +130 cm



Variations in the sharp front levels of rising damp
-1 blue = decrease; 0 green = no variation;
1 orange = increase;; 2 red= remarkable increase.



Variation in decayed brick extensions
green = no variation; orange = increase; red = remarkable increase; ; uncolored = / non comparable.

Variation in algal band levels:
light green = negative or no variation; green =slight increase; dark green = significant variation

elizen@unive.it

Effectiveness of the conservative methodologies

Preventive conservation

Hypothesis: over time, masonries over +120 cm are supposed to get dried

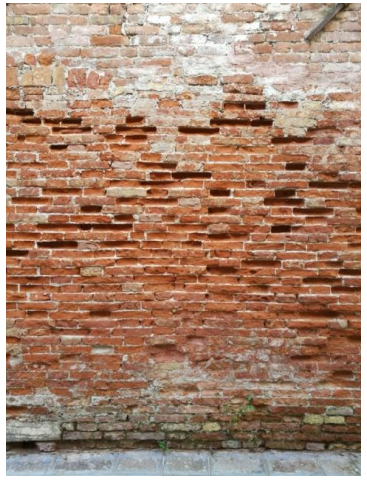
Methods against Rising Damp

Methods which stop/limit rising damp

1. Damp-proof course
   - 1.1 Mechanical interruption
   - 1.2 Chemical interruption
     - 1.2.1 injection
     - 1.2.2 impregnation
2. Evaporation increase
   - 2.1 Knapen siphons
   - 2.2 Drying stones
   - 2.3 Wall base ventilation
3. Electrokinetic
   - 3.1 Electro-osmosis
     - 1.1.1 Active
     - 1.1.2 Passive
   - 3.2 Other systems

Methods which tackle symptoms (i.e. additional measures)

1. Special plasters
2. Veneer walls
3. Drainage



- *A posteriori* and over time evaluation of interventions to define the most suitable solutions → **compatibility with the environment and the historical materials**

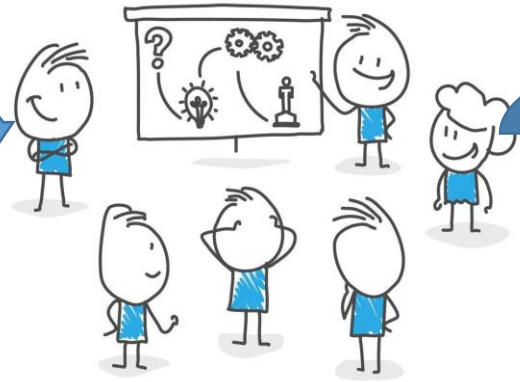
elizen@unive.it

Research and Education

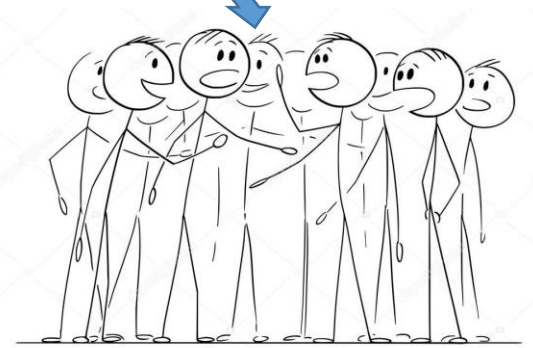
Dissemination

"There is also a need to further invest in research and education by systematically including cultural heritage in the national education systems and national research programs. "

From **Research** to capabilities in **Conservation practice**



Consolidate the current educational paths and creation of **new professionals**



Culture and cultural heritage can be the key to **citizen engagement** (idea of common good), as well as to social, environmental, economic and governance innovation.

(European Commission, Directorate-General for Education, Youth, Sport and Culture, *Strengthening cultural heritage resilience for climate change – Where the European Green Deal meets cultural heritage*, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/44688)

Resilient Cultural Heritage: protect cultural heritage from sea-level rise

elizen@unive.it