*sustainability*

MDPI

*Article*

# Heritage Resilience and Identity: Lesson from Trabocchi Coast about Climate Change Adaptation Strategies

**Luisa Irazú López Campos [1,*], Fernanda Prestileo [2], Eleonora Maria Stella [3], Alessandra Mascitelli [4], Eleonora Aruffo [4], Piero Chiacchiaretta [4], Piero di Carlo [4] and Stefano Dietrich [2]**

1 CONAHCYT—Consejo Nacional de Humanidades, Ciencias y Tecnologías, Av. Insurgentes Sur 1582, 03940 Mexico City, Mexico
2 CNR-ISAC—National Research Council–Institute of Atmospheric Sciences and Climate, Via del Fosso del Cavaliere 100, 00133 Rome, Italy; fernanda.prestileo@cnr.it (F.P.); s.dietrich@isac.cnr.it (S.D.)
3 CNR-ISPC—National Research Council–Institute of Heritage Science, Area della Ricerca di Roma 1, Via Salaria km 29.300, 00010 Montelibretti, Italy; eleonoramaria.stella@cnr.it
4 Center for Advanced Studies and Technology (CAST), Department of Advanced Technologies in Medicine and Dentistry (DTM&O), University "G. d'Annunzio" of Chieti-Pescara, Via dei Vestini 31, 66100 Chieti, Italy; alessandra.mascitelli@unich.it (A.M.); eleonora.aruffo@unich.it (E.A.); piero.chiacchiaretta@unich.it (P.C.); piero.dicarlo@unich.it (P.d.C.)
* Correspondence: irazu13@yahoo.com

**Abstract:** Climate change and land use are major drivers of environmental and socioeconomic transformations in landscapes and in coastal areas. The objective of this study was to present an interdisciplinary and participatory research methodology for analysing the evolutionary process of a coastal case study, the Trabocchi Coast in the Abruzzo Region (Italy), from multiple perspectives, including climate change, technological history, conservation protocols, and social function. The goal was to assess the resilience of these coastal structures, i.e., their ability to cope and adapt to changes while maintaining their identity and recognition. The adopted approach combined qualitative and quantitative data from the meteorological analyses, literature review, and field investigations involving a participatory workshop, from which a significant portion of the analysed results presented here emerged. The results indicate that the Trabocchi Coast has undergone significant changes in recent decades, posing a serious threat to cultural heritage due to climate change (sea-level rise, coastal erosion, storms, flooding and salinisation), changes in use and mass tourism. However, these changes have also presented challenges and opportunities for coastal development, stimulating diverse resilient responses from local communities, ranging from resistance to innovation. The paper discusses the factors that may make the Trabocchi Coast a model of resilience considering these changes. This is supported by the role of local institutions as guarantors of the cultural heritage value of the trabocchi in that specific landscape context, as evidenced by the approval of the "Costa dei Trabocchi Special Territorial Project" by the Abruzzo Region in 2023.

**Keywords:** climate change; trabocchi; intangible cultural heritage; coastal areas; resilience; coastal management; adaptive strategies; heritage uses



**Citation:** López Campos, L.I.; Prestileo, F.; Stella, E.M.; Mascitelli, A.; Aruffo, E.; Chiacchiaretta, P.; di Carlo, P.; Dietrich, S. Heritage Resilience and Identity: Lesson from Trabocchi Coast about Climate Change Adaptation Strategies. *Sustainability* **2024**, *16*, 5848. https://doi.org/10.3390/su16145848

Academic Editors: Konstantinos S. Ioannou, Evangelia Karasmanaki and Georgios Tsantopoulos

Received: 4 June 2024
Revised: 30 June 2024
Accepted: 2 July 2024
Published: 9 July 2024



## 1. Introduction

The Italian coast of the Adriatic Sea is characterised by the presence of "trabocchi," ancient wooden "fishing machines" [1,2], which are relevant examples of the vernacular architecture in this coastal area.

This study focuses on a particular region, characterised by considerable environmental, historical, and cultural value, marked by significant open debates on different hot topics, and marred by the presence of landslide phenomena across the territory.

The evidence emerging from the mapping, analysis, and research phases has revealed how the course of events has defined the evolutionary developments that are sometimes

notable and sometimes less invasive but, in any case, nonetheless incisive in defining the territorial physiognomy. Therefore, it seems clear how the participatory phase serves as the glue between the analytical phase and the practical feedback, enabling motivation, justification, and understanding of the dynamics at work.

The stretch of coastline in the Abruzzo Region, from the municipality of Ortona to Vasto, in the province of Chieti, is known as the Trabocchi Coast, with 31 still standing today [2], serving as symbols of regional local identity and heritage (Figure 1).

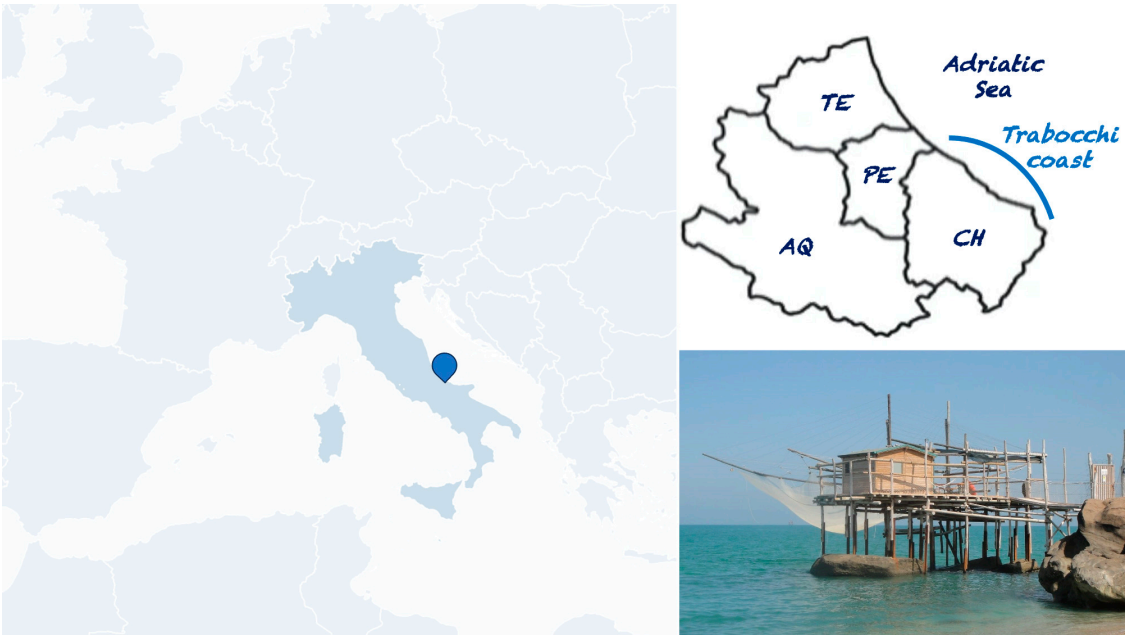



**Figure 1.** The five province of Abruzzo Region, Italy: TE, Teramo; PE, Pescara, CH, Chieti, AQ, L'Aquila) with highlighted the Trabocchi Coast along the coastline in province of Chieti and the Trabocco Punta Le Morge, Torino di Sangro (map by Alessandra Mascitelli and photo by Luisa Irazú López Campos).

Most trabocchi are privately owned, and only a third are subject to the constraints established by current national and regional protection laws [3] (p. 4). It is within the context of this coast and this specific vernacular architecture that our research is focused and must be framed in the dynamic context of what is happening in the Mediterranean basin.

The effect of climate change, for which the temperature appears to be a clear indicator, on heritage can be easily identified by the analysis of extreme weather-related consequences. The significant increase in extreme climate events, their intensity, and the related effects on the landscape and cultural heritage has been an emerging theme in the existing literature [3–6].

Specifically, regarding the Abruzzo Coast, it was observed that being affected for most of the year by the clear contrast between the tropical air masses and those of polar origin allows for the transit of unstable weather [3,7]. Studies have shown that the main cause of the risk of coastal erosion is storm surges. Their potential increase in the Adriatic Sea must be seen in relation to the increase in wind speed; in particular, it was tested how future storm events can be generated by increasing the wind intensity of the meteorological model [8].

In a previous study, the authors analysed the case of the Trabocco Turchino [3], recognised by the population as an identity element of the Abruzzo coastal area. This trabocco, which collapsed due to a strong sea storm in July 2014 and previously in 2003, has since undergone the recovery interventions and been destinated to a new function for cultural and tourist purposes [1,3,9,10].

The historical analysis of the trabocchi serves as a valid case study for understanding the institutional process of recognising cultural heritage and the social motivations behind it. This understanding underscores the need for conservation and the importance of studying the causes that challenge it, such as climate change and, as in this specific case, the resulting extreme weather events that increasingly affect the Adriatic Coast. Conservation strategies aimed at transmitting our cultural heritage to future generations must consider the value that the property has for its population and the function it serves. Such recognition and function in the present will enable it to survive the passage of time and be projected into the future. Hence, there is the need to monitor changes in the environment and plan concrete actions aimed at the conservation of cultural heritage by adapting it to these environmental stresses in order to make it resilient [3].

In this study, after the literature review on the historical, socio-economic, and conservative aspects in Section 3, we provide a climatic characterisation of the Abruzzo Region in Section 4, specifically for the province of Chieti, focusing on temperature trends that highlight ongoing changes and their likely consequences in terms of extreme events. This analysis scientifically supports the population's perception of climate change, as evident from the participatory workshop conducted with citizens in San Vito Chietino discussed in Sections 5 and 6, and further commented on in Section 7 prior to reaching the conclusion in Section 8.

## 2. Research Aim and Methodology

The main objective of this study was to present a methodological approach for analysing the Trabocchi Coast from various research angles, especially in light of the challenges presented by climate change, land use changes, and resilience capacity. We explored the significant historical, climatological, and social factors of the region to assess how climate change, resilience, and land use alterations have impacted the preservation of its cultural heritage. The research aimed to address the following key questions:

- How has the Trabocchi Coast changed over time in response to environmental factors and climate change?
- What are the current and future threats and opportunities for the conservation of trabocchi in relation to social and economic factors?
- How do local communities perceive and value the Trabocchi Coast and its heritage?
- In what ways can trabocchi serve as a model of resilience for other cultural assets?

To address these questions, we proposed an interdisciplinary and participatory research methodology [11] that involved researchers from different disciplines and actors from different sectors. The research team was composed of experts in meteoclimatology, communication, history of art, conservation science, cultural history, cultural mediation, and environmental sciences, who collaborated to collect and analyse data from diverse sources and perspectives.

The strategy and group work method involved contributions from various disciplines and specialties. The collaborative effort aimed to generate a proposal for addressing the impact of climate change on heritage elements, specifically focusing on trabocchi but remaining potentially applicable to any other cultural asset. The objective was to provide guidelines that could benefit decision-makers, local authorities, and the broader public.

By enhancing the understanding of heritage issues, the aim was to assist these stakeholders to make more informed and up-to-date decisions, including specific intervention proposals for conservation efforts. The research group's working methodology intended to offer a precise, comprehensive, and detailed perspective, achieved through the multidisciplinary composition of its members and, importantly, by considering the perspectives of various involved actors/actants [11]. This inclusive approach allowed for the analysis of a broader range of valuable elements, including social perception.

The proposed research methodology was grounded on the following principles:

- Interdisciplinarity: The research integrated the knowledge, expertise, and methodologies of diverse researchers from different disciplines. This approach aimed to offer a comprehensive and holistic understanding of the focal issue, in this instance, the Trabocchi Coast and its dynamics. The research team collaborated collectively to delineate the case study, set research objectives, design the research plan, determine data collection and analysis methods, and identify effective means of disseminating the results.
- Participatory Methodology: The research engaged different actors in the co-production of knowledge and information gathering, and in the elaboration and definition of key points related to cultural and social policy. This approach aimed to enhance the relevance, timeliness, and validity of the obtained results [12]. Stakeholders were involved from the beginning, consulted, and actively invited to participate through the implementation of a horizontal participatory workshop, a crucial component of the research process. They contributed essential elements, including identifying strategic lines, formulating research questions, and validating and assessing the research findings. In terms of transparency and ethics in data handling, participants were promptly informed of the workshop's objectives and had agreed that the information provided by them would be used by the research group for analysis and to enrich the research results that underlie this publication. Likewise, they agreed to the use of photographic images being taken during the group activities for the purpose of disseminating the work accomplished.
- Horizontal Approach: In addressing any issue, it was recognised that all the involved actors held equal importance, contributing key elements for a comprehensive understanding of the case study. While not everyone is the same or establishes identical dynamics or connections, everyone holds equal value when delving into any issue in depth. The horizontal approach was fundamental in this research proposal, acknowledging that each actor is essential [13].

The expected benefits of this research concerning trabocchi as heritage elements include:

- Generating a detailed and comprehensive understanding of the Trabocchi Coast and its resilience, considering the complexity and diversity of environmental, historical, cultural, touristic, social, and economic factors.
- Fostering, facilitating, and promoting dialogue and collaboration among researchers and actors involved, enriching reflection and knowledge generation, valuable for identifying objectives and proposing concrete solutions for the Trabocchi Coast.
- Enabling the research group to understand the perception of various actors involved in the trabocchi issue regarding the meaning of heritage. It is crucial to comprehend the heritage value attributed to trabocchi, its evolution, and how it has been affected or modified over time.
- Providing stakeholders with a comprehensive perspective on the issue, empowering them to participate in an informed and responsible manner in decision-making and propose concrete actions for the conservation and sustainable development of the Trabocchi Coast.

## 3. The Abruzzo Trabocchi: Fishing Machines between Tradition, Oblivion, Rehabilitation, and Reuse

### *3.1. Literature Review*

In recent years, an increase in the extensive scientific literature on the topic of the Trabocchi Coast has proliferated in parallel with the enormous increase in tourism and media attention.

This section delves into the region's historical background, providing a basis to understand its current heritage landscape. Looking back on the recent history of this characteristic vernacular cultural heritage, up until the 1970s, maintenance work on these fishing machines was carried out by the fishermen themselves who worked there, without altering

the system's organisation. The railway, built in 1863-1864, which ran along the coast from Ortona to Vasto, was integrated into the natural and agricultural landscape and preserved this portion of the coast from building development. This 26 km coastline is at high hydrogeological risk due to its particularly vulnerable cliffs [3,14].

The sudden socio-economic growth has caused negative effects in this area. The choice of technologies and building materials foreign to the local culture, the progressive shift away from traditional knowledge and technologies, and the rise in mass tourism did not take into account the environmental consequences for this fragile area.

During this period (the 1970s and 1980s) of rapid growth and transformation, which saw people looking for more lucrative jobs, the trabocchi were mostly abandoned. However, it should be underlined that this phenomenon of under-utilisation began at the end of the Second World War [15] (p. 334).

Since the early 1990s, the interest of the institutions responsible for the full protection of these traditional fishing machines has grown [3] (pp. 3–4). Starting from 1994, specific regional laws have proposed measures for the recovery and enhancement of this so-called "spontaneous architecture", as representative instances of the construction practice of the *genius loci* [1] (pp. 246–247). These laws have initiated funding supported by the creation of a specific guide for the restoration and maintenance of these fishing machines. The topic regarding the construction of new trabocchi with adequate technologies and materials has also been addressed [9].

The decommissioning of the railway (Figure 2), which occurred in 2005 [14] (pp. 323–335), triggered a broad debate on the future of the coast and led, at the same time, to the rediscovery of the trabocchi. In this perspective, the "Theatine Coast Park" ("Theatine" means the stretch of coastline in the province of Chieti), promoted since 1997, was established to protect the areas of the coast freed from the railway.


(**a**) (**b**)

**Figure 2.** (**a**) Decommissioned railway station in the Municipality of San Vito Chietino; (**b**) Decommissioned railway stretch along the coast of San Vito Chietino near Trabocco Turchino (photos by Fernanda Prestileo).

From a legislative and planning perspective, an approach aimed at achieving integrated conservation has been outlined, based on the principles established by the "Amsterdam Declaration" [16]. This is in order to protect the entire landscape context of the Trabocchi Coast and prevent the improper use of the territory from erasing its cultural identity in favour of a standardised landscape, indifferent to coastal problems and environmental vulnerability.

Tourism impacts both, physical development and image, and could play a significant role in causing strong anthropic pressure [1]. This stretch of coast is, in some places, still free from tourist interventions but threatened—now that it is no longer protected by the presence of railway—by the pressure of a new real estate expansion which, in part, has already begun.

From the study and rediscovery of the trabocchi, the knowledge useful for activating adequate actions to achieve sustainable use of coastal environmental resources has continued to be developed, such as defining guidelines for the creation of sustainable bathing facilities [14] (pp. 30–33). The need to respond quickly to growing tourist demand has led to the defining of a new eco-systemic approach, falling within the new scope of "environmental planning". In this context, climate change is closely linked to the concept of resilience which is configured as the type of attitude to adopt [14] (pp. 13–16).

In January 2023, the Department of Territory and Environment of the Abruzzo Region adopted the Special Territorial Project (STP) of the Trabocchi Coast entitled "Enhancement and Requalification of the Theatine Coast". The project, which is configured as a complex project of a wide area, is in response to the priority objective of enhancing the coastal area of the Theatine Coast to guarantee the quality of its development and its territorial transformations, while respecting the environmental, historical, and landscape values present [10]. The STP includes the southern part of the Abruzzo Coast, which is scarcely urbanised and partly intact, from the municipalities between Ortona and Vasto.

In accordance with the design vision indicated by Forlani [14], the purpose is to achieve a new idea of territory that takes both the protection of the environment and its strong tourist vocation into account, promoting a form of experiential tourism (slow crossing of the landscape). The STP intends to structure a widespread tourist system of excellence that finds its self-generating strength in the protection and safeguarding of local identities and authenticity (environmental, landscape, historical, architectural, and artistic).

Among the numerous objectives mentioned, the STP is aimed at facilitating interventions around the "Green Corridor of the Province of Chieti" [17], starting from the use and enjoyability of the same infrastructure together with the recovery and unitary repurposing of disused railway stations. In fact, the Green Corridor consists of all the disused railway areas of the coastal line between Ortona and Vasto Marina acquired by the Province of Chieti together with the former railway stations. It also includes the "Green Road of the Province of Chieti", a cycling and walking route as non-motorised slow infrastructure is irreplaceable for the enhancement of the environmental resources of the coastal area and for the valorisation of public and private property, as well as for a new way of enjoying the coast [10].

The STP also provides for active conservation to maintain the constituent values and morphologies of the territory, also taking into account the architectural typologies, as well as the techniques and traditional building materials. Among the various actions planned, there is also the promotion of environmental recovery activities aimed, in particular, at maintaining the safety of areas characterised by potential geological and hydrogeological hazards, as well as the enhancement of the environmental ecosystem and of the connotative features of the coastal landscape.

The intervention criteria and guidelines of the STP must be consistent with the indications deriving from the Guidelines and the Climate Profile of the Climate Change Adaptation Plan of the Abruzzo Region (PACC) and from the Analysis of the possible costs of Climate Change. This analysis must consider different risk scenarios of sea level rise (SLR) or increased flood risk and on the estimate of the monetary value of the areas exposed to a possible risk of soil loss in the scenarios considered in the study (APAT and CMCC) [10,18].

### *3.2. Recovering Trabocchi: Some Considerations*

Regarding the conservation of this type of artefacts, some problematic aspects have been highlighted which reveal the complexity of the issue, since it involves a theoretical and

planning reflection pertinent to the sphere of both intangible and tangible cultural heritage. The dual nature of these artefacts must be considered, as these are structures suspended between land and sea, destined not to last over time [2], and which have undergone periodic renovations and replacements starting from the 19th century, even if they are attested in the 17th century [19]. Currently the trabocchi in Abruzzo, which have remained intact to our days, were built over a period time ranging from the 1880s to 1930s [20] (pp. 38–49). According to Serafini, "Being machines used traditionally for fishing, and therefore as productive buildings to all effects, trabocchi may be considered a particular articulation of what is termed 'industrial archaeology'" [2] (p. 658). These structures, which appear fragile in appearance, are structures constituted of very specific elements that make up the system, including the gangway, fishing plate, stabilising grid, fishing device, and functional equipment (Figures 3 and 4). The evolutionary process characterising these artefacts took place as a function of changes due to the transfer of technology (first and foremost, the construction of the railway) and to changes due to the change in use, fundamentally, but not exclusively, from fishing to the catering service of the seaside tourism system. In the first case, mutations mainly concerned the technical, constructive apparatus, in the second case, they concerned the morphological dimensional system for reasons related to the possible extended use and therefore to the necessary safety [9].

**Figure 3.** Trabocco La Rosa dei Venti-Canale-Trabocchi Coast (photo by Luisa Irazú López Campos).

It follows that, concerning these artefacts, we cannot analyse their codified conservation history according to the criteria of philological restoration, which is intended as a complex of investigations and actions that aim to bring the artifact back to its original form, freeing it from subsequent additions or alterations. In this case, traditional knowledge and construction techniques have come into play which, as emerged from the literature [15] (pp. 328–337), have been passed down orally based on the function of the trabocchi (fishing), on the adaptability of the materials with respect to the landscape context and, lastly, on the structure which had to adapt to the conformation of the coast (sandy or rocky) [2] (p. 650). The use of tradition and the recovery of ancient knowledge are profoundly immaterial aspects that must be documented. To this end, the STP project promotes the recovery, maintenance, and valorisation of the trabocchi, guaranteeing the appropriateness of these management actions over time, and avoiding their historical, cultural, and landscape debasement [10]. It has been established that the trabocchi must be recovered by means of the techniques appropriate to their restoration and renovation. The trabocchi can also be

reconstructed where ancient pre-existences can be found and contribute to the equipment of the coastal selvedge, with uses related to small-scale fishing and educational activities aimed at the knowledge of the marine environment, as below explained.

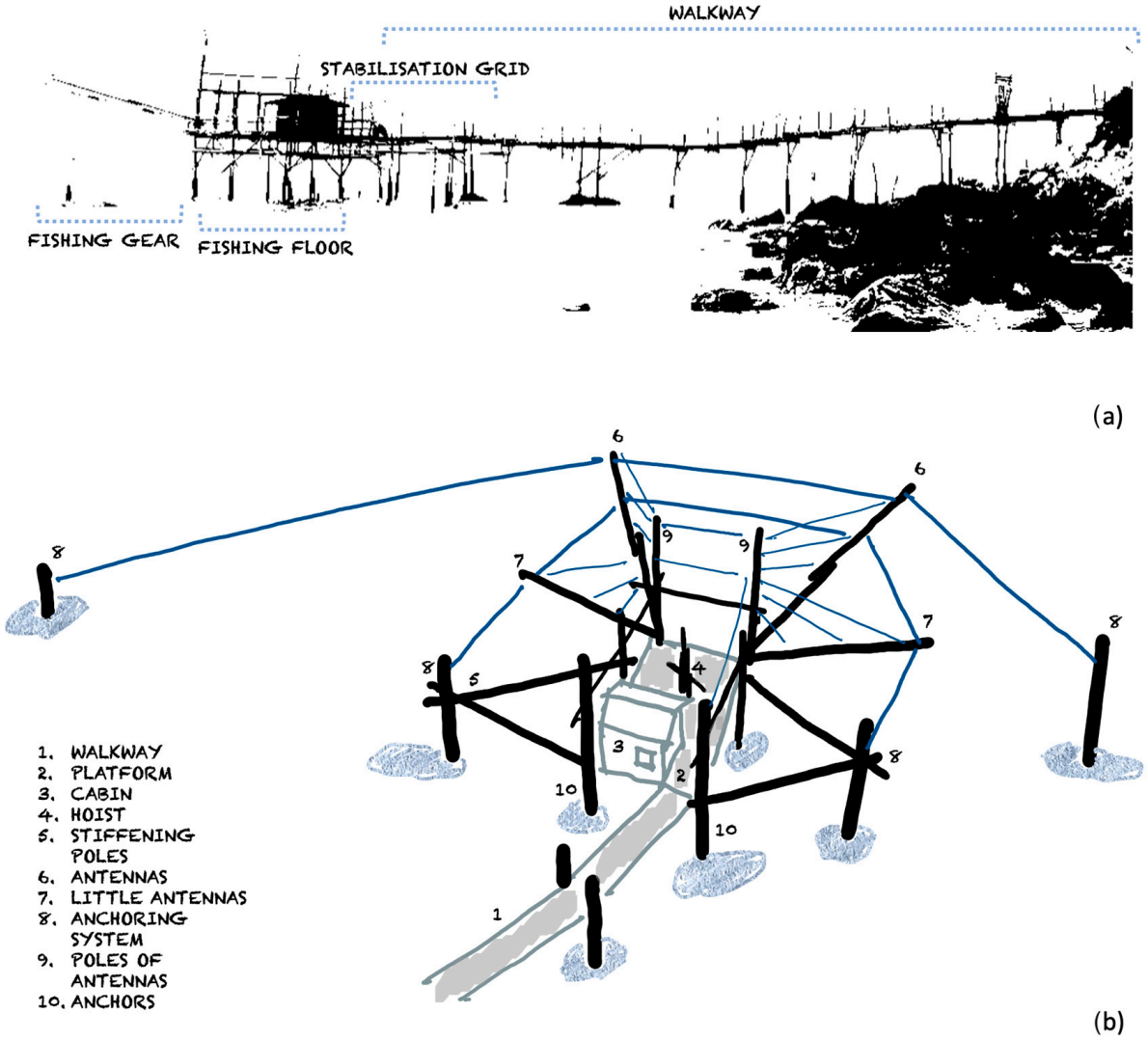



**Figure 4.** (**a**) Trabocco operational features (**b**) Trabocco structural elements.

Indeed, the trabocchi, as identity elements, must be preserved and maintained in their typological, constructive structure. Therefore, the constituent materials, the composition and volumes must remain unchanged and consistent with the original image of the artefacts. Projects supported by joint actions between the municipalities of the Trabocchi Coast, the Province of Chieti, the "Soprintendenza Archeologica Belle Arti e Paesaggio" (Superintendency of Archaeology, Fine Arts, and Landscape), and Abruzzo Region in continuity with the good practices initiated over time for the same purposes of urban and territorial regeneration of the territory of reference must be carried out and implemented. This is the case of the reconstruction of the Trabocco Turchino (Figure 5), which is the only one of public property, destroyed in 2003 and in 2014 by two different sea storms [1,3,9,10], which has since been used by local associations for cultural and social purposes.

Following this exploration of the historical context that shaped the region, we will now examine how climatic conditions have impacted its evolution and development, and the preservation of its cultural heritage elements over time.

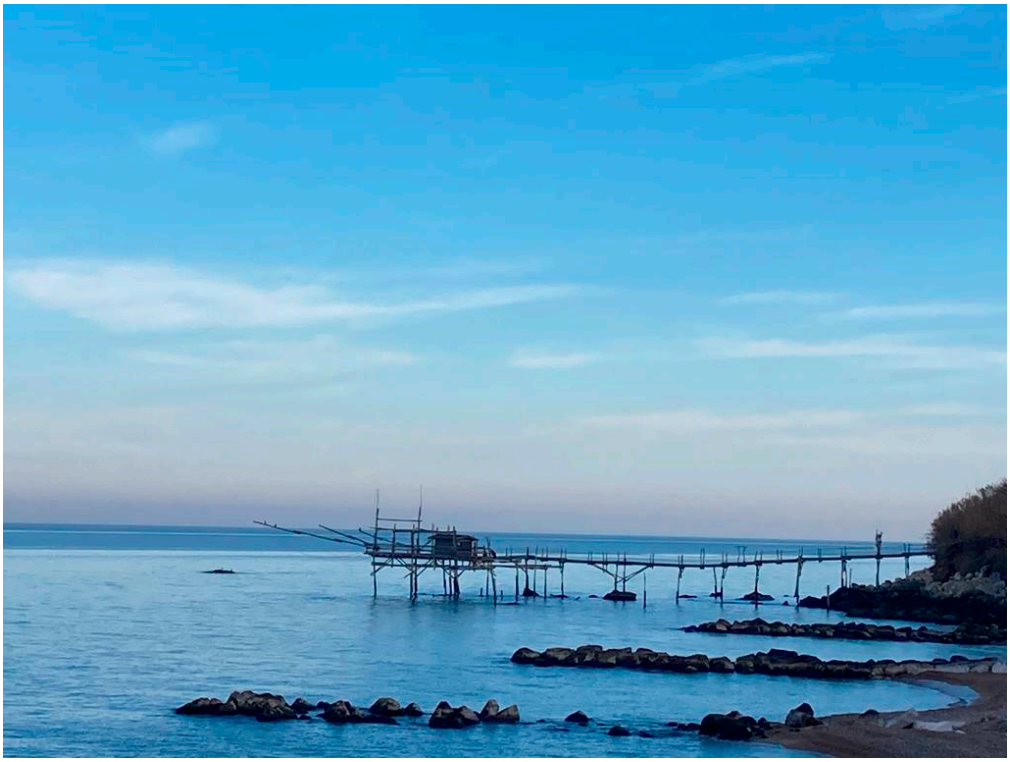


**Figure 5.** Trabocco Turchino-San Vito Chietino–Trabocchi Coast (photo by A. Masciteli).

## 4. Meteorological–Climatic Characterisation of Abruzzo Region

The climate of the Trabocchi Coast significantly affects its environmental and cultural heritage. Analysing climatic patterns and their historical effects is key to evaluating the future resilience of the region's cultural heritage. In reference to the dual emergency situation experienced by Trabocco Turchino [1,3,9,10], the transition to the research segment analysing the climatic conditions in the region is now undertaken. This exploration aims to elucidate the factors contributing to the area's susceptibility to risks arising from climate change.

In this context, the need to understand the coast characteristics in order to comprehend the weather-related phenomena features and be able to impact the stability and the conservation of the studied area becomes clear. In the analysis of the stability conditions of the slopes connecting directly with the line of coast of the Adriatic Sea [21–23], in the stretch between Pesaro and Vasto, there is a cliff for large stretches raised up to approximately 200 m above sea level. Landslides, often large, are already known and described starting from the 19th century [24], have involved the area periodically and on several occasions. From Torre Mucchia to Punta Penna, near the port of Vasto, the coast is high with the presence of short pebble and sandy beaches in the large inlets which the crag appears to be structured. Only at the mouth of the Sangro river the continuity of the high coast is interrupted by a wide sandy coast. South of Punta Penna, up to beyond the port of Termoli, there is a succession of cliff sections and sandy beach sections. The Adriatic coastal strip and its immediate hinterland are characterised by outcrops of Quaternary formations of coastal and deltaic facies, covering the marine silty clays of the Plio–Pleistocene age. The coast is currently subject to intense erosive activity due to the lack of sediments carried by rivers (along which there has been a strong increase in activity in recent years mining) and from the sea (where many cliffs are now protected with shore walls or breakwaters). A comparative analysis of the historical, geometric and dynamic data of some coastal landslides in the Adriatic regions allows us to recognise some substantial similarities and hypothesise the existence of a common failure mechanism. The mechanism is very simple—the collapsed material apparently advances the front beach; however, this local growth of the coast is short-lived,

as the materials' landslides are easily mobilised by wave motion and redistributed along the coast. Unique evidence of the landslide event is given by the larger boulders remaining in the lower areas of backdrops [25,26].

Starting from this basis, the aim of this section was to describe the climate change in the Abruzzo Region and its influence on the whole Trabocchi Coast, a 26 km stretch of the Adriatic Coast characterised by these ancient wooden fishing machines. We analysed the temperature trends since 1930, using the data measured by the network of the former Regional Hydrographic Institute and currently managed by the Functional Centre of the Abruzzo Region. We also used the ERA5 dataset [27,28], a global reanalysis of atmospheric, land, and ocean observations, to compare our results on a larger spatial and temporal scale. We found that the temperature increased coherently with what happened in the northern hemisphere, and that the increase was more pronounced in spring and summer, especially in the most recent period (1980–2015). We also found that some areas have local microclimates that induce variations in temperature above the regional average. These results, combined with an analysis of wind gust and convective precipitation patterns, painted a clear picture of the environmental stresses to which the area is exposed, and showed significant evidence of impact on the territory.

### *4.1. Data and Methods*

We used the historical temperature series measured by the network of the former Regional Hydrographic Institute and currently managed by the Functional Centre of the Abruzzo Region. The network consists of 22 stations with the most complete data record since 1930, as many stations were recently activated while others were decommissioned over the years. The stations are located at different altitudes and covermost of the regional territory. The data include the maximum, minimum, and daily mean temperatures.

Before using the historical temperature series, we performed a data homogenisation and quality control process to consider any variations in the data attributable to external factors, such as movement of the station, change of measurement system and human error [7]. We also compared our data with those of the nearby stations and with the ERA5 dataset to ensure consistency and reliability.

The ERA5 dataset is a global reanalysis of atmospheric, land and ocean observations, produced by the European Centre for Medium-Range Weather Forecasts (ECMWF). It provides hourly data on many variables, such as temperature, precipitation, wind, humidity, pressure, and radiation, at a spatial resolution of about 31 km. The ERA5 dataset covers the period from 1940 to the present and is updated monthly. We used the ERA5 dataset to compare our results on a larger spatial and temporal scale, and to validate our data and methods.

We analysed the temperature trends for each station and for the regional average, considering maximum, minimum, and daily mean temperatures. We also performed seasonal analyses, dividing the year into four seasons as follows: winter (December–January–February), spring (March–April–May), summer (June–July–August), and autumn (September–October–November). We calculated the trends by linear regression model (least-squares best-fit) in different temporal intervals (1930–1979, 1950–2015, 1980–2015) to find the slopes as function of the period.

### *4.2. Results and Discussion*

The analysis of the temperature trends in the Abruzzo Region shows a clear and consistent increase in all stations, seasons, and time intervals, in line with the global and regional warming observed in the northern hemisphere. The increase is more marked in the most recent period (1980–2015), and in spring and summer.

The annual regional mean temperatures, considering the average on the observation stations available in the Abruzzo Region, show an increase in the daily mean temperature, maximum and minimum, with a greater rate starting from 1980. The daily mean temperature shows an increasing trend in the period of 1930–1979, equal to 0.13 °C every 10 years,

while considering the period of 1950–2015, the increase is equal to 0.42 °C per decade, an increase which becomes even more pronounced (0.60 °C per decade) considering the period of 1980–2015. While there is a positive trend at the regional level in terms of the time span (1980–2015), there are areas, such as Chieti (Figure 6) and Pescara, where local microclimates induce variations in positive rates of temperature increase above the regional average. Moreover, considering the period of 1950–2015, Lanciano (about 10 km from the coast) shows a significantly higher increase trend (0.44°/decade) than the regional average.

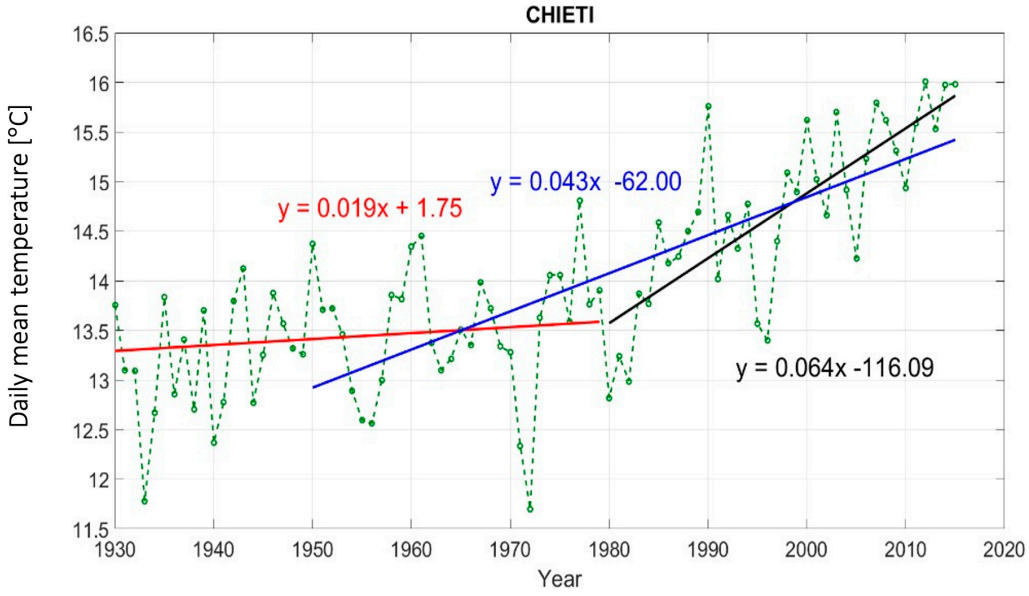



**Figure 6.** Daily mean temperature through the years over Chieti area.

Considering the maximum temperatures, averaged over all the measuring stations available in Abruzzo, in the period of 1930–1979, the change is slight and equal to 0.10 °C per decade; whereas in the period 1950–2015 the temperature increase is equal to 0.63 °C per decade (0.21 °C greater than the increase in mean daily temperature compared to the same period); with Pescara and Lanciano showing a trend of 0.65°/decade and 0.64°/decade respectively. Moreover, in the time interval of 1980–2015, the increase is equal to 0.78 °C per decade, therefore 0.18 °C higher than the increase in the mean daily temperature in the same period. Locally, Pescara showed much higher variation (0.92 °C/decade).

The minimum temperatures, averaged over all the measuring stations available in Abruzzo, show in the period of 1930–1979, a change equal to 0.18 °C per decade; in the period of 1950–2015, the temperature increase is 0.22 °C per decade, and in the time interval of 1980–2015, the increase is equal to 0.42 °C per decade. Locally, Chieti shows higher variation with 0.24 °C/decade and 0.47 °C/decade for the periods of 1950–2015 and 1980–2015, respectively.

Seasonal analyses, always considering the daily mean temperature and the average over all the Abruzzo measuring stations, show that the temperature increase over the period 1950–2015 is more marked in spring and summer with a rate of 0.46 °C per decade, while in autumn and winter a variation between 0.39 °C and 0.37 °C per decade is observed. On the contrary, in the most recent time interval (1980–2015), there is no clear distinction between spring–summer and autumn–winter; however, more marked differences are observed in the individual seasons as follows: in spring, there is the greatest increase (0.75 °C per decade), while in autumn, there is the smallest (0.42 °C per decade). Finally, in summer and winter, the increase is 0.69 and 0.51 °C per decade, respectively.

The comparison of our results with the ERA5 dataset shows good agreement and consistency, both in terms of magnitude and direction of the trends. The ERA5 dataset also allows us to extend our analysis to a larger spatial and temporal scale and to see how the temperature trends in the Abruzzo Region are related to the global and regional climate

change. We find that the temperature trends in the Abruzzo Region are similar to those observed in the Mediterranean basin and in Southern Europe, which are among the most vulnerable and exposed areas to the climate change impacts [7].

The results, combined with an analysis of wind gust and convective precipitation patterns [3] (p. 6), paint a clear picture of the environmental stresses to which the area is exposed, showing significant evidence of impact on the territory [3,29].

## 5. The Importance of the Social Factor in Heritage Conservation: A Proposal for Addressing It

### *5.1. The Institutional Recognition of the Role of the Local Community in Heritage Conservation*

Having conducted an extensive multi-temporal examination of the historical and climatological dimensions of the Trabocchi Coast in the Abruzzo Region, we now complement our approach by focusing on the social factor—the populace and its role in the perception, appreciation, and preservation of local heritage. Beyond the environmental, scenic, historical, and monumental assets spanning the entire Trabocchi Coast, the Special Territorial Project 2023 (STP) [10] regards the inhabitants as the genuine wealth of the region. They represent intrinsic components of authentic and identity-shaping local communities, highlighting the intimate connection between residents and the territory. For this research, as well as for the proposal of the STP 2023, considering the social aspect is one of the main pillars of our approach. If we do not consider the population as a fundamental actor in heritage conservation, the work becomes somewhat senseless. The current significance of heritage conservation lies in acknowledging the importance and use that heritage elements can and should have [3], especially in improving the quality of life for those who use and enjoy them, by serving as reinforcing elements of their identity and self-esteem, and as a tool for better self-assessment as individuals and as a collective. Despite appearing logical and almost intuitive, recognition of the role of citizens in heritage matters has not always been present or valued, even by organisations such as UNESCO, a recognised advocate for heritage-related concerns.

An example of this is that, in 2002, on the 30th anniversary of the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, this institution, through the Budapest Declaration, established as key strategic objectives for heritage "the 4 Cs" [30], Credibility, Conservation, Capacity Building, and Communication. It was not until three years later, in the 2007 World Heritage Committee, that a fifth "C" was added, Community [31], recognising the vital involvement of the local community in safeguarding and protecting its heritage, 33 years after the Convention's origin. Therefore, our proposal includes considering the population as one of the relevant actors in institutional decision-making, so that, drawing from their experience as users of assets considered heritage, we enrich the experts' perspective, making it a fundamental complementary element when designing and implementing regulatory strategies, such as the STP.

### *5.2. A Participatory Horizontal Tool That Acts as a Social Thermometer for Local Heritage Perception*

Following the institutional recognition of the significant role of the local population in heritage matters, the challenge became how to address this citizen-driven work. Our focus is on implementing strategies that include them, take them into account, consider their input and, above all, allow them to have influence in the decision-making process. This is where a crucial aspect of our research proposal lies, in the design of a participatory tool used to acquire knowledge, collect data, and gather opinions from local actors involved. Thus, the conceptualisation, design, organisation, execution, and analysis of a horizontal participatory workshop [32] conducted in November 2023 in San Vito Chietino, one of the municipalities of the Trabocchi coastline. The objective of this tool was to engage the local community in a dialogue about their perception of the past, present, and future of the Trabocchi Coast (Figure 7). This encompassed their understanding of the concept of heritage, the elements they consider as part of their heritage, and the challenges and opportunities they identify in the region.

**Figure 7.** Trabocco Punta Fornace, San Vito Marina—Trabocchi Coast (photo by Luisa Irazú López Campos).

Thirty participants voluntarily attended the workshop, having been directly invited by the Municipality of San Vito Chietino, which provided us with a working space in its facilities, and by residents who helped spread the word about the activity. Participants came from various locations in the Abruzzo Region and other parts of Italy. They represented diverse groups, including local authorities, cultural associations, environmental groups, and citizens of all ages, ranging from a 5-year-old child to families, seniors, young people, couples, and individuals attending alone. Each attendee actively participated at some point during the workshop, fostering a sense that their voice was equally relevant, useful, and important throughout.

In methodological terms, it is important to mention that the workshop was conducted through an open call. This was announced by the municipality and through direct, word-of-mouth invitations among friends and acquaintances. Citizens of all ages, including children and young people living on the Abruzzese coast, were invited to share their reflections with other citizens about the cultural elements they considered most relevant in their environment and their perceptions of how these elements should be used and preserved. There was no pre-selection of participants or formal registration. The workshop engaged with the group that formed at the time. Attending to the group that formed, regardless of its composition, was part of the horizontal methodological strategy employed, where each participant's contributions, opinions, reflections, and proposals were considered equally important in terms of their validity [32]. The workshop comprised two main segments, a plenary session and a group participatory work session. During the plenary session (Figure 8a), the scientific committee introduced the research project and its objectives, emphasising to attendees the crucial role their contributions would play. In this regard, attendees were asked for permission to use the data generated during the workshop for academic and scientific purposes, to which there was unanimous consent. During the working session (Figure 8b), participants collaborated in groups, focusing on specific topics related to the themes of the research. The objective was to facilitate the sharing and exchange of views and experiences concerning heritage in the Trabocchi Coast. This process yielded updated and first-hand information about the local inhabitants' perception of their

regional identity and heritage references. The workshop presented a valuable opportunity to collect qualitative data and ideas.

(**a**)

(**b**)

**Figure 8.** Horizontal participatory workshop "Conservare il mio Patrimonio" (Preserve my heritage), November 2023, San Vito Chietino—Trabocchi Coast; (**a**) plenary session (**b**) group participatory work session (photos by Fernanda Prestileo).

It is essential to highlight that the participatory methodological tool designed for this exercise does not presuppose that the representativeness of findings should be measured by the number of participants involved. Given that it produces qualitative rather than quantitative data and is grounded in horizontal methods of work, each contribution bears inherent value. Each actor is unique, forming distinct connections and dynamics with the case study in question [11]. No single contribution carries greater significance than another, and all should be regarded equally during the analysis of results [32].

## 6. Results Achieved through the Utilisation of the Social Factor (Citizen Participation) as a Key Element of Our Research

Before kicking off the discussion, some of the key issues, findings, and perspectives that emerged from the horizontal participatory workshop, which are relevant to the research addressed in this study, are as follows:

- Concerns among residents regarding challenges stemming from mass tourism and urbanisation, which have affected the Trabocchi Coast in recent decades. These challenges have led to the erosion of the "human dimension" and the original identity of

small localities, coupled with inadequate services to address hygiene, accommodation, and transportation requirements.

- The imminent change in the use of trabocchi, transitioning from traditional fishing machines to trendy restaurants, raising concerns about the lack of promotion of their historical and functional roots, as well as their significance for the region's identity.
- Among participants, diverse perspectives emerged, with some viewing trabocchi as a commercial brand imposed by regional authorities, while others perceive them as symbols of the territory and sources of income.
- The argument that heritage conservation loses its essence when it fails to contribute to the well-being of its "emotional owners", the local community.
- The perception of trabocchi as cultural heritage elements that have survived and adapted to environmental and social changes over time.
- The local community places a high value on the emotional and historical connection with trabocchi, leading some individuals to establish associations or cooperatives dedicated to their preservation and management.

There was a shared recognition of the importance of striking a balance between tourism and the preservation of the natural landscape, as well as the transmission of trabocchi stories and traditions to younger generations. Some attendees to the workshop mentioned that the value of the trabocchi is based on what they represent from a historical and past perspective, while others asserted that their value cannot solely depend on what they signified in a remote era but rather on what they signify for the population in the present. Thus, they highlighted that while preserving the authenticity and history behind heritage is important, it is also essential to understand that its value resides not only in its past but also in its meaning and utility in the present. Many participants agreed that it is imminent for the trabocchi to change their use, but they were very insistent that their originality be respected in the process, especially in terms of materials, emphasising what we have already mentioned about the Italian tradition of conserving and restoring heritage, where the replacement of original construction materials is not appreciated and should be avoided as much as possible. In this dilemma between accepting the change and evolution of trabocchi while simultaneously being concerned about their conservation, everyone agreed on the need to adapt to the necessary strategies to prevent their disappearance, as their value lies in the meaning they have for the region, and that is where their importance lies, in terms of heritage, not only material but also emotional, and therefore, immaterial.

Regarding climate change, workshop participants asserted that its effects on the Trabocchi Coast has manifested both long-term consequences and immediate phenomena. Residents have observed irregularities in seasons and cycles, along with land and sea warming, and assert that this has led to a decline in biodiversity. They attributed the decline in traditional fishing activity and the abandonment of trabocchi to a notion deeply ingrained in the collective imagination of the region (Figure 9). This notion asserts a scarcity of fish near the coast caused by climate change and overfishing, yet it lacks substantial scientific backing and evidence. This argument relies on the collective imagination and its beliefs or perceptions, raising an important question about our responsibility as researchers. How can we democratise knowledge, making it accessible to the population, to challenge unfounded ideas or prejudices that have endured due to an apparent lack of information? Addressing this challenge is crucial to preventing the population from forming inaccurate connections and communications regarding the issue at hand, in this specific case, the trabocchi.

(**a**) (**b**)

**Figure 9.** Trabocco Punta Le Morge (2013)—Torino di Sangro, Trabocchi Coast—tight mesh net known as "trabocchetto": (**a**) Fishing technique; (**b**) detail of "papalina", the blue fish caught (photos by Luisa Irazú López Campos).

## 7. Discussion

As a point of discussion, we will begin by emphasising that it is noteworthy to observe that the demand we recorded in the community is for no changes, neither in the original structure nor in the traditional use of the trabocchi, perhaps as a way of repeating a static institutional discourse about heritage, rather than reflecting on the possibility of assuming that heritage in general, and more specifically, the notion of it, has changed over time, leading from a static perspective focused on its conservation to a more dynamic approach that recognises the importance of change and adaptation [33]. We thus report that, at the beginning of the workshop, they opposed the change in use, arguing that heritage should be inviolable—a powerful and definitive term in its meaning. As the workshop progressed and certain questions were posed on this matter, the participants acknowledged that the idea of no change might stem from an Italian way of thinking about the conservation of cultural heritage. This approach values the original, the initial, the authentic, without deeply reflecting on how this static nature can lead to the disappearance of a heritage asset due to lack of relevance and use for current generations. We can say that this way of conceiving heritage, its conservation, and its management largely come from established heritage practices in Italy, specified in the Cesare Brandi's Theory of Restoration of 1963, which not only exists to this day but is regulated by Italian legislations [34–36].

This research clearly highlights the need for cultural heritage to adapt and evolve to ensure its conservation and relevance in today's society. In this regard, we can emphasize that some attendees to the workshop mentioned the value of trabocchi for what they represent from a historical and past perspective, while others asserted that their value cannot solely depend on what they signified in a remote era but rather on what they signify for the population in the present. Thus, they highlighted that while preserving the authenticity and history behind heritage is important, it is also essential to understand that its value resides not only in its past but also in its meaning and utility in the present. In this dilemma between accepting the change and evolution of trabocchi while simultaneously being concerned about their conservation, everyone agreed on the need to adapt to the necessary strategies to prevent their disappearance, as their value lies in the meaning they have for the region, and that this is where their importance lies, in terms of heritage, not only material but also emotional, and therefore, immaterial.

Considering the definitions of resilience, defined as a criterion for vulnerability computation of a site of cultural and natural interest in Europe [37–40], a flow chart has been included in order to obtain an overview of the topics considered and addressed as the object of this study (Figure 10, green text) and in the previous one [3] (Figure 11, orange text), as

well as the topics considered but not analysed for the purpose of this study reported in this paper (Figure 10, red text).

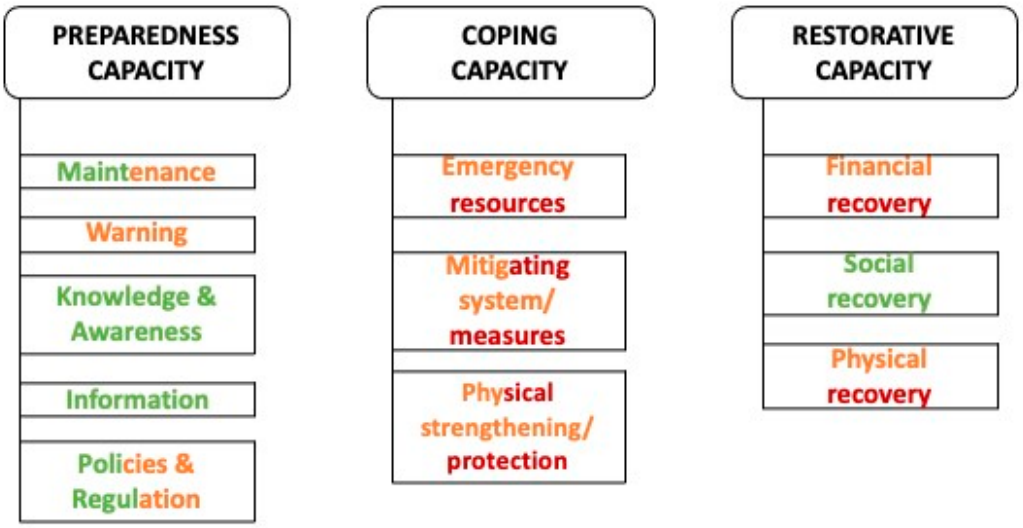
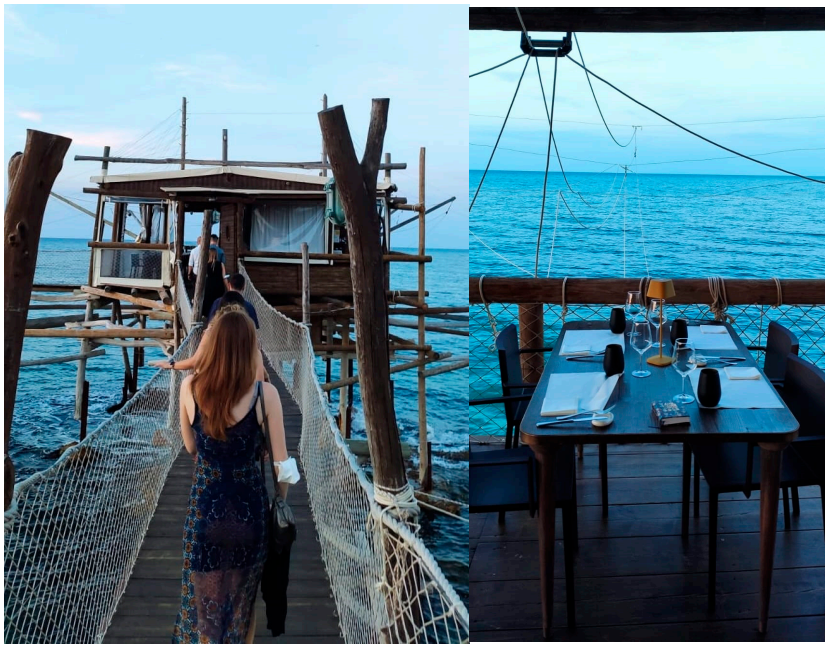



**Figure 10.** Flow chart of criteria, belonging to the definitions of resilience considered in our study based on vulnerability methodology defined by [38,40] in green text, topics considered and addressed as the object of this study; in orange text, topics addressed in our previous study [3]; in red text, topics considered but not analysed for the purpose of this study.



(**a**) (**b**)

**Figure 11.** Trabocco Mucchiola (2023)—Ortona, Trabocchi Coast—Current use of trabocchi as restaurants: (**a**) Restaurant customers entering the trabocco via the walkway; (**b**) detail of one of the tables in the restaurant (photos by Valentina Profeta).

Following collective reflection and analysis, workshop participants agreed that if the use as restaurants had not been assigned, several trabocchi on the Trabocchi Coast would probably have disappeared by now (Figure 11). Delving deeper into this, workshop participants engaged in a reflection on what heritage resilience means and how it is closely related to the use of cultural assets, and how heritage adapts to changes through various strategies. From this, we consider that the discussion should encompass the fact

that some heritage assets, such as the trabocchi, were not originally constructed with the intention of standing for a long time. Their persistence in time is decided once they acquire not only a utilitarian but also a heritage significance, at which point their management, use, and therefore conservation strategies become more complex. Thus, if these elements now considered heritage adapted to their change in perception [41,42], transitioning from utilitarian elements to becoming reference points for a social group, territory, and culture, we must be consistent and then provide them with the strategies and tools to adapt to the necessary changes to fulfil this role. It is a reality that they are no longer useful in terms of their fishing activity function, but rather in terms of the emotion, the identity [43,44], and the link they have acquired over time, which require them to remain standing longer than originally planned and intended. For this, they must be resilient and adapt to the new demands and realities of the context. Among these new realities is, as we have demonstrated throughout the research, climate change and its effects on the region, specifically those caused by rising temperatures, which can accelerate coastal erosion processes [45–47], affecting marine ecosystems [48,49] and influencing increasingly frequent and intense extreme weather [50,51] events, such as storms or floods [52–54]. Thus, the strategy that has naturally emerged in the region is to resort to changing use as a strategy for persistence and therefore as an element of resilience, which so far has proven to be the only valid and functional strategy to ensure, at least for now, the conservation and durability of the trabocchi over time, a time for which they were not programmed or envisioned at the time of their original construction.

In terms of climate change, we emphasise that from the participatory group reflection, several other specific situations resulting from this phenomenon in the region were identified, such as the consequences of the loss of the characteristics of the traditional seasons. In this regard, the participants asserted that the climate has undergone dramatic changes, as already reported in this document, compelling them to adopt resilient measures such as harvesting crops earlier, both in vineyards and olive groves. It is common in the Abruzzo Region for residents to have vineyards or olive groves, either as a business, part of cooperatives, or for personal or family consumption. Hence, several attendees at the workshop shared their sentiments regarding this new reality, stating that climate change has had a severe impact on the region, affecting aspects of its tangible and intangible heritage. An example of this is the impact on its rural culinary heritage. Consequently, they have had to implement drastic measures to avoid crop loss and adapt to the new timings. Now, strategies must change. The impact has been felt in daily life and has affected heritage-related activities, traditions, ways of living, and modes of social organisation. This highlights that, particularly in heritage-related matters, the impact of climate change is imminent. We can translate the results obtained throughout this research by affirming that resilience in heritage matters not only exists but must persist to guarantee its conservation. One resilience strategy for heritage, particularly concerning the trabocchi, is changing their use, a reality already evident on the Trabocchi Coast in the Abruzzo Region. With extreme conditions, constant temperature changes, ongoing climate variations, strong winds, and tide variations, decisions must be made regarding this reality both in the region and globally.

The patterns of the seasons, including their timing, temperatures, and rainfall, have undergone significant changes. It is not feasible to apply the same processes on the same dates as before, particularly in terms of harvests and fishing. The resilience of the population serves as a valuable resource for implementing new processes and strategies, thereby ensuring the preservation of know-how, knowledge, traditions, identity, and local heritage [55].

## 8. Conclusions and Future Perspectives

It is crucial to recognise that heritage is not a static element but a dynamic one, evolving in use and perception over time at both institutional and social levels. Our proposal therefore is to work towards recognising and differentiating what is inherent

in the institutional discourse and management of heritage from what emanates from the emotions and identity attachment of the local population, referred to as "social perception". Once this distinction is acknowledged, the proposal is to enhance and complement the institutional vision of heritage with that of the citizens, those who live and use heritage assets, thereby allowing us to have a comprehensive and contemporary understanding of the heritage values that are significant for the population and for the institutions and thus reach a consensus between both assessments in order to make better decisions regarding their management and conservation. The inclusion of the voice and perspective of the population can undoubtedly improve the legitimacy, and, above all, the effectiveness of the decisions taken by the institutions, the responsible parties, and the authorities in charge.

The workshop attendees agreed on the idea that heritage is a common good that "belongs" to them, a valuable concept when considering public and heritage policies by local and national institutions. Another element on which they agreed was that it is the state's responsibility to conserve heritage, arguing that institutions have the budget for it. It may seem contradictory to confidently declare ownership of heritage while simultaneously delegating its care to the state, but this highlights the lack of opportunity they often have to be actively involved in heritage initiatives. This method represents an opportunity to involve the population in projects related to the development of projects and strategies for the conservation of local heritage resources, making them active actors in the generation of ideas and initiatives that can endure over time, thanks to social commitment and agreement. It is a gap in institutional heritage management to involve them and thus capitalise on their sense of ownership to achieve successful and lasting projects.

In this regard, active participation of the local population in heritage-related decision-making is crucial to ensure its long-term preservation. Our participatory workshop in San Vito Chietino demonstrated how citizens are willing to contribute their knowledge, experiences, and perspectives to inform and enrich heritage conservation strategies. By engaging the community in this process, we not only strengthened their sense of belonging and local pride but also promoted a more inclusive and sustainable management of cultural heritage.

Based on the findings from the workshop, we see how the community is organising itself in response to temperature variations, creating new ways of doing things, new strategies as tools of resilience against the imminent changes caused by climate change. This speaks to how, in the present, we are not only the spokespersons and custodians of passing the heritage baton from one generation to the next, but we are also, as individuals and as a society, not only responsible for an existing and static heritage but also act as generators of heritage in the present. We are generators of strategies and new elements that complement the existing heritage, providing it with the necessary tools to endure and not disappear due to lack of relevance or meaning for those who use and enjoy it. Thus, the importance of inclusion in heritage is demonstrated, as is the importance of our proposal to include all stakeholders in the theme and work towards its conservation, as an act of democratisation of culture and the decisions made about it. We are thus generators of heritage in the present, impacting the path not just passing on the baton of its care and conservation; therefore, the argument for involving the population in the management and decision-making regarding its use and conservation is solidly supported.

Heritage, as an element of belonging and persistence, underscores the urgency of its resilience and adaptation to imminent changes in the territory, whether due to climate change, poor governmental decisions, wars, or other factors. In this sense, the analyses of impact of extreme meteorological events provides useful feedback to the question about the consequences of climate change, for which the temperature appears to be a clear indicator, on heritage and indicates how returning to a protection perspective favours both the reuse and conversion of structures compatibly with the characteristics of the area analysed. In this way, we can conclude that resilience in heritage is undoubtedly a powerful strategy to prevent its disappearance and that throughout this process, the population must always be involved. The issue of protecting the cultural heritage has its basis in a previous work focused on the analysis of the intense weather that led to the

collapse of the "Trabocco Turchino" structure. Its destruction in 2014 laid the theoretical and methodological foundations for defining the guidelines for intervention by safeguarding the "historical instance" recognised by local communities while ensuring its educational and promotional function. From what has emerged, it is evident how, throughout history, the social aspect has increasingly shown its key role in the preservation process. The common sense of citizens and consequently the bottom-up process of awareness, if properly introduced in decision making, can provide a clear support emphasising the importance of participatory planning even more in matters related to intangible cultural heritage. Local knowledge, traditional know-how, and those emerging over time are of enormous importance to consider when developing heritage conservation strategies in the face of the imminent effects of climate change, and when proposing new cultural and heritage policies. This is a thread of reflection that will be taken up in an interdisciplinary manner by this research group in future collaborative project endeavours.

**Author Contributions:** Conceptualisation, L.I.L.C., F.P., E.M.S. and A.M.; methodology, L.I.L.C.; formal analysis, E.A., P.C. and P.d.C.; investigation, L.I.L.C., F.P., E.M.S., A.M., E.A., P.C., P.d.C. and S.D.; writing—original draft preparation, L.I.L.C., F.P., E.M.S., A.M., E.A., P.C., P.d.C. and S.D.; writing—review and editing, L.I.L.C., F.P., E.M.S. and A.M.; supervision, S.D. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Informed Consent Statement:** The participants to the public workshop in San Vito Chietino were not asked for any registration or personal data during the work session. All participants gave their consent to the publication of photos taken during the event for academic and scientific purposes. Regarding the use of images of minor attendees, their parents signed a permission for non-profit and purely academic image use.

**Data Availability Statement:** Data are contained within the article.

**Acknowledgments:** We thank the Municipality of San Vito Chietino for their support in the organisation and promotion of the participatory-horizontal workshop "Conservare il mio Patrimonio" (Preserve my heritage), a crucial component of the research process, which took place in the "Sala Polivalente" of the Municipality in November 2023. We also extend our gratitude to all the attendees of the workshop, who greatly contributed to the acquisition of data and results that added significant value to this research. Additionally, we would like to acknowledge and thank Christian Benedetti, Valentina Profeta, Gianni Santavicca, Enzo Di Lello, Francesca Giusti, and Silvio Sallese for their willingness to support us in the development of the workshop and for kindly providing some images to illustrate this paper. Alessandra Mascitelli and Piero Di Carlo acknowledge financial support funded by the European Union NextGenerationEU, under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2-M4C2, Investment 1.5 Call for tender No. 3277 of 30 December 2021, Italian Ministry of University, Award Number: ECS00000041, Project Title: "Innovation, digitalisation, and sustainability for the diffused economy in Central Italy", Concession Degree No. 1057 of 23 June 2022 adopted by the Italian Ministry of University. CUP: D73C22000840006.

**Conflicts of Interest:** The authors declare no conflicts of interest.

## References

1. Forlani, M.C.; Borrone, M.; Radogna, D. Sustainable development and heritage: "Trabocchi" and the rules for building on the coast. *WIT Trans. Ecol. Environ.* **2010**, *128*, 245–257. [CrossRef]
2. Serafini, L.; Di Toro, N. Not just wood. The fishing machines of the central Adriatic. In *Roma, Capitale d'Italia 150 Anni Dopo. Preesistenze Architettoniche. Aree Archeologiche-Paesaggio*; Bellanca, C., Antonini Lanari, C., Eds.; Artemide: Rome, Italy, 2021; Volume 2, pp. 649–661.
3. Mascitelli, A.; Prestileo, F.; Stella, E.M.; Aruffo, E.; López Campos, L.I.; Federico, S.; Torcasio, R.C.; Corsi, A.; Di Carlo, P.; Dietrich, S. Impact of Climate Change on the "Trabocchi Coast" (Italy): The Trabocco Turchino Case Study. *Sustainability* **2023**, *15*, 10880. [CrossRef]
4. Mahoney, K. Extreme hail storms and climate change. *Bull. Am. Meteorol. Soc.* **2020**, *101*, S17–S22. [CrossRef]
5. D'Adderio, L.P.; Pazienza, L.; Mascitelli, A.; Tiberia, A.; Dietrich, S. A Combined IR-GPS satellite analysis for potential applications in detecting and predicting lightning activity. *Remote Sens.* **2020**, *12*, 1031. [CrossRef]

6. Chkeir, S.; Anesiadou, A.; Mascitelli, A.; Biondi, R. Nowcasting extreme rain and extreme wind speed with machine learning techniques applied to different input datasets. *Atmos. Res.* **2023**, *282*, 106548. [CrossRef]
7. Aruffo, E.; Di Carlo, P. Homogenization of instrumental time series of air temperature in Central Italy (1930–2015). *Clim. Res.* **2019**, *77*, 193–204. [CrossRef]
8. Yu, C.S.; Decouttere, C.; Berlamont, J. Storm Surge Simulations in the Adriatic Sea. In *CENAS: Coastline Evolution of the Upper Adriatic Sea Due to Sea Level Rise and Natural and Anthropogenic Land Subsidence*; Gambolati, G., Ed.; Springer: Dordrecht, The Netherlands, 1998; pp. 207–232.
9. Forlani, M.C. *Cultura Materiale e Progetto Sostenibile. Una Guida al Mantenimento dei Trabocchi della Costa Teatina*; Edicom Edizioni: Monfalcone, Italy, 2014.
10. Special Territorial Project 2023. Available online: https://www.provincia.chieti.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/9124 (accessed on 11 December 2023).
11. Latour, B. *Changer de Société, Refaire de la Sociologie*; La Découverte Poche: Paris, France, 2010.
12. Campos y Covarrubias, G. *Metodologías d la Investigación Cualitativa en las Ciencias Sociales: Etnografía, Historias de Vida, Estudios de Caso, Comunidad y Diagnóstico*; Universidad Nacional Autónoma de México Escuela Nacional de Trabajo Social: Ciudad de México, Mexico, 2017.
13. Corona Berkin, S. *Producción Horizontal del Conocimiento*; CALAS: Guadalajara, Mexico, 2020.
14. Forlani, M.C. *Progettare per l'ambiente Costiero. Il Recupero della Cultura Materiale e la Valorizzazione delle Risorse Nella "Costa dei Trabocchi"*; Edicom Edizioni: Monfalcone, Italy, 2022.
15. Cuzzucoli Crucitti, R. *La Costa dei Trabocchi nei Parlamenti, Statuti e Capitolari dei Feudi dell'Abbazia di S. Giovanni in Venere*; Edizioni Carabba srl: Lanciano, Italy, 2020.
16. The Amsterdam Declaration of 1975. Available online: https://humanists.international/policy/amsterdam-declaration-1952/ (accessed on 7 December 2023).
17. Farinelli, V.; Nicolai, N.C. *La Via Verde della Costa dei Trabocchi: Itinerari e Percorsi Lungo la Pista Ciclopedonale in Abruzzo*; Menabò: Ortona, Italy, 2022.
18. Available online: https://www.regione.abruzzo.it/content/piano-di-adattamento-ai-cambiamenti-climatici-pacc-abruzzo (accessed on 11 December 2023).
19. Cupido, P. *Trabocchi, Traboccanti & Briganti*; Edizioni Menabò: Ortona, Italy, 2003.
20. Marino, L.; Pignatelli, O.; Barone, P. *L'ingegnere Sopra e Sotto il Mare: La Fabbrica dei Trabocchi, Macchine per la Pesca Costiera*; DIDA Press: Florence, Italy, 2018.
21. Grbec, B. Climate change and Adriatic ichthyofauna. *Fish. Oceanogr.* **2020**, *9*, 187–191.
22. Santaloia, F.; Cotecchia, V.; Monterisi, L. Geological evolution and landslide mechanisms along the central Adriatic coastal slopes. In *Advances in Geotechnical Engineering: The Skempton Conference: Proceedings of a Three Day Conference on Advances in Geotechnical Engineering, Organised by the Institution of Civil Engineers and Held at the Royal Geographical Society, London, UK, on 29–31 March 2004*; Thomas Telford Publishing: London, UK, 2024; pp. 943–954.
23. Doglioni, A.; Galeandro, A.; Guerricchio, A.; Simeone, V. Tectonic Stress as Possible Co-predisposing Factor for Landslides Along the Central Adriatic Coast of Italy. In *Engineering Geology for Society and Territory-Volume 2: Landslide Processes*; Springer International Publishing: Cham, Switzerland, 2015; pp. 283–287.
24. Segrè, C. *Considerazioni Geognostiche Circa il Consolidamento della Ferrovia nei Tratti Franosi del Litorale Adriatico, Con Speciale Riguardo Alla Frana di Torino di Sangro*; Tip. Unione Ed.: Turin, Italy, 1918.
25. Cancelli, A.; Marabini, F.; Pellegrini, M.; Tonnetti, G. Incidenza delle frane sull'evoluzione della costa adriatica da Pesaro a Vasto. *Mem. Soc. Geol. Ital.* **1984**, *27*, 555–568.
26. Mascitelli, A. Progetto di Sviluppo Locale e Valorizzazione Ambientale del Territorio Teatino. Master's Thesis, Sapienza University of Rome, Rome, Italy, 2015.
27. Hersbach, H. The ERA5 Atmospheric Reanalysis. In *AGU Fall Meeting Abstracts*; Wiley: New York, NY, USA, 2016; NG33D-01.dataset.
28. Tiberia, A.; Mascitelli, A.; D'Adderio, L.P.; Federico, S.; Marisaldi, M.; Porcù, F.; Realini, E.; Gatti, A.; Ursi, A.; Fuschino, F.; et al. Time evolution of storms producing terrestrial gamma-ray flashes using ERA5 reanalysis data, GPS, lightning and geostationary satellite observations. *Remote Sens.* **2021**, *13*, 784. [CrossRef]
29. Di Carlo, P.; Aruffo, E.; Brune, W.H. Precipitation intensity under a warming climate is threatening some Italian premium wines. *Sci. Total Environ.* **2019**, *685*, 508–513. [CrossRef]
30. The Budapest Declaration on World Heritage of 2003. Available online: https://whc.unesco.org/archive/2002/whc-02-conf202-5e.pdf (accessed on 20 December 2023).
31. Available online: https://whc.unesco.org/archive/2007/whc07-31com-13be.pdf (accessed on 4 December 2023).
32. Corona Berkin, S. Flujos metodológicos desde el sur latinoamericano. La zona de la comunicación y las metodologías horizontales. *Comun. Soc.* **2017**, *30*, 69–106. [CrossRef]
33. Recht, R. *Penser le Patrimoine: Mise en Scene et Mise en Ordre de l'art*; Éditions Hazan: Paris, France, 2008.
34. Brandi, C. *Teoria del Restauro, Collana Piccola Biblioteca n. 318*; Einaudi: Torino, Italy, 1977.
35. Decreteto Legislativo Numero 42, 2004. Available online: https://www.normattiva.it/urires/N2Ls?urn:nir:stato:decreto.legislativo:2004-01-22;42 (accessed on 25 January 2024).

36. Cordaro, M. Restauro e tutela: Scritti scelti (1969–1999). In *Annali dell'Associazione Ranuccio Bianchi Bandinelli*; Griffiti editore: Roma, Italy, 2000; pp. 1–192.
37. Sardella, A.; Palazzi, E.; von Hardenberg, J.; Del Grande, C.; De Nuntiis, P.; Sabbioni, C.; Bonazza, A. Risk mapping for the sustainable protection of cultural heritage in extreme changing environments. *Atmosphere* **2020**, *11*, 700. [CrossRef]
38. Bonazza, A.; Sardella, A.; Kaiser, A.; Cacciotti, R.; De Nuntiis, P.; Hanus, C.; Maxwell, I.; Drdácký, T.; Drdácký, M. Safeguarding cultural heritage from climate change related hydrometeorological hazards in Central Europe. *Int. J. Disaster Risk Reduct.* **2021**, *63*, 102455. [CrossRef]
39. Available online: https://www.protecht2save-wgt.eu (accessed on 18 June 2024).
40. Cacciotti, R.; Sardella, A.; Drdácký, M.; Bonazza, A. A Methodology for Vulnerability Assessment of Cultural Heritage in Extreme Climate Changes. *Int. J. Disaster Risk Sci.* **2024**, *15*, 404–420. [CrossRef]
41. Grütter, J.K. *Basics of Perception in Architecture*; Springer Nature: Berlin/Heidelberg, Germany, 2020.
42. Bianco, L. Architecture, values and perception: Between rhetoric and reality. *Front. Archit. Res.* **2018**, *7*, 92–99. [CrossRef]
43. Hauge, Å.L. Identity and place: A critical comparison of three identity theories. *Archit. Sci. Rev.* **2007**, *50*, 44–51. [CrossRef]
44. Moqadam, S.; Nubani, L. From house to home: Exploring the spatial expression of social identity on traditional Shiraz houses. *Archnet-IJAR Int. J. Archit. Res.* **2024**, *18*, 81–101. [CrossRef]
45. Pang, T.; Wang, X.; Nawaz, R.A.; Keefe, G.; Adekanmbi, T. Coastal erosion and climate change: A review on coastal-change process and modeling. *Ambio* **2023**, *52*, 2034–2052. [CrossRef]
46. Appiotti, F.; Krželj, M.; Russo, A.; Ferretti, M.; Bastianini, M.; Marincioni, F. A multidisciplinary study on the effects of climate change in the northern Adriatic Sea and the Marche region (central Italy). *Reg. Environ. Change* **2014**, *14*, 2007–2024. [CrossRef]
47. Parete, G.; Bruno, M.F.; Calabrese, P.; Carlucci, R.; Chiarulli, M.; D'Onghia, G.; Fiore, A.; Fratino, U.; Longo, C.; Longo, F.; et al. Climate impacts and adaptation strategies for coastal erosion, aquaculture, and tourism along the Adriatic side of Apulia region. *Front. Clim.* **2024**, *6*, 1378253. [CrossRef]
48. Boicourt, W.C.; Ličer, M.; Li, M.; Vodopivec, M.; Malačič, V. Sea state: Recent progress in the context of climate change. In *Coastal Ecosystems in Transition: A Comparative Analysis of the Northern Adriatic and Chesapeake Bay*; Wiley: New York, NY, USA, 2020; pp. 21–48.
49. Cushman-Roisin, B.; Gacic, M.; Poulain, P.M.; Artegiani, A. (Eds.) *Physical Oceanography of the Adriatic Sea: Past, Present and Future*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2013.
50. Hochman, A.; Marra, F.; Messori, G.; Pinto, J.G.; Raveh-Rubin, S.; Yosef, Y.; Zittis, G. Extreme weather and societal impacts in the eastern Mediterranean. *Earth Syst. Dyn.* **2022**, *13*, 749–777. [CrossRef]
51. Menna, M.; Martellucci, R.; Reale, M.; Cossarini, G.; Salon, S.; Notarstefano, G.; Mauri, E.; Poulain, P.M.; Gallo, A.; Solidoro, C. A case study of impacts of an extreme weather system on the Mediterranean Sea circulation features: Medicane Apollo (2021). *Sci. Rep.* **2023**, *13*, 3870. [CrossRef] [PubMed]
52. Gonella, M.; Teatini, P.; Tomasi, L.; Gambolati, G. Flood risk analysis in the Upper Adriatic Sea due to storm surge, tide, waves, and natural and anthropic land subsidence. In *CENAS: Coastline Evolution of the Upper Adriatic Sea Due to Sea Level Rise and Natural and Anthropogenic Land Subsidence*; Springer: Dordrecht, The Netherlands, 1998; pp. 313–324.
53. Međugorac, I.; Pasarić, M.; Güttler, I. Will the wind associated with the Adriatic storm surges change in future climate? *Theor. Appl. Climatol.* **2021**, *143*, 1–18. [CrossRef]
54. Cavaleri, L.; Bertotti, L.; Buizza, R.; Buzzi, A.; Masato, V.; Umgiesser, G.; Zampieri, M. Predictability of extreme meteo-oceanographic events in the Adriatic Sea. *Q. J. R. Meteorol. Soc. J. Atmos. Sci. Appl. Meteorol. Phys. Oceanogr.* **2010**, *136*, 400–413. [CrossRef]
55. Gouritin, A. Matriz de análisis: Territorio y derechos humanos. In *Migrantes Climáticos en México*, 1st ed.; FLACSO: Ciudad de México, Mexico, 2021; pp. 67–113.