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Regeneration Criteria for Adaptive Reuse of the Waterfront Ecosystem: Learning from the US Case Study to Improve European Approach

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Abstract: The article addresses the contemporary debate on urban and environmental regeneration, investigating the need to establish new criteria to implement the defence of coastal ecosystems by climate problems. The research looks at coastal vulnerabilities, starting with the environmental fragility of flooding, as an opportunity to regenerate waterfront ecosystems. The research aim concerns the analysis of US advanced regeneration practices to learn and transfer the principles derived from them to the European context. This transferability takes place through the construction of regeneration criteria for the coastal ecosystems rebalancing. The regeneration criteria are resulted from an ecosystem reading of the winning projects of the *Rebuild by Design* competition. These practices represent in the scientific literature an exceptional example of a holistic response to the problem of post-disaster intervention. These cases offer an integrated response in terms of processes, investments, the duration of the design and realization. In addition, these cases simultaneously address multiple vulnerabilities, making it possible to extrapolate from their analysis specific directions to replicate in contexts where even just one of the critical issues exist. The methodological analyses exploit the focus emerged from the scientific literature on environmental vulnerabilities, technological innovation, and stakeholder involvement. The results are regeneration criteria able to verify the appropriateness of ecosystem anti-flooding strategies. Comparing the results with the most recent US and the EU strategic documents, the regeneration criteria demonstrate their relevance and coherence with the international priorities as well as their potential transferability to the European context.

Keywords: regeneration; ecosystem reading; coastal cities; flooding; urban technology

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1. Waterfront Ecosystem Scenario and Research Intentions

The coastal ecosystems represent one of the most exposed settlements to the environmental fragility of flooding [1]. Considering the coastal ecosystem as a living organism, these upheavals destabilise the fragile balance that characterises its potentiality and criticality. It highlights the need for damage mitigation strategies and increasing public demand for protective measures [2]. Historically, American and European coastal cities have played the tent poles of economic, cultural, and infrastructural wealth. It depended on their ability to attract goods and people; especially after the opening of a global ecosystem [3]. The cultural, economic, and landscape attributes of coastal cities make them a privileged field of research to reflect on the future of waterfront ecosystems. The attractive potential of coastal areas has dictated a shift in the economic interests of cities towards flood defence and management [4].

In particular, American coastal cities have adopted urban policies aimed at exploiting the qualities of coastal settlements and ecosystems as a waterfront renaissance [5]; a phenomenon that arose in the United States and Canada, spread worldwide, and is based on the integration of holistic knowledge and coastal land modelling operations.

In contrast, European coastal cities have adopted approaches aimed at harmonising coastal ecosystem transformations in the creation of new waterscapes, coastal landscapes that mediate between the need for protection and market demands [6]. In particular, investors with significant financial resources often monopolise the growth of the coastal ecosystem agenda by regenerating brownfield sites into new elite waterfronts [7]. The complex dynamics of intervention in coastal ecosystems must address the residual effects of an industrial culture, the needs of the actors involved and the interests of the real estate market [8]. The American approach, more focused on defensive recreational transformations than the European technological one, could improve and implement the European vision from the point of view of landscape transformation. This is an innovative objective based on the preservation of the coastal city values and the waterfront ecosystem identity [9].

The comparison between the American and European context introduces some reflections related to the practical transferability of coastal regeneration strategies between such different contexts. An example of transferability is the regeneration practices of the American coastal ecosystems of Miami to the Italian ones of Venice. In fact, Italy adopts the vision of the American city-region, which, although still fragmented into different centres, seems based on a single settlement model. The latter, characterised by the material quality of the construction and the density of services, is based on the balance of the dynamic relationship between land and water. Venice welcomes Florida's approach to the regeneration practices used for the large and low coast and sandy plateaus subject to sea level rise. Venice, in fact, borrowed both the technique of restoring and recovering the lifting of the seabed and the administrative approach in the codification of the lightness of transitional structures (on wood) for regulating the life of the inhabitants [5].

In this scenario, the paper offers coastal ecosystem criteria as an opportunity to regenerate and defend tangible values (ecological, human, settlement, infrastructural, etc.) and intangible values. The latter constitutes the cultural capital of the site defined as a place of intersection for the aggregation, exchange, flow of knowledge, and traditions (including social and natural identities). Furthermore, the urban regeneration of the waterfront becomes a crucial and strategic step in the regeneration of ecosystems [5]. The waterfront assumes significance as a symbolic space of urban identity based on new hubs of cultural capital [10]. The waterfront ecosystem can be both an urban infrastructure and a public space of the city, thus, becoming a fundamental element to capture the urban dynamics [11–15]. The regeneration of waterfront ecosystems is an extraordinary opportunity to promote endogenous economic development, encourage the creation of new economic activities and dynamited existing ones [16]. In this perspective, the waterfront configures itself as a catalyst element of processes capable of contributing directly and indirectly to the regeneration of ecosystems [17]. It is relevant if we consider that, since the 1970s, transformations of the world's urban waterfronts have been essential practices for the revitalization of major urban areas [18]. The rebalancing of coastal ecosystems must, therefore, take into account various aspects on an international scale, ranging from conflicts over land ownership, cultural heritage, and social and environmental justice [18].

The research interprets the waterfront as a complex dynamic system that provides protective services and balance of coastal ecosystems. The examination of coastal regeneration strategies highlights the complexity of the coastal ecosystem, defined as an engine of interactions between its elements and circular autopoietic feedbacks. The coastal ecosystem could be a loop characterised by circular processes in which a part of the output is sent back to the beginning as a preliminary response to which the waterfront has been called to respond. By analysing the strengths and weaknesses of the coastal ecosystem, the research uses them to conduce a balance operation between conservation and transformation. By recognising the mutability of coastal ecosystem evolution as dynamic and irregular, the criteria could guide ecosystem regeneration [19]. Supported by an empirical approach, the article raises an ecosystem reading of flood mitigation strategies in the United States. They, chosen as the latest example of a holistic response to the problem of post-disaster interventions, identifies six cases of defensive measures. In particular, the research investigates the *Rebuild By Design* competition announced by the US Government to rebuild the New York and New Jersey coastlines destroyed by Hurricane Sandy. The winning *Rebuild By Design* projects represent the most recent defensive experimentation against catastrophic coastal flooding events based on global participation [20]. *Rebuild By Design* demonstrates for its ability to combine different factors: the response methods, the amount of funds invested, the duration of the project, and the timing of the implementation of defensive measures [20].

From the point of view of the response mode, the implementation of a call for proposals allowed for a holistic quality of defence proposals that involved experts from all over the world to test innovative solutions [21]. In Europe, the approach of an integrated team does not extend to the holistic value whereby experts of world calibre come together for an integrated comparison as in the case of the Costa da Caparica in Portugal [22].

In terms of the amount of funding ($1 billion spent on post-Sandy protection projects in New York and New Jersey), it can serve as a model for resilience efforts in other coastal cities [23]. In Europe, the allocation of funds is less than the American one and often it is delayed in time. This lack of investment causes inefficiency as in the case of the Axis of Greece [24].

From the point of view of project duration, these projects were set up in less than a year precisely to represent the maximum response in the shortest possible time [25]. In Europe, for bureaucratic reasons, the procurement of a project often requires a long procedure as in the case of the Barcelona waterfront in Spain [26].

From the point of view of the implementation time of defensive measures, most of them were carried out on time, in contrast to European cases where the implementation time can be up to 30 years as in the case of Venice in Italy [27].

Finally, all of these *Rebuild By Design* factors have collaborated in the rebalancing of American coastal ecosystems by returning the experimentation of advanced solutions that respond to a plurality of concomitant vulnerabilities [25]. Addressing simultaneously all these characteristics make ecosystem-rebalancing practices of the winning projects useful to identify transferable solutions in other ecosystems where also just only one or few vulnerabilities are.

The research aim concerns the analysis of US advanced ecosystem regeneration practices to deduce principles and criteria to apply to further practices with particular reference to the European context. Specifically, the strength of the proposed approach, compared to similar analyses already conducted, is the combination of analyses that integrate, respectively, what emerges from the theory of scientific literature and from case studies concretely implemented [18,25,27]. The innovation lies both in the process and in the product that derives from it: the analysis of the literature allows us to identify "ecosystem focuses" applied to the technological, cultural, and environmental reading of the various experiments. Otherwise, the reading of the practices exploits the systemic vision of the Technology of Recovery, identifying strengths and weaknesses according to an "ecosystem reading" based on a material-constructive, perceptive-cultural, morphological-dimensional, and ecological vision. From the integration of these two innovative methods of ecosystem investigations, it is possible to trace an innovative product: a system of ecosystem regeneration criteria.

This approach proposes an advance compared to the canonical ones; distinguishing itself for the disciplinary pluralism, it involves Evaluation, Urban Planning, and Regeneration Technology and for the reading modalities, it offers ecosystem reading and ecosystem focus. It differs from the holistic approach in which the specialists are integrated to evolve towards a dialogue between the parts that make up the ecosystem.

The paper is organised in five sections. Section 1 is an introduction to the waterfront ecosystem scenario and research intentions. Section 2 concerns the methodological approach that is based on a comparison of ecosystem readings and the focus that emerged from the literature review. Section 3 describes the results obtained from the literature review of ecosystem rebalancing initiatives as coastal ecosystem dimensions and as criteria for its regeneration. Section 4 discusses operational guidance in comparison with the US and EU contexts.

2. Methods to Build Ecosystem Criteria

The aim of the methodology is to carry out a comparative analysis of US experiences in order to understand the most significant emerging criteria. These criteria are closely linked to ecosystem services, as they are concerned with establishing multiple benefits provided by ecosystems to humankind. In particular, the criteria aim to support life in terms of production of private land for public use, such as the defensive solutions of coastal urban parks. In addition, they supply water sources and marine fauna as well as the activities that follow and regulate the climatic catastrophic actions with reference to high tide and flood phenomena. In conclusion, they also enhance the cultural values in terms of preservation and regeneration of the landscape and existing building heritage.

The research does not aim to establish a ranking of individual projects, but rather to understand the strategies adopted. It helps to identify the main elements of success in order to implant their transferability in EU strategies. It pays particular attention to the definition of criteria as a tool to improve decision-making processes and ecosystem regeneration projects in general. The methodology is divided into three main phases as shown in Figure 1.

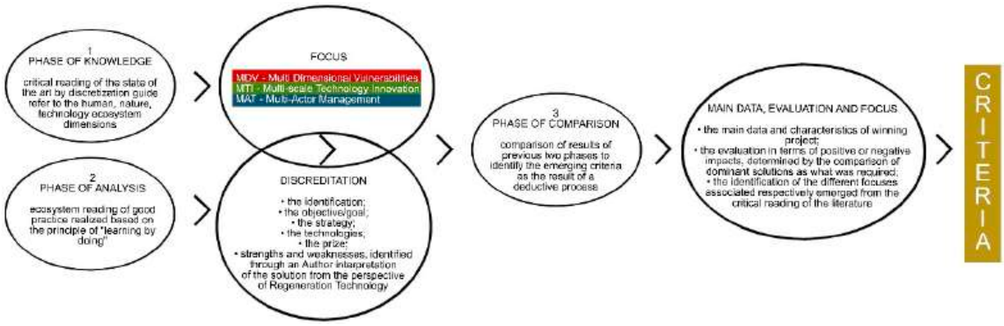

Figure 1. Illustration of research methods process, authors' elaboration.

The first step refers to knowledge, built up by the critical reading of the state of the art that allows the research to identify the literature focuses. The systemic dimension of the waterfronts tries to achieve an equilibrium ecosystem when they are all connected. The criterion driving this discredit refers to the dimensions of the human–nature–technology ecosystem [28]. This evaluation is congruent with the multidimensional character of the evaluation of urban regeneration plans, considering multiple objectives derived from demands of different natures. They include the ecological, social, cultural, innovative, and technological frameworks. Supported by a comprehensive and systematic literature review, they could refer to multi-scale technological integration, multidimensional vulnerability mitigation, and the encouragement of multi-actor management towards the regeneration of the built heritage.

The second step refers to the analysis through reading the ecosystem of winning design practices, which urban regeneration and transformation plans have switched to the ecosystem regeneration approach [29]. These practices reflect the political and decision-making processes, including where different types of alternative evaluations are based on the principle of "learning by doing" [30]. Evaluation has assumed the role of a strategic tool for decision-making processes, useful to verify the results of interventions through continuous feedback actions. In fact, evaluation is closely linked to programming to support decision-making [31]. From an operational point of view, evaluation contemplates different approaches and methods in relation to the object of the evaluation itself, depending on the nature of programmes, plans, and projects. It identifies the critical issues of stakeholder participation and involvement in choices and decision-making [32]. The evaluation also takes on different connotations depending on the moment in which it is carried out: in the final phase (ex-post evaluation) to obtain an overall judgement to be compared with the initial strategic hypotheses for reflection and rethinking. Ex-post evaluation is a retrospective evaluation tool and plays a very important role, especially in the context of urban regeneration and transformation projects. It allows learning from the latest experiences and to transfer the lessons learned to other territorial realities through a comparison operation between the best proposals examined [33]. Evaluating winning practices means analysing the success and failure factors of the experiences under examination, identifying the significant intervention criteria in order to promote new knowledge. In this perspective, the ex-post evaluation is configured as a reinterpretation through which it is possible to reconstruct the phases of each experience, reinforcing and classifying the knowledge of the most significant themes. The research adopts a methodology based on the skills of urban recovery and regeneration [33–35].

Beginning with the identification of the winning projects for analysis, significant American practices were chosen as an outstanding example of a holistic response to the problem of post-disaster interventions [23]. In particular, learning from the *Rebuild By Design* competition how the winning projects were organised to respond to Hurricane Sandy, flood mitigation strategies in the United States describe a post-disaster strategy addressed. *Rebuild By Design* represents one of the most recent experiments in catastrophic flood defence based on global participation: the US case studies are significant for the holistic quality of the defence proposals that involved experts from around the world to test innovative solutions. Among these, we have included the following:

- the Living Breakwaters for Staten Island;
- the Exist, Delay, Store, Discarge for Hoboken;
- the New Meadowlands for Newark;
- the Living with the Bay for the South Shore of Nassau County;
- the Hunts Point/Lifelines: Greenway Open market for the South Bronx;
- the Dry Line (or BIG U) for Manhattan.

This phase is carried out through the collection of data on the implemented methodology and consists of the following activities:

- the identification, by selecting the name of the project, the proposed defence system and the name of the designers who built it;
- the objective, by defining what vulnerability it proposes to solve;
- the strategy, defining the policy adopted and what the project promotes through its implementation;
- the technologies, focusing on the solution adopted and the degree of innovation and sustainability that characterises it;
- the prize, referring to the amount of money allocated for the project design and construction phase.

To this formal analysis, the study added the identification of strengths and weaknesses, through an ecosystem reading of the project from the point of view of Regeneration Technology. This study identified ecological, material-constructive, morphological-dimensional, and perceptual-cultural impacts [34].

The third phase is a comparison of the results of the previous two phases by discrediting the design project as seen from the filters of literary focuses. It attempts to identify emerging criteria as results of a deductive process, which includes the following:

- the main data and characteristics of the winning project;
- the evaluation in terms of positive or negative impact, determined by comparing the dominant solutions against what is required;
- the identification of the different associated focuses, respectively, emerged from the critical reading of the literature material;
- the identification of the emerging criteria.

"Learning from comparison" allows for the acquisition of new experiences that can be transferred to other contexts [36]. Finally, by comparing the various projects with the emerging criteria, it is possible to determine a matrix that shows how the latter are present, albeit in a less dominant form, in the other projects. The emerging criteria can be validated in the strategic documentation of the United States and the European Union in order to implement their scenarios. They can also fill any gaps between the evaluation criteria and their strategic goals.

3. From Ecosystem Reading to Waterfront Regeneration Criteria

The waterfront ecosystem represents important environmental infrastructures that can guarantee and enhance biological exchange reducing ecological impoverishment. It gives shape to demands for environmental and territorial continuity, understood as a rejection of environmental degradation [37]. It also denotes a profound cultural change aimed at managing the relationship between city/sea, settlement system/sea front, by involving many actors with different roles [38]. Despite the scientific interest in the coastal ecosystem as a driver of social, economic, and cultural development, research has focused on the specific impacts of flooding on settlements and communities [39]. Supported by a comprehensive and systematic literature review, these impacts relate to: (a) reactivating multi-scale technological integration; (b) mitigating multidimensional vulnerabilities; (c) encouraging multi-actor management towards the regeneration of built heritage.

(a) In Urban Technology, the search for the spatial and temporal balance of the vulnerable ecosystem has to take into account, simultaneously, several factors (social, cultural, economic, techno-technological, and environmental) that may relate to each other in different orders. The ordering of the environment offers better possibilities to build human settlement through smart strategies, coherent with the stimuli and tools offered by our time [40].

The coastal ecosystem is unbalanced both during the impact of the unexpected climatic event and during the integration of the protective solution into the existing waterfront ecosystem. This underlines the importance of identifying criteria that define the appropriateness of solutions capable of integrating into a complex ecosystem mechanism, bringing together natural and artificial aspects [41]. Although each technology interferes with the context, there are technologies more appropriate to fit the biophysical cycles of the environment. Technologies, if appropriate, may not be universally valid, but rather on a regional and local scale. In fact, they could induce the ecosystem to have a flexible and adaptive balance to its dynamic transformations [42].

(b) The climatic emergency modifies the environment and with it changes the capacity to accommodate the transformations necessary to protect settlement systems. In this sense, vulnerability is interpreted both as a condition of exposure and as a capacity to cope with dynamic processes. It is developed with reference to the experience that individuals and communities have when faced with environmental risks and pressures [43]. Each coastal ecosystem, as a complex system linked to the characteristics of the elements that compose it, can be undermined by the speed of technological evolution and its inability to adapt itself. For this reason, settlement systems are in continuous and rapid transformation: their size, organisation, economic structure, the inhabitants and their way of experiencing the urban system change [44]. All these changes have repercussions on the housing order and bring out the vulnerabilities that characterise urban systems. Specifically, the vulnerability is both what is observed at the moment of its manifestation and the set of those processes that generated it [45].

(c) In the United States, the climate emergency could be an opportunity to address bottom-up experimentation to achieve social equity and strengthen participatory justice [46]. Collaborative adaptation and justice approaches trigger dynamic, incremental, and cyclical learning processes in which techniques are combined with participatory approaches. In these sustainable ecosystem strategies, awareness of the role of stakeholders in decision-making processes related to flood protection can be increased [47].

Following the logic of the cycle, every time a coastal ecosystem has to face a catastrophic environmental event, it will have to regenerate the balance lost due to disturbance.

The coastal ecosystem must adopt new regenerative and adaptive signs to establish a new balance. This approach produces feedback that can strengthen the ecosystem and make it better prepared to face the next disruptive event. Therefore, the coastal ecosystem follows circular processes in which a part of the output is sent back to the beginning as information [48]. In this perspective, the ecosystem exploits its autopoietic ability of using solution feedbacks to face the next disruptive phenomenon.

The results of the rebalancing process reviewed through the circular achievement of the "facing the catastrophic environmental event" phase, the "ecosystem rebalancing" phase, the "new adaptive and regenerative solution" phase, and the "feedback to ecosystem empowering" are illustrated in Figure 2. These phases reveal the need to act according to precise and elaborate visions that emerged from the critical analysis of the literature. In fact, whenever an ecosystem is "facing catastrophic environmental event" for "ecosystem rebalancing", it is necessary to investigate the vulnerabilities in the different dimensions (Multidimensional Vulnerabilities—MDV). This analysis is necessary to respond to the needs of the ecosystem through a "new adaptive and regenerative solution" attentive to the integration needs of the innovative technological solution at different scales (Multi-scale Technology Innovation—MTI). The outcome of the adequacy of the solution to the climatic disruption of the ecosystem is verified through the "feedback to ecosystem empowering" through the participation of different categories of multi-actors (Multi-Actor Management—MAT). The three focuses overlap and combine, allowing for a multidimensional reading of the ecosystem. In particular, the intersections of MTI, MDV, and MAT make it possible to establish the main criteria that can be used to evaluate the effectiveness of the intervention hypotheses. Integration makes the waterfront a dynamic and adaptive ecosystem in which humans, technological services, and natural elements work together to maintain a balance that benefits each of the parts described.

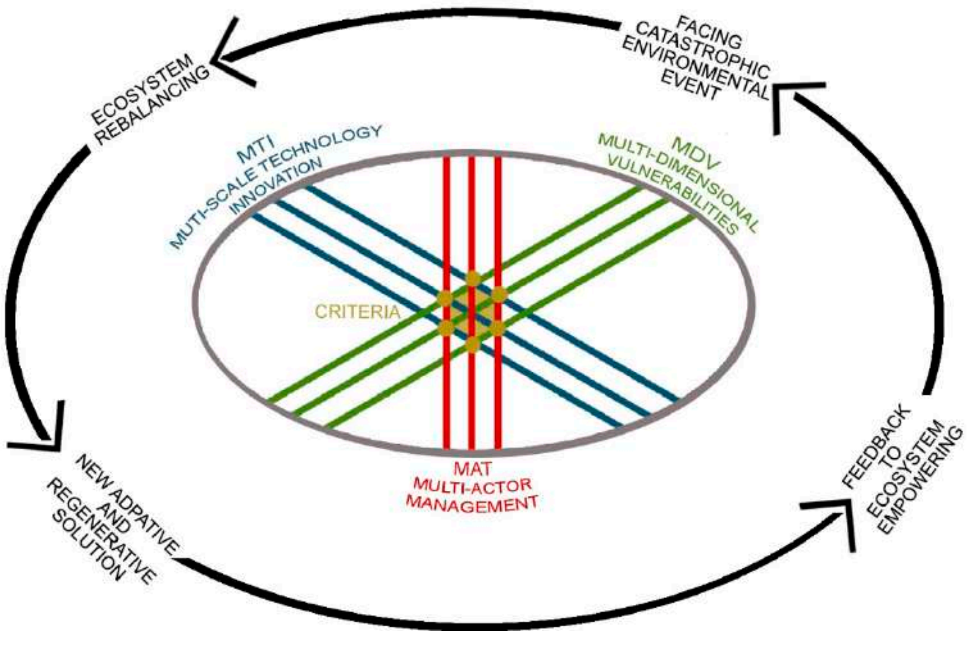

Figure 2. Ecosystem Rebalancing: integration of multi-scale technology innovation, multidimensional vulnerabilities, and multi-actor management for waterfront ecosystem criteria, Author's elaboration.

Following the second phase of the research on ecosystem reading, the paper studies the new defence measures against future natural disasters [49]. In the contemporary climate scenario to mitigate flooding and protect the ecosystem, the US approach focuses on holism by combining different strategies for critical infrastructures, innovative solutions, and mechanical modelling actions. The latter acts on the morphology of a site, influencing its susceptibility to flooding. The impact of flooding is often shaped by coastal characteristics:

elevation and slope can influence the behaviour of a climatic event and the associated rise in sea level. Coastal ecosystems, especially New York's marshy and/or sandy ones, are often reinforced with rock and/or concrete to defend the coastline from the natural action of marine erosion. These effects are linked to critical infrastructure strategies, which are often governed by trade-offs that prevent the exploitation of class synergies and social equity [50]. The various impacts of flooding include the disruption of critical infrastructure of transport systems, energy, telecommunications, social networks, and wastewater treatment plants. These impacts could result in water pollution with the release of other contaminants, degradation of natural resources, and loss of individual and business income. For these reasons, stakeholders have been forming coalitions of decision-makers in recent years to contribute to a prudent, equitable, and science-based climate change policy. Besides the environmental losses caused by hurricanes and floods, there are also serious economic losses that harm local communities. In this regard, the OneNY2050 document investigates city protection strategy based on bottom-up actions. It would address the climate emergency by achieving social equity and strengthening participatory justice in 2050. This focus on collaboration comes from considering the risk of loss of life, injury, illness, or aggravation of existing health conditions, bringing with it psychological effects such as depression and chronic anxiety of exposed citizens [51]. This approach has led to the creation of a centralised and coordinated monitoring system that focuses on comprehensive risk assessment at the city level.

This assessment is refined for each catastrophic climate event based on the empirical experience of the environmental event [52]. Comparing different catastrophic climate events and understanding which sector has been less vulnerable than another can give us an order of magnitude of the margin for improvement. For example, in relation to damage to energy resources from an extreme storm, Hurricane Sandy in 2012 was more catastrophic than Hurricane Irene, which occurred only the year before in 2011 [53]. Catastrophic events can also have effects on the alteration of the established image of the coastal landscape due to risk reduction interventions in coastal areas with high landscape/cultural value [54]. In this sense, the choice of interventions has to take into account many factors, among which the attractiveness (tourism and induced activities) determined by the presence of cultural assets and landscape value. Intervention strategies for these areas must take into account the priority need to protect the consolidated image of the places [33].

HUD Housing and Urban Development (Department for Housing and Urban Development) decided to launch a competition, called *Rebuild By Design*, established for the reconstruction of New York and New Jersey through a program of six interventions to address the problem of coastal protection [55]. The drafting of the program was based on a holistic approach coordinated by different experts of coastal regeneration [56]. The intervention scheme was based on the following six fundamental points:

- • the construction of a system of marshes and dams in order to channel the water in the event of flooding;
- • the design of a system of public spaces with attractions and recreational functions that should have shielded the coastline;
- • the establishment of education centres for the protection of local natural species;
- • the construction of a drainage system, which through a set of pumps, guaranteed the management of flood waters;
- • the expulsion of excess water permeable within the coast;
- • the design of a new system of public green and garden roofs that would allow the collection of rainwater [57]. On 23 July 2013, with the expiration of the competition notice, six of the ten proposed projects were declared winners, operating in geographically different areas but sharing the same criteria.

The Living Breakwaters is a system of eco-sustainable swamps and docks built on Staten Island by "Scape/Landscape Architecture".

The project objective aims to safeguard the southern shore of Staten Island, which is vulnerable to the action of the waves that break on the coast, thus, causing coastal erosion.

The project strategy promotes the creation of underwater natural obstacles whose protective coating is made up of oyster shells. They are composed of calcium carbonate and allow for the recreation of the natural habitats that have been destroyed. They also allow for the restoration of the chemical composition of the original ecosystem. In the wake of the environmental designs, education centres for the culture of settled species and support areas for controlling fishing and water sports have been created.

The technological solutions are breakwaters and eco-sustainable concrete quays encompass the technologies used.

The prize awarded was $60 million.

The strength of the project proposal is the low ecological impact. In fact, the layered system innovatively fuses the marine and terrestrial strategies through the creation of flanges that mitigate the wave action, preventing coastal erosion. An additional strength is the material-constructive impact, through the creation of "cliff roads" (made of ecological low pH concrete) restoring the original habitat of the area without affecting the pre-existing flora and fauna. In addition, the perceptual-cultural impact is minimal, as the barrier is placed below sea level. The use of oysters aims to recall the historical value of the mineralogical composition of the city of New York to the collective history. Finally, the management and maintenance costs are included in the construction costs and guaranteed for the entire life cycle of the work.

The weakness of the project proposal is the morphological-dimensional impact. In fact, the technology is able to attenuate the tidal flow during the storm, but not contain or repel it as shown in Figure 3 [58].

Figure 3. Aerial photographic survey of the project area, Francesca Ciampa elaboration, 2019.

The Resist, Delay, Store, Discharge—A Comprehensive Strategy for Hoboken is a protection, absorption and exhaust system made in Weehawken, Hoboken, and Jersey City by "The Oma Team".

The project objective aims to safeguard the city of Hoboken, and the areas adjacent to it, from any floods caused by heavy rainfall or violent storm surges (Hurricane Sandy caused the flooding of 80% of the area).

The project strategy provides for the integration of infrastructure elements, in particular the vegetation terraces that act as protective walls and garden roofs that guarantee excellent resistance to rainwater.

The technologies used are based on a drainage system equipped with pumps to expel excess water.

The prize awarded was $230 million painfully invested in the project, which is yet to be completed, or in the implementation phase.

The strength of the project proposal is the lower ecological impact. In fact, the proposed system exploits the absorbing capacity of the natural elements that filter the excess water. Firstly, by the morphological-dimensional impact, given by the system of green walls and garden roofs, which positively affects the cemented face of the city. Secondly, by the material-constructive impact due to the use of biocompatible materials, and finally, from the perceptual-cultural impact, guaranteed by the green roofs and natural terraces, which beautify the view of its urban landscape under which the underground drainage system is hidden.

The weakness of the project proposal is the high costs, which are due to the adaptation of the buildings of the pre-existing urban fabric, as shown in Figure 4 [59].

Figure 4. Aerial photographic survey of the project area, Francesca Ciampa elaboration, 2019.

The New Meadowlands—Productive City + Regional Park is a protection system built in Meadowlands by “Mit Cau”, “Zus”, and “Urbanistein”.

The project goals are the protection and growth of the marshy area between Jersey City and Newark at the southern end and up to Hackensack in the northern part.

The project strategy envisions the creation of a system of embankments and swamps, aimed at protecting the land in the event of sea level rise. It also collects rainwater seeking to limit the overflowing phenomena of the adjacent city’s sewage systems. The project promotes growth thanks to a mixed use of the area and road networks to give direct access to the park, public spaces, recreational areas, and residential areas.

The technologies used are represented by a system of water collection and protection of existing species.

The prize awarded was $250 million, currently used in the design empowerment, which will be completed in 2022.

The strength of the project proposal is the ecological impact for the improvement of new habitats and recreational places; and also the material-constructive impact for its minimal structure to protect the existing species on site.

The weakness of the project proposal is the morphological-dimensional impact, which intervenes on the population density. To worsen the assessment, the perceptual-cultural impact affects virgin site as densely populated centres. The amount of costs for the community and for the government will be allocated for the construction of the project [60].

The Living with the Bay—Resiliency Building Options for Nassau County’s South Shore is a dam and marsh system built in Nassau County by “The Interboro Team”.

The project goal is to create an eco-sustainable protection system that reduces the action of waves breaking on the coast and protects the bay from storm surges and sea level rise, all factors caused by the frequent storms that hit the Nassau county coast.

The project strategy involves the construction of a large greenway used for recreation spaces and as a network of infrastructure for the protection, containment, and channelling of water, to allow its expulsion away from the inhabited centres.

The technology used involves a connection system between dams and marshes that channel the water towards the bay, cleaning it and supplying the aquifers.

The prize awarded was $125 million, fully invested in the construction of the site, which will be completed by 2022.

The strengths of the project proposal are the minimum ecological impact guaranteed by the use of eco-sustainable materials for the construction of the protective barrier. The material-constructive impact guarantees greater water resistance than all the projects analysed so far.

The weaknesses of the project proposal are the morphological-dimensional impact, due to the shape and size of the barrier, and the perceptual-cultural impact that change the geographic configuration of the site. It also affects the historical identity of the urban landscape, resulting in very high costs [61].

The Hunts Point/Lifelines: Greenway and Open Market is a backbone system of green infrastructure and food distribution centres built in the South Bronx by "Penn Design/Olin".

The project objective goal is the safeguarding of the coastal strip of Hunts Point in the South Bronx, guaranteeing the protection of the industrial area in the neighbourhood by the flooding event.

The project strategy promotes the creation of a greenway that allows the transport of goods and the achievement of areas for leisure and the use of open spaces. In addition, the construction of a new food distribution centre is planned, a pivot of economic attraction and source of livelihood in the event of a natural disaster.

The technology used is based on a vegetation system composed of aquatic plants that block and filter the water.

The prize awarded was $20 million that, however, have been invested in the renovation of the district heating system; for this reason, new funds are expected to be allocated for the redevelopment of the site.

The strength of the project proposal is the minimal ecological impact. It exploits the fusion of the marine and terrestrial strategies with aquatic plants and tree-lined roads to mitigate the action of water. The material-constructive impact is positive thanks to the creation of "green roads", which, in case of danger, shield food distribution centres and guarantee the transport of food. For this project, the perceptual-cultural impact has been minimal since the tree-lined streets represent not only the technology introduced, but at the same time, are places of recreation and social rebirth.

The weakness of the project proposal is the morphological-dimensional impact because the entire image of the site is distorted, as shown in Figure 5 [62].

Figure 5. Aerial photographic survey of the project area, Francesca Ciampa elaboration, 2019.

The Dry Line/BIG U is a Defensive Barrier System defined by the integration of the Lower Manhattan coastal design and built by the BIG team. It has expanded itself by incorporating a heterogeneous group of experts with experience in a holistic design approach. The collective can include figures such as One Architecture (water and urban planning); Starr Whitehouse (landscape architecture); James Lima Planning and Development (finance and economics); Green Shield Ecology (ecology); Buro Happold (engineering and sustainability); Level Infrastructure (engineering) and Arcadis (hydrologic engineering); AEA consulting (arts and cultural planning); Project Projects, and the School of Constructed Environments in collaboration with the Mayor's Office of Recovery and Resiliency.

The project concept exploits crisis, a time of great urgency, as a great opportunity to contemplate a resilient infrastructure for Lower Manhattan. The project plans to fill the separation between the city and the water with a series of construction elements, designed for specific neighbourhoods. It tries to design technological and social infrastructures intended as a great global strategy rooted in local communities.

The project objective is to safeguard the island of Manhattan from coastal floods and frequent hurricanes, such as the passage of Irene in 2011 and Sandy the following year.

The project strategy involves the creation of a 16 km of green infrastructure barrier whose plants are defence tools compatible with the marine environment. The vertical vegetation system, which protects from the waves (for about ten miles), is located close to the coastline. It is raised above sea level in order to accommodate areas with attractive or recreational functions, such as pedestrian spaces, cycle paths, commercial properties, and cultural premises.

Walkways, raised platforms, and absorption basins that can act as a zone of friction and containment during disasters represent the technologies used.

The prize awarded to the project was $335 million and resulted in not only the completion of the work in a short time, but also the construction of a large attractive and recreational centre for the entire Lower Manhattan area.

The strength of the project proposal is low ecological impact exploiting the protective vegetation system, which determines the creation of new habitats, parks, walks, and nature reserves. The design area can be divided into three compartmentalized areas that communicate with each other, but work independently; precisely, in order to allow greater protection of the site in case of damage to one of them. An additional strength is the perception-cultural impact, as the site looks like a walk surrounded by greenery, which changes its function of the neighbourhood it crosses. An excellent sealing and water absorption system does not violate the visual continuity between land and sea.

The weakness of the project proposal is the high material-constructive impact, due to the introduction of macro tanks and immersion pumps. A further weakness point is the morphological-dimensional impact, which becomes more impactful due to a system of mobile protective barriers that encompass the coast [54]. From a social point of view, this project probably aims to improve the protection of the areas of Wall Street and, therefore, those with the highest economic potential. The city has dedicated more than $400 million to the first phases of the BIG U, and the federal government has given $511 million. The project is finished and has been a worldwide success, as shown in Figure 6 [63].

The results of this systematisation result in the creation of a matrix to extrapolate the general recurring criteria assumed predominantly for one solution rather than another. In the following matrix of the six projects, the first column contains the names of the projects, given in the order of the analysis followed in Section 4. Arbitrary columns6 were assigned to each of them in order to be able to distinguish them in subsequent processing. In the second column, there are the main data, which have been previously discredited. In the third column, there are the positivity and negativity impacts evaluated. This step highlights both the potential and the limiting factors that emerge from the analysis of US practices. In particular, it is possible to verify the effects of their design through the study of realised experiences. In the fourth part, the examination identifies a focusing system based on the evaluation of the observed models, taking into account the characteristics of the projects under examination and the contextual conditions. In order to identify transferable models, albeit with adaptations to the characteristics of the specific contexts, these focuses were classified according to the fulfilment of the MTI, MDV, and MAT conditions emerged from the critical literature as meeting the project requirements. The first focus takes on a blue colour, as it is related to Multi-scale Technology Innovation, the second focus takes on a green colour, as it is related to Multidimensional Vulnerabilities, and the third focus takes on a red colour, as it is related to Multi-Actor Management. Finally, in the last column, in yellow, there are the emerging criteria declared as shown in Figure 7 (all the colours used are in line with what has been said previously in Figure 1 in paragraph 3 on methodology).

Figure 6. Aerial photographic survey of the project area, Francesca Ciampa elaboration, 2019.

Projects	Main Data	Evaluation	Focus	Criteria
The Living Breakwaters	Eco docks made of oyster shells and low PH concrete and built to avoid coastal erosion regenerating natural ecosystem	Positive impact Fusion of marine and terrestrial strategies with eco-friendly material connected to place history Negative impact Not contain tidal flow into innland	Natural Material Solution Eco-Regeneration approach Landscape modelling use	Eco-sustainable landscape
The Exist, Delay, Store, Discarge	Integration of infrastructural elements, such as vegetation terraces like protective walls and garden roofs like rainwater resistant tool. All supported by underground drainage system	Positive impact System exploits the absorbing capacity of the natural elements to filter the excess water. Negative impact High costs due to the adaptation of the pre-existing buildings	Infrastructural-drainage design Green technology integration Community-Led for Land use	Comprehensive Strategy
The New Meadowlands	Park system of embankments matched with mixed use of the area and the construction of road networks to the park, public spaces, recreational and residential areas	Positive impact Creation of new habitats and recreational places with solution to protect existing species on site Negative impact The population density increase which followed overbuilding center	Nature-Based solution Adaptive reuse of built heritage Mixed use for Gentrification	Park Productive City zone
The Living with the Bay	Greenway used for recreation spaces and a network of infra-structures for the protection	Positive impact Eco-sustainable materials for the construction of the protective barrier Negative impact The shape and size of the barrier which would thus become a visual limit affecting historical identity of the urban landscape	Green infrastructure network Ecogical Regeneration material Landscape historical protection	Adaptive protection Building system
The Hunts Point/Lifelines	Creation of a greenway that allows the transport of goods and the achievement of areas for leisure and the use of open places	Positive impact Fusion of marine and terrestrial stra-tegies with aquatic plants and roads as recreation and social rebirth Negative impact Entire image of the site is distorted by the project	Redevolpment of infrastructure Ecological as economic rebirth Identity heritage protection	Acceptability/ Compati-bility with preexistence
The Dry Line/ BIG U	Walkways and raised platfor-ms and creative absorption basins with friction and con-tainment during disasters	Positive impact Design area can be divided into three compartmentalized areas that communicate with each other but work independently, precisely in order to allow greater protection of the site in case of damage to one of them Negative impact High material-constructive impact, due to the disaster wich affecting systems such as macro tanks and immersion pumps, in disagreement with the will of the community	Technological pedestrian path Ecological material approach Community participation	Recreational defensive technology

Six projects — MTI MDV MAT — Six Criteria

Figure 7. Waterfront Ecosystem Regeneration Matrix, authors' elaboration.

In the case of the first criterion, relating to the *Eco-sustainable landscape* with natural material, the research emphasizes both the eco-friendly materials for the transformation. From a multi-scale perspective, the protective design must be integrated with the coast, thus, defining a new landscape. The latter must meet the surrounding environment by triggering virtuous processes of environmental protection aimed at safeguarding the traditional background of the site.

The second criterion, *Comprehensive Strategy* for low ecological impact, is based on a holistic approach that places in collaboration several actors to recreate the lost links between the environment and local stakeholders. Furthermore, this criterion aims to exploit multi-actor participation to obtain comprehensive strategies. The collaboration acts on the different dimensions of vulnerabilities with innovative scalar solutions.

The third criterion, *Park Productive City Zone*, is based on the idea of implementing infrastructure capable of producing economic development. This implementation postpones the attractive capacities to regenerative operation, increasing the market value and its employment offer.

The fourth criterion, *Adaptive Protection for Building System,* is based on solutions capable of dealing with ecosystem criticalities, starting with the environmental one, exploits the multi-scale dimension of latest defensive technological solutions.

The fifth criterion, *Acceptability and Compatibility to the Pre-existence*, is based on the compatibility of the transformations to integrate the requirements they are called upon to meet. Acceptability of transformation as a predisposition to change the image of a coastal ecosystem with a consolidated historical identity. The principles of acceptability and compatibility can be defined as follows [64]:

- Acceptability: the ability to ensure that project solutions are accepted both by citizens and local administrations and by indirect and potential users of the coastal area. The term refers to the intangible effects of the transformation.
- Compatibility: the ability to avoid irreversible changes in the shape of the site or in its characteristic elements, in the proportions and dimensional relationships between the parts. The ability to avoid degradations or failures deriving from the design solutions. The term refers to the tangible effects of the transformation.

The fifth criterion takes into account the combination of the two identified principles, considering the impacts of the project solution in terms of alteration (or compromise) of the tangible and intangible values of the site.

Finally, the last criterion, *Recreational Defensive Technology*, refers to the integration of several aspects within the single modelling tool of the coast. The technological solution fulfils both human lives and the waterfront protection acting, in the absence of catastrophic climatic events, as recreational equipment useful for income neighbourhood and its stakeholders.

4. How Ecosystem Regeneration Criteria Could Improve EU Strategies?

These criteria are the expression of different variables and uses at different scales, each relating to specific aspects of waterfront ecosystem regeneration. The extrapolated criteria bring together both aspects related to the circular use of eco-friendly materials and recreational solutions to increase well-being and employment. In each criterion, technological factors (in terms of innovative solutions), social factors (in terms of community participation, recreational uses, and involvement of stakeholders), and environmental factors (with attention to eco-friendly and nature-based design, material, and factual choices) coexist. Technological interventions transform coastal ecosystems, both as a representation of the community landscape and as an infrastructure of natural and artificial services. The environmental condition in urban settlements initially requires the provision of ecological services through the planning of natural ecosystems in urbanised areas according to strategic criteria; then, the value and opportunities for socio-economic development can be created. Environmental protection is the first prerequisite for a defined ecosystem. Through their technological protection, urban ecosystem services improve the ecological, social, and settlement scale. By associating ecosystem balance with the state of human beings, disruption is an equivalent reason for why the identification of criteria is essential to restore lost balances.

By relating the case studies examined (left) to the different criteria that emerged (right), it is possible to construct a matrix that highlights the adaptability and possibility of matching these criteria through their correspondence with the other projects examined.

Although each project corresponds to a direct dominant criterion whose link is weighted with a greater thickness, other secondary criteria belong to the other projects in the matrix, albeit they link indirectly. For example, the project "The Hunts Point/Lifelines" has as a dominant criterion "Acceptability/Compatibility with pre-existing features" and as a secondary criterion "Park Productive City Zone, and Recreational Defensive Technology" as shown in Figure 8.

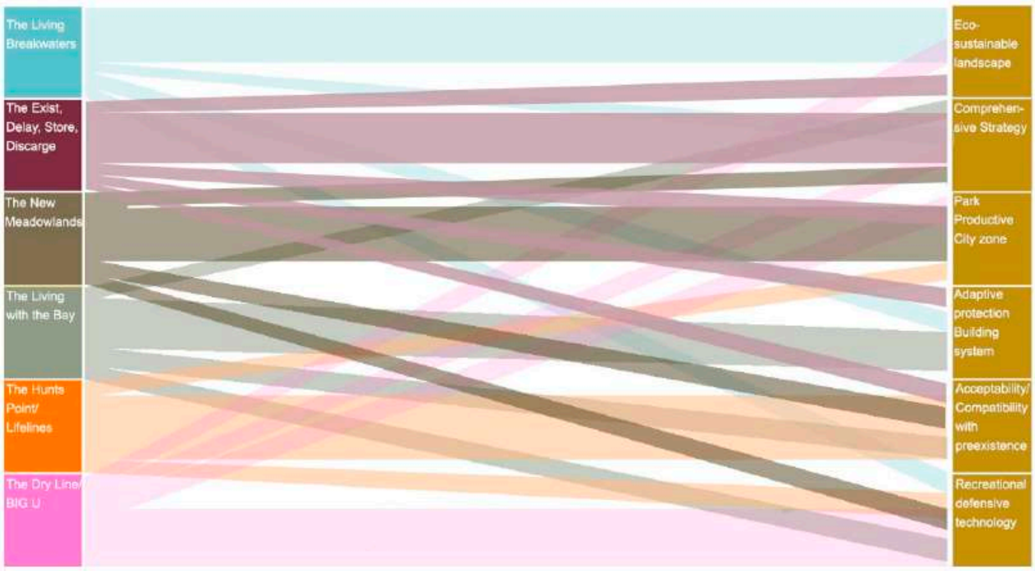

Figure 8. The matching of Regeneration Waterfront ecosystem criteria, authors' elaboration.

The system of criteria, determined by analysing the regeneration and rebalancing processes of coastal ecosystems, represents a significant transferable sustainable strategy. In order to restore the topicality and avant-garde of *Rebuild By Design* projects, it is possible to validate the criteria derived with the most recent American and European documents. By establishing the criteria with the US and EU strategic lines, it is possible both to demonstrate the correspondence, and, therefore, the topicality, of the research result, and to integrate the current scenarios by filling any strategic gaps in both contexts.

The identified criteria correspond to the actions foreseen in the recent US guidelines for a resilient strategy to address critical climate issues expressed in Resilience 21 [65]. Each criterion was correlated to the most significant actions, highlighting the adequacy of what was developed with the current US policy framework. Moreover, in order to validate the transferability of these criteria also in European contexts, it was significant to correlate the research results to the most recent European goals with reference to the Agenda 2030 [66] and the European Green Deal [67]. This comparison allows us to see how the criteria used meet the European goals by finding a correspondence with some of the SDGs of the 2030 Agenda. The criteria are also adaptable in those territories through the indications of the European Green Deal such as shown in Figure 9.

The indications of the validation return a scenario of correspondence between the American and European guidelines. This comparison shows the advancement of European legislation in the sustainability field but the lack of specific flooding action. However, it is evident that the American ones provide precise information on the regeneration of the waterfront ecosystem after climate disasters. For this reason, these criteria could act as an integrating factor in the European regulatory framework to implement and to fill existing gaps. These criteria would enhance the European debate towards the construction of precise guidelines for waterfront ecosystem regeneration. This comparison operates in the perspective of new advancement scenarios by testing these criteria in the European context.

Criteria	American actions	European goals	
Waterfront ecosystem criteria	Resilience21 building a nation of resilient communities (Biden, 2021)	Agenda 2030 SDGs (United Nations, 2015)	European Green Deal (European Commission, 2019)
• Eco-sustainable landscape	**ACTION 10.** Fundamental research on future hazards, risks, and vulnerabilities informed by best in class science.	**SDG 14: Life Below Water**	**(§2.2.2)** Greening national budgets and sending the right price signals **(§2.1.8)** A zero pollution ambition for a toxic-free environment
• Comprehensive Strategy	**ACTION 1.** Create leadership positions and establish the organizational structure necessary to advance change throughout the federal government. **ACTION 2.** Establish a National Resilience Task Force to bring a community of experts into the process of designing and addressing climate risk and multihazards. **ACTION 6.** Develop a contemporary decision-making framework for federal investments and further update NEPA environmental review processes.	**SDG 9: Industry, Innovation and Infrastructure**	**(§3)** The EU as a Global Leader **(§2.1.1)** Increasing the EU's climate ambition for 2030 and 2050 **(§2.1.8)** A zero pollution ambition for a toxic-free environment
• Park Productive City zone	**ACTION 4.** Research and prepare critical infrastructure, services, and stockpiles for climate change and stresses related to climate risk and public health. **ACTION 8.** Create a Resilience Finance Committee to develop and support innovative financing and investment tools,funds, and incentives for a range of funders and investors by drawing upon private and public investment to support and accelerate programmatic, technical, and physical upgrades.	**SDG 12: Responsible Consumption and Production**	**(§2.1)** Designing a set of deeply transformative policies **(§2.1.1)** Pact Increasing the EU's climate ambition for 2030 and 2050
• Adaptive protection for Building system	**ACTION 5.** Buildings and infrastructure that advance resilience, sustainability, and social and climate justice **ACTION 9.**Expand and align successful federal programs to accelerate holistic mitigation and adaptation improvements in homes, buildings, and infrastructure.	**SDG 13: Climate Action**	**(§2.1.4)** Building and renovating in an energy and resource efficient way **(§2.1.5)** Accelerating the shift to sustainable and smart mobility **(§2.2.3)** Mobilising research and fostering innovation
• Acceptability and Compatibility to the preexistence	**ACTION 3.** National recovery and Build Back Better initiative through environmental innovation in clean energy and advanced technologies.	**SDG 11: Sustainable Cities and Communities**	**(§2.1.7)** Preserving and restoring ecosystems and biodiversity **(§2.2.1)** Pursuing green finance and investment and ensuring a just transition
• Recreational defensive technology	**ACTION 7.** Create a "Future Visioning" Task Force to address communities threatened by climate and human-caused displacement including sea level rise, wildfire, riverine and coastal flooding, environmental degradation and pollution, civil unrest, etc. This task force must support free will and mobility of communities to determine their own futures and have enough funding for support and proactive action. Considerations must include local, regional, and global-reaching influences on American communities broadly: Identify and provide technical and funding support to receiving communities to help them prepare for significant population and demographic changes, to ensure housing stock, infrastructure, and community services are in place in addition to support networks and services. When affordable housing is to be relocated after consultation, build the receiving properties before demolishing the old and ensure that the total amount of affordable housing available to a population remains stable or increases.	**SDG 8: Decent Work and Economic Growth**	**(§2.1.3)** Mobilising industry for a clean and circular economy **(§4)** Time to Act - Together: A European Climate

Figure 9. Criteria validation with US and EU strategic documents, authors' elaboration.

This experimentation would make it possible to associate the criteria with American actions and European goals in order to construct a system of complex indicators aimed at regulating waterfront ecosystems. The innovation of the American criteria could significantly influence European growth towards building more sustainable landscapes whose ecosystems could represent renewed forms of protected habitats. These criteria would positively influence European strategies and make them more inclusive and comprehensive. These criteria could hybridise employment and production goals with ecological and recreational qualities of flooding solutions.

5. Conclusions

The innovativeness of the research consists in the product based on the construction of the criteria, but also in the process related to the methods of ecosystem reading. The criteria help to rebalance the physical, social, and economic pressures caused by disruptive climatic events, thereby counteracting them and reinforcing the regeneration process. The identification of these criteria highlights the need for an integrated approach to ecosystem services and the role of their assessment as a binder in urban regeneration phases. It is possible to trace a principle of circularity ascribable to the autopoietic capacity of the waterfront ecosystem, interpreting the coastal ecosystem as a driving force for social sustainability, economic growth, and environmental protection. These criteria embrace the demands of heritage and culture while respecting the identity traits of the genius loci and develop towards resilient functions that are mindful of social and environmental justice. The importance of having identified criteria for the regeneration of urban waterfronts lies in their ability to rebalance waterfront ecosystems, while also revitalising the main urban areas in which they are embedded.

In addition, the paper compared the criteria with international thematic standards of reference works to demonstrate the relevance and cutting edge of the practices and results achieved. This comparison offers the possibility to associate the criteria with American actions and European objectives in order to test these criteria in the European context. These criteria would improve the European vision in a multi-scale perspective, from the building ecosystem to the coastal ecosystem, following the incentives for integration as well as the acceptability of transformations compatible with a renewed identity that respects the pre-existence. The innovation of the American criteria could significantly influence European growth towards building more sustainable landscapes whose ecosystems could represent renewed forms of protected habitats. These criteria would positively influence European strategies, making them more inclusive, comprehensive, and hybridising employment and production goals with ecological and recreational qualities of solution infrastructure. By involving different aspects of coastal ecosystems, pre-existing assessment tools can be implemented to determine a complex and comprehensive regenerative process. Their applicability, transferability, and replicability of the waterfront regeneration criteria allows us to hypothesize the construction of a system of complex indicators to define the specific actions of coastal ecosystems that technicians and administrators can follow. The transferability of the criteria developed in the European context encounters limitations due to the need to adapt these ecosystem regeneration approaches to mitigate the vulnerabilities they address. Moreover, it offers an opportunity to test how an ecosystem regeneration approach can support the planning and designing of coastal ecosystems.

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References

1. Scheffer, M.; Carpenter, S.; Foley, J.A.; Folke, C.; Walker, B. Catastrophic shifts in ecosystems. *Nature* **2001**, *413*, 591–596. [CrossRef] [PubMed]
2. Smith, M.D. An ecological perspective on extreme climatic events: A synthetic definition and framework to guide future research. *J. Ecol.* **2011**, *99*, 656–663. [CrossRef]

3. Turner, B.L. Vulnerability and resilience: Coalescing or paralleling approaches for sustainability science? *Glob. Environ. Chan.* **2010**, *20*, 570–576. [CrossRef]
4. Di Palma, M. Strategie integrate per lo sviluppo sostenibile delle città portuali. *BDC* **2010**, *10*, 103–113.
5. White, J.T. Pursuing design excellence: Urban design governance on Toronto's waterfront. *Prog. Plan.* **2016**, *110*, 1–41. [CrossRef]
6. Kinder, K. *The Politics of Urban Water. Changing Waterscapes in Amsterdam*; University of Georgia Press: Athens, GA, USA, 2015.
7. Kelly, K. *What Technology Wants*; Penguin: New York, NY, USA, 2010.
8. Ciampa, F. An Ecosystem-Based Mitigation Model for vulnerable settlement systems: The experience of Venice (Italy) in addressing the risk of flood disasters. In Proceedings of the EGU General Assembly 2021, Göttingen, Germany, 19–30 April 2021.
9. Beauregard, R.A.; Lieto, L. *Planning for a Material World*; Routledge: London, UK, 2016.
10. ACTeon. *A Guide to Support the Selection, Design and Implementation of Natural Water Retention Measures in Europe. Capturing the Multiple Benefits of Nature-Based Solutions in the EU*; Publication of the European Union: Luxembourg, 2016.
11. Du Plessis, C.; Brandon, P. An ecological worldview as basis for a regenerative sustainability paradigm for the built environment. *J. Clean. Prod.* **2015**, *109*, 53–61. [CrossRef]
12. Costanza, R.; de Groot, R.; Braat, L.; Kubiszewski, I.; Fioramonti, L.; Sutton, P.; Farber, S.; Grasso, M. Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosyst. Serv.* **2017**, *28*, 1–16. [CrossRef]
13. Wang, R.; Li, F.; Hu, D.; Larry Li, B. Understanding eco-complexity: Social-Economic-Natural Complex Ecosystem approach. *Ecol. Complex* **2011**, *8*, 15–29. [CrossRef]
14. Fusco Girard, L.; Nocca, F. Moving towards the Circular Economy/City Model: Which tools for Operationalizing This Model? *Sustainability* **2019**, *11*, 6253. [CrossRef]
15. Ellen MacArthur Foundation. *Growth within: A Circular Economy Vision for a Competitive Europe*; Ellen MacArthur Foundation: Cowes, UK, 2015.
16. Mang, P.; Reed, B. Regenerative Development and Design. In *Encyclopedia of Sustainability Science and Technology*; Springer: New York, NY, USA, 2019.
17. Heynen, N.; Kaika, M.; Swyngedouw, E. *The Nature of Cities—The Politics of Urban Metabolism*; Routledge: London, UK, 2005.
18. Avni, N.; Tescher, N. Urban waterfronts: Contemporary streams of planning conflicts. *J. Plan. Lit.* **2019**, *34*, 408–420. [CrossRef]
19. Beauregard, R.A. In Search of Assemblages. *Crios* **2012**, *4*, 9–15.
20. Collier, S.J.; Lakoff, A. Vital systems security: Reflexive biopolitics and the government of emergency. *Theory Cult. Soc.* **2015**, *32*, 19–51. [CrossRef]
21. Cornell, S.; Berkhout, F.; Tuinstra, W.; Tàbara, J.D.; Jager, J.; Chabay, I.; de Wit, B.; Langlais, R.; Mills, D.; Moll, P.; et al. Opening up knowledge systems for better response to global environmental change. *Environ. Sci. Policy* **2013**, *28*, 60–70. [CrossRef]
22. Ferreira, J.C.R. Ordenamento Ambiental de Frentes Urbanas Litorais em Áreas Baixas de Elevado Risco e Vulnerabilidade ao Galgamento Costeiro. 2016. Available online: http://hdl.handle.net/10362/19883 (accessed on 13 March 2021).
23. Collier, S.J.; Cox, S.; Grove, K. Rebuild by design in post-Sandy New York. *Limn* **2016**, *7*, 52–68.
24. Koutsoyiannis, D.; Mamassis, N.; Tegos, A. Logical and illogical exegeses of hydrometeorological phenomena in ancient Greece. In Proceedings of the IWA 1st International Symposium on Water and Wastewater Technologies in Ancient Civilizations, Iraklio, Greece, 28–30 October 2006.
25. Cardno, C. Rebuilding by Design. *Civ. Eng. Mag. Arch.* **2014**, *84*, 66–80. [CrossRef]
26. Mediero, L.; Santillàn, D.; Granados, A. Detection and attribution of trends in magnitude, frequency and timing of flood in Spain. *J. Hydrol.* **2014**, *517*, 1072–1088. [CrossRef]
27. Camuffo, D.; Bertolin, C.; Schenal, P. A novel proxy and the sealevel rise in Venice, Italy, from 1350 to 2014. *Clim Chang.* **2017**, *143*, 73–86. [CrossRef]
28. Latour, B. *Non Siamo Mai Stati Moderni*; Elèuthera: Milan, Italy, 2015.
29. Ciampa, F. Participatory design approach for the Bronx waterfront. In Proceedings of the 6th International Virtual Conference on Advanced Scientific Results, Bratislava, Slovakia, 25–28 June 2018; Volume 6, pp. 202–206. [CrossRef]
30. Fusco Girard, L.; Cerreta, M.; De Toro, P.; Forte, F. *The Human Sustainable City: Challenges and Perspectives from the Habitat Agenda*; Routledge: Milan, Italy, 2019.
31. Savino, M. *Waterfrond d'Italia, Piani Politiche Progetti*; Franco Angeli: Milan, Italy, 2010.
32. Forss, K.; Rebien, C.C.; Carlsson, J. Process Use of Evaluations. *Evaluation* **2002**, *8*, 29–45. [CrossRef]
33. Bottero, M.; Lami, I.; Lombardi, P. *Analytic Network Process. La Valutazione di Scenari di Trasformazione Urbana e Territoriale*; Alinea: Florence, Italy, 2008.
34. Caterina, G. Innovative strategies for the recovery of historic cities. *TECHNE* **2016**, *12*, 33–35.
35. Miano, P.; Pinto, M.R.; De Medici, S. Architectural themes and processes of conservation and transformation in the post-emergency phase. The case of Bohol's churches. *Abit. La Terra Dwell. Earth* **2017**, *42*, 43–61.
36. Viola, S.; Diano, D. Repurposing the Built Environment: Emerging Challenges and Key Entry Points for Future Research. *Sustainability* **2019**, *11*, 4669. [CrossRef]
37. Kaika, M. *City of Flows*; Routledge: London, UK, 2005.
38. Swyngedouw, E. *Social Power and the Urbanization of Water: Flows of Power*; Oxford University Press: Oxford, UK, 2004.
39. Fitzgerald, E.; Schramm, C.J. *Inside Real Innovation: How the Right Approach Can Move Ideas from R&D to Market and Get the Economy Moving*; World Scientific Pub Co Inc.: London, UK, 2013.

40. Masjuan, E.; March, H.; Domene, E.; Saurí, D. Conflicts and Struggles over Urban Water Cycles: The Case of Barcelona 1880–2004. *Tijdschr. Voor Econ. Soc. Geogr.* **2008**, *99*, 426–439. [CrossRef]
41. Gibbons, L.V.; Cloutier, S.A.; Coseo, P.J.; Barakat, A. Regenerative development as an integrative paradigm and methodology for landscape sustainability. *Sustainability* **2018**, *10*, 1910. [CrossRef]
42. Keil, R. Progress Report—Urban Political Ecology. *Urban Geogr.* **2005**, *26*, 640–651. [CrossRef]
43. Bakker, K. *An Uncooperative Commodity—Privatizing Water in England and Wales*; Oxford University Press: Oxford, UK, 2003.
44. Gómez-Baggethun, E.; Gren, Å.; Barton, D.N.; Langemeyer, J.; McPhearson, T.; O'farrell, P.; Andersson, E.; Hamstead, Z.; Kremer, P. Urban ecosystem services. In *Urbanisation, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment*; Springer: Dordrecht, The Netherlands, 2013.
45. Walker, G. *Environmental Justice: Concepts, Evidence and Politics*; Routledge: New York, NY, USA, 2012.
46. Cook, I.; Swyngedouw, E. Cities, Social Cohesion and the Environment: Towards a Future Research Agenda. *Urban Stud.* **2013**, *49*, 1938–1958. [CrossRef]
47. Opdam, P. Implementing human health as a landscape service in collaborative landscape approaches. *Landsc. Urban Plan.* **2020**, *199*, 103819.
48. Geneletti, D.; Cortinovis, C.; Zardo, L.; Adem Esmail, B. *Planning for Ecosystem Services in Cities*; Springer Nature Switzerland AG: Cham, Switzerland, 2020; ISBN 978-3-030-20024-4.
49. NYC Department of City Planning. *Climate Resiliency Design Guidelines for Waterfront Revitalization Plan*; Ann. N.Y. Acad. Sci. Flood Hazard: New York, NY, USA, 2019. Available online: http://www1.nyc.gov/site/planning/data-maps/flood-hazard-mapper.page (accessed on 23 January 2021).
50. The City of New York. *One New York: The Plan for a Strong and Just City*; Ann. N.Y. Acad. Sci.: New York, NY, USA, 2015.
51. Buchanan, G. *Damage Assessment Report on the Effects of Hurricane Sandy on the State of New Jersey's Natural Resources Final Report*; Department of Environmental Protection, Office of Science State of New Jersey: Jersey City, NJ, USA, 2015.
52. Blake, E.; Kimberlain, T.; Berg, R.; Cangialosi, J.; Beven, J. *Tropical Cyclone Report Hurricane Sandy (AL182012)*; National Hurricane Center: New York, NY, USA, 2015. Available online: http://storms.ngs.noaa.gov/storms/sandy/imagery/tms (accessed on 23 January 2021).
53. The ICOMOS Guardians of Heritage. *Forum of Participation for the G7 of Culture in Florence: Heritage and Sustainability in the SDGs 2030*; Seekers of Meaning: Firenze, Italy, 2017; Available online: http://unescoblob.blob.core.windows.net/pdf/UploadCKEditor/PROGRAMMA%20G7ICOMOS%201.pdf (accessed on 23 January 2021).
54. Williams, J. Circular cities: Challenges to implementing looping actions. *Sustainability* **2019**, *11*, 423. [CrossRef]
55. Honan, K. *5 Years After Sandy, Here's How NYC is Spending Billions in Federal Aid in Rockaways*; Department of New York Governament: New York, NY, USA, 2017. Available online: https://www.dnainfo.com/new-york/20171026/rockaway-beach/where-did-hurricane-sandy-money-go-fema-hud/ (accessed on 23 January 2021).
56. Rebuild by Design. Rebuild by Design Report. 2019. Available online: http://www.rebuildbydesign.org/resources/website-pdfs (accessed on 23 January 2021).
57. Design New York City Department. Design and Planning for Flood Resiliency: Guidelines for NYC Parks, New York City Department of Parks and Recreation. 2017. Available online: https://www.nycgovparks.org/planning-andbuilding/planning/resiliencyplans/flood-resiliency (accessed on 23 January 2021).
58. Federal Transit Administration. *Flooded Bus Barns and Buckled Rails*; Office of Budget and Policy: Washington, DC, USA, 2011. Available online: https://www.hsdl.org/?abstract&did=685187 (accessed on 23 January 2021).
59. Tollefson, J. Hurricane sweeps US into climate-adaption debate: Manhattan flooding bolsters argument for a massive engineering project to protect New York. *Nature* **2012**, *491*, 157.
60. NYC Department of City Planning. *The Projected 2050 Floodplain for New York City*; NYC Flood Hazard: New York, NY, USA, 2019. Available online: https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/climateresiliency/flood-risk-nyc-info-brief.pdf. Available online: https://www.pnas.org/content/early/2017/10/03/1703568114 (accessed on 23 January 2021).
61. Annals of the New York Academy of Science. *Building the Knowledge Base for Climate Resiliency*; NPCC Technical Details: New York, NY, USA, 2015.
62. Shaevitz, D.A. Extreme Weather: Subtropical Floods and Tropical Cyclones. Ph.D. Thesis, Columbia University, New York, NY, USA, 2016.
63. ORR; NPCC. Sea Section II on Sea Level Rise. Climate Resiliency and Design Guidelines. 2017. Available online: https://msc.fema.gov/portal (accessed on 23 January 2021).
64. De Medici, S. Italian Architectural Heritage and Photovoltaic Systems. Matching Style with Sustainability. *Sustainability* **2021**, *13*, 2108. [CrossRef]
65. Aho, M.; Schoeman, L.; Sarkozy-Banoczy, S. *Building a Nation of Resilient Community*; USA Government: Washington, DC, USA, 2021. Available online: https://www.resilience21.org/home (accessed on 23 March 2021).
66. United Nations. New Urban Agenda. 2019. Available online: www.habitat3.org (accessed on 23 January 2021).
67. European Commission. The European Green Deal, Brussels. 2019. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640&from=EN (accessed on 23 January 2021).