The future of ecological water landscape. Adapting the existing to sea level rise.

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ABSTRACT

Climate change is producing a radical mutation in the world of design, inviting designers to change their attitude from designers of the present to facilitators of the future, placing them before the challenge of planning the *unexpected* of a territorial structure that we know will change drastically, but in ways not actually foreseeable. The following research focuses on this change of attitude, probing the attention on the issue of sea level rise through a compositional and design exploration. If technical solutions such as dams and resistant waterfront are activated on one side, on the other it is necessary to identify coexistence strategies with the variation of the sea, especially for those peripheral areas where it is not possible to foresee heavy infrastructure investments. The challenge is to imagine new aquatic landscapes of the future, to create both the basis for dialogue and a reference tool for change.

For this purpose, the research started by wondering what the constitution of the current landscape is, how it can be defined and what the bases are for an imaginary of future water landscapes. The proposed solution is that of exploration through the representation of a compositional catalog of the water space, which allows to sample the current elements of which the territory is composed, and then, through the instruments of drawing and composition, probing its evolution according to the scenario of sea level rise. The result is therefore that of a large table of elements that speaks of the territory and its transformation, of the current relationship between architecture and water and of what could come, an orientation abacus for the composition of the future water landscape.

Keywords: *sea level rise, spontaneous heritage, adaptation, peripheral areas, waterfronts*

WATER AND ARCHITECTURE: CHANGE OF DESIGN ATTITUDE

Climate change places us in front of a new adaptation challenge, an emergency that takes place in different areas and ways of human life and that in architecture pushes us to change the design methods and the relationship that this establishes with the territory, of which there is no longer an image of finite completeness, but which now contains within itself the knowledge of its mutability.

Forecasts on the future of global geomorphology are indeed numerous, but always uncertain as many of the changes will depend on how governments and communities will act with respect to the need to change their behavior to slow down the climate crisis. Will we manage not to exceed the 1.5 ° increase? No one can predict this, and many of the current predictions currently prove to be mostly pejorative. Here then we have to face the unexpected that falls within ecological design, posing challenges, including those made by Winy Maas *"We need an agenda for change to be implemented. Now! This will form the future city. (…) How can we accommodate the future? How to facilitate the unexpected? "*(Maas, 2019). The role of designers must therefore change from designers of the present to facilitators of the future, working for the narration of new landscapes where water plays a fundamental role. Again quoting Mass, *"water has become a symbol of a pressing alarm, a clear symptom of the climate changes that dominate the news, in often unexpected forms. (…) New and fascinating places, new landscapes. Let's create them! It's a real agenda for the project! ".*

The same reference also comes from Henk Ovink (Ovink, 2019), Dutch special envoy to the United Nations and expert on floods, who argues that at the moment the challenges we face are threefold: the rise in sea level, the subsidence of the ground and the increase in the intensity of hurricanes. *"Since the demand for water exceeds our reserves, we are depleting the aquifers in a rapid and totally unsustainable way. This behavior is sinking the ground in our cities more and more, and faster than ever. Cities are sinking 100 times faster than sea levels rise and this mix of events is becoming more and more lethal. (...) Sea level rise is accelerating, so we need to adapt differently, move faster, be more flexible. (…)And design is political: its aspirations and inspiring abilities make it a catalyst for change. "*

The role of the designer is therefore fundamental to catalyze new narratives, imaginaries and reflections on the future development of water landscapes.

SEA LEVEL RISE AND ARCHITECTURAL COMPOSITION. STATE OF THE ART

The architectural composition now has the role of helping in the challenges of the future, trying to create new visions of the landscape, where the relationship with water is an emerging relationship, to be renewed with respect to the dynamics that have existed so far. The imagery linked to the landscapes of the future is already strongly present, especially linked to those areas for which the investment-population link is predominant. In fact, we can see the great urban conurbations, from New York to the Great Bay Area passing through the Netherlands, where the technical and design proposals are numerous precisely because large investments are foreseen to safeguard the housing and economic production poles. In fact, by analyzing the major publications and projects presented to date, it can be seen how the narrative and imagery linked to the challenge of sea level rise is producing for these areas a series of visions that will guide the transformations of the coastal landscape. To date, there are three main trends identified that arise from this condition: large technological infrastructures, urban defense waterfronts, floating architecture.

The construction of large technological infrastructures is now a well-known process, both as regards the works carried out or planned and for the utopian visions. The history of the protection of Netherland is certainly a notable example, which since the dawn of its existence has been fighting against the sea. The Oosterscheldekering represents only the last step of many of the works carried out to safeguard the territories, as well as other huge works are foreseen to deal with the future elevation, such as the construction of two dams of unprecedented size that would close the access of the oceans in the North Sea. The smallest would be about 160 kilometers long, and would protect the entire western end of the Channel, between Brittany in France and Cornwall in England. The second dam would be nearly 500 kilometers long going from Scotland to Norway. A project almost comparable to that of Atlantropa, a dam that at the beginning of the

1900s was theorized as a proposal to the Nazi regime by the engineer Herman Sorgel and which planned to close the Strait of Gibraltar to create new arable land in the Mediterranean and make Europe and Africa one great continent.

Among the urban waterfront projects, the most published project is the *Dryline* designed by BIG studio for New York, the metropolis most exposed to the risk of flooding in the Western world. The project is configured as a green barrier aimed at protecting Manhattan from hurricanes and floods, combining technological elements with a strong compositional drive that aims to implement the quality of the urban space.

BIG also participates in the design of floating architecture, proposing both his vision for a floating city, *Oceanix*, and creating housing prototypes for students in Copenhagen, the *Urban Rigger*. If, on the one hand, we try to protect ourselves from flood forecasting, water is also seen as the new housing frontier. A great supporter of this thesis is Koen Olthuis, who in addition to exclusively designing floating architecture with his Waterstudio, has coined the notion of *city app*, floating architectures that can fill the temporary need for infrastructure in large coastal cities, such as the project for a mobile Olympic park.

NEW NECESSARY VISIONS OF WATER LANDSCAPE, PERIPHERAL AREAS AND THE *UNEXPECTED.*

If, as seen for large metropolitan areas, visions relating to future changes abound, there is a whole other slice of population and territories that are left aside. In fact, we are talking about those peripheral areas for which no investments are planned, but whose mass exodus would still lead to large housing imbalances and the loss of a great cultural heritage. Take for example the area of the Po Delta, an area that has always been populated in conjunction with major changes in the coast, for which no action is planned other than abandoning the area in the event of flooding. The history of this area, however, like many others of its kind, speaks of adaptation and coexistence with the element of water. In an era in which preserving and reusing the existing is fundamental in ecological, cultural and housing distribution terms, can we hypothesize to continue the process of adaptation that the settlement morphology has already perpetuated in these areas? Quoting Rudofsky (Rudofsky, 1964), the spontaneous architecture of these areas is the current state of a centennial process of adaptation that a community has carried out within a territory. Can the resulting characteristics be exploited to elaborate future visions of coexistence with change? The study of water heritage, or historical instances of adaptation and coexistence with water, can in fact help us today to identify stories and best practices for future development. As Henk Ovink states, we must look to the past, to territorial history, through developments by non-linear parts, it is necessary to develop theories that can help the metamorphosis of the existing towards future scenarios. The heritage of the marginal territories must therefore be hybridized. Heritage in itself is a hybrid concept, which in its conservation and in its passing on is always subject to more or less evident political choices. The need is to continue this dialogue to create hybrid forms of adaptation to morphological variation. In architecture, therefore, it is necessary to identify those forms of *grafting* (Zucchi, 2014) that can work lightly on the existing.

If we project the forecasts of rising water levels on the Po Delta, for example, we can see how the historical centers are built in the emerging points with respect to the flood levels. One can cite the case of Codigoro, whose inhabited area was moved after the only documented case of internal tsunami in the history of the Adriatic Sea, finding it located in a place protected from floods. An area like this will also be located between two large commercial poles, Venice and Ravenna, that will affect and will be the terminus of the global shipping line of the *New Maritim Silk Road*, as well as other comparable areas between Europe and Asia. These territories therefore risk becoming territorial debris, comparable to the urban ones on which urban development is currently working.

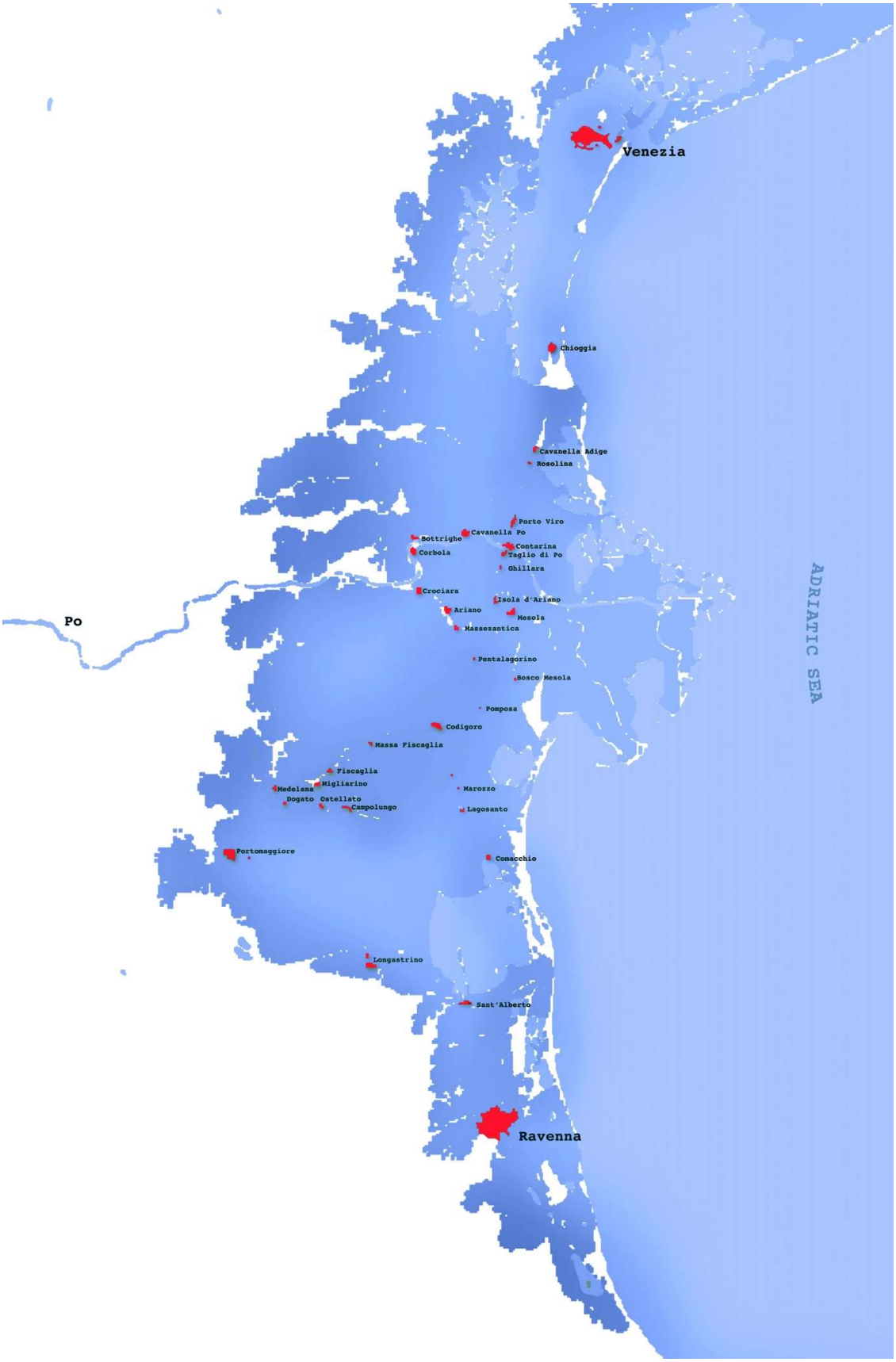

Figure 1. Scenario of the Po delta to 2050

We see then that from an experimental design perspective the peripheral territories such as that of the Po Delta acquire a strong interest, reflecting the needs and the starting conformation in which to probe new design visions. We need to work on the metamorphosis of the forms of living to create evocative landscapes and visions where territorial issues become an aesthetic design force, and marginal territories such as that of the Po Delta are today the best field of action and testing in this regard.

Returning also to analyzing the project of the *unexpected* previously mentioned and evoked precisely on the occasion of the future design, there are several theories relating to Ecological Urbanism that hypothesize open design systems, which move from a vision of a schematized area to the development of punctual systems adaptive: starting with the idea of the *planetary garden* by Gilles Clémènt that states the passage from the figure of the landscape architect to that of the gardener and sees time as a fundamental part of the project , passing through Andrea Branzi's *weak metropolis,* a hybrid territory that adapts to the seasons and time, allowing continuous solutions of flexibility in an integrated territory without specializations, or more the *structured ecologies* of Chris Reed and Nina Marie Lister, which imitate nature in order to insert the project in its dynamics. But most of all, a new relation with water must be integrated in the design process.

During the *Thinking days* of the second Pisa Architecture Biennale, Ico Migliore and Didier Faustino introduce the theme of metamorphosis as the need to design new living sequences, to build scenarios that we will then inhabit. Everything must transform and metamorphose itself, starting from the existing to make it evolve, transforming the very role of urban planning from a control tool to a vision of the future. From their dialogue emerges the theme of the imagination, of the scenario as a necessary design technique.

Citing what was described by Marteen van der Vorde, director of the Dutch West8 studio, it is important to create time for the water, to allow it to swell and then return to the sea. Time and cyclicality are therefore the constants of these projects, probing the speed and adaptation of the element, in the variations of the geomorphological behavior.

According to Vincent Perreira, of the AAVP studio, one no longer builds a city, a building, but an architectural landscape with respect to which human emotion and sentiment must be at the fore. Designing with water refers to dimension of architecture as an element within the landscape, which it forms and with which it communicates. Precisely this characteristic makes this action closely linked to the processes of morphological change to which the news bears witness through floods, floods or tsunamis. A dialogue with the catastrophic event which, however, must become poetic in order to define new landscapes.

Returning to a closer analysis of the centers of the Po Delta in the scenario of 2050, we can see how the morphological structure defined by centuries of cohabitation with water is a resistant structure on which these theories can be perfectly tested. This area was in fact defined in Roman times as the *Padusa* area, a large marshy area, submerged for tens of kilometers from the current state, which the change in water level and the reclamation carried out by man have subtracted from the water in the time. In a flooded future, the structure that guided the human settlement

resists and is emerging. Certainly the centers will not be able to continue to be lived without adaptation strategies, but the possible evolutions must already be defined today. The project must therefore deal with this scenario, taking up the history of this area and continuing its development linked to water.

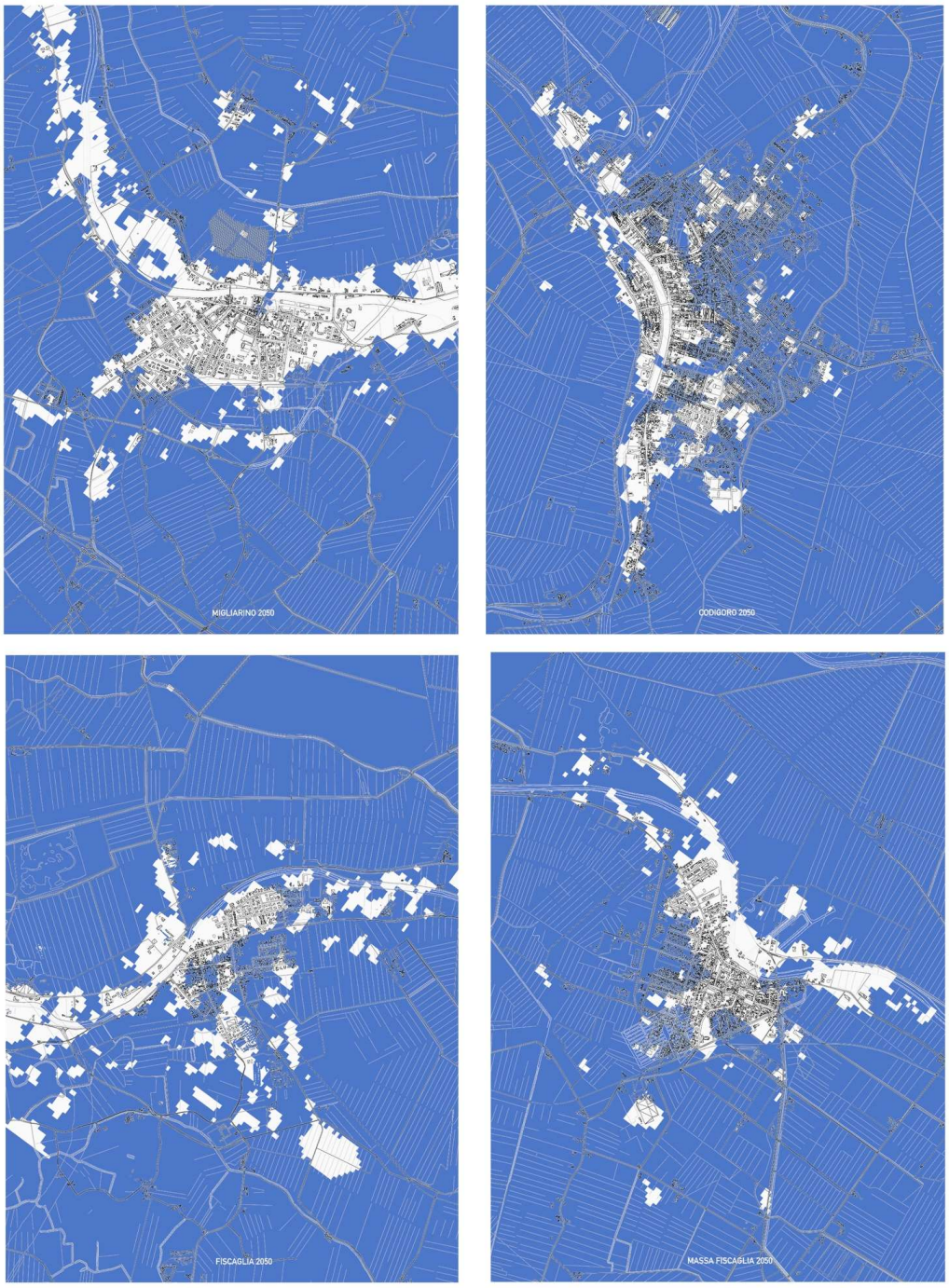

Figure 2. Migliarino, Codigoro, Fiscaglia e Massa Fiscaglia 2050 scenario

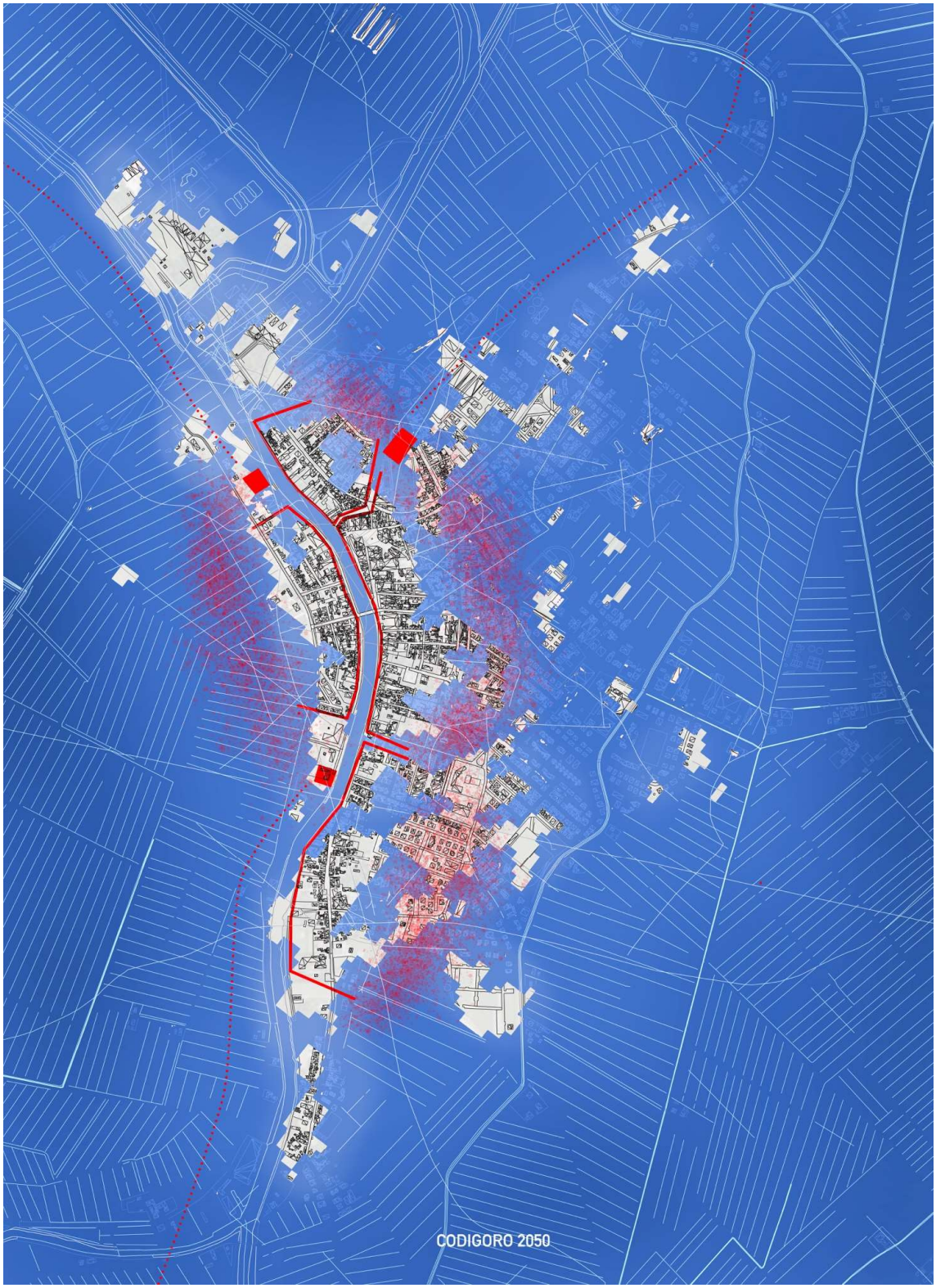

Figure 3. Design intervention scheme on Codigoro 2050: resilient waterfronts, green protection belt, new infrastructures, new blue landscape.

VARIATION ELEMENTS OF WATER LANDSCAPE: ABACUS AND SCENARIO PROJECTIONS.

In order to intervene in the definition of this new landscape, an attempt was made to understand what the compositional elements of these water landscapes were, in order to be able to probe their evolutionary, resilience and adaptation developments relating to the scenario of sea level rise. The research therefore focuses on identifying which *grafts*, which mutations and which landscapes can be deployed for the future of marginal territories. Everything resides in the relationship between water and design, between history and evolution.

Analyzing the production related to the relationship projects between architecture and water, it can be seen how difficult it is to find a systematic analysis. In fact, there are numerous publications that talk about sectoral aspects, such as water houses, floating architecture or urban waterfronts. However, there is no overall analysis that can support the development of a system architecture for a water territory. A notable text to highlight is that of Giuseppe Anzani "*Water Places. Notes for an archeotypology of space*"(Anzani, 1999), where the author provides an analysis of the space of water from different points of view by combining a study of the subject between myth, culture, technique, necessity of life and developments of the imaginary in architecture Contemporary. Starting from this and from the cataloging and research of the major projects published to date, it was considered necessary to identify and outline the different areas and categories in which the water project identifies itself, defining an abacus of design cases that can help define a common syntax at the basis of planning, dialogue and communication and the study of possible future evolutions.

The result of this first investigation is identified in a subdivision of the relationships between water and design by thematic and compositional areas: territorial systems, compositional elements, perceptive elements and terrestrial textures of gardens. For each of these areas, the main elements have been identified and shown in graphical schemes to analyze their intrinsic characteristics. In the following table they are listed as follows:

Thematic area	Elements of belonging
Territorial systems	Ridge, valley floor, headland, perpendicular plain, parallel plain, coast, isthmus, sea.
Compositional elements	Float, stilt house, dock, overhang, edge, hangar, spaced, underwater, lighthouse, pier, canal, reservoir, bridge, moat, dam, dock, waterfront
Perceptual relationships	Reflection, evaporation, underwater estrangement, estrangement under water, noise, color, temperature, ice, variation
Terrestrial textures	Meten, kepos, impluvium, Islamic, English, Italian, Versailles, Barragan, Niemeyer, Scarpa, Ishigami

Table 1. Compositional relations between architecture and water

The articulation of the relationship between architecture and water is complex. Of these four areas, those affected by the changes due to sea level rise are the territorial systems of the coast and their compositional elements contained therein. Below is the overall scheme that illustrates all the different components from which to start for an analysis of the design linked to the sea level rise. Each element can be associated with different articulations according to the formal outcomes they can assume, but attributable to a given spatial relationship. For each element, the research produced a specific analysis sheet through which to find those fundamental relationships.

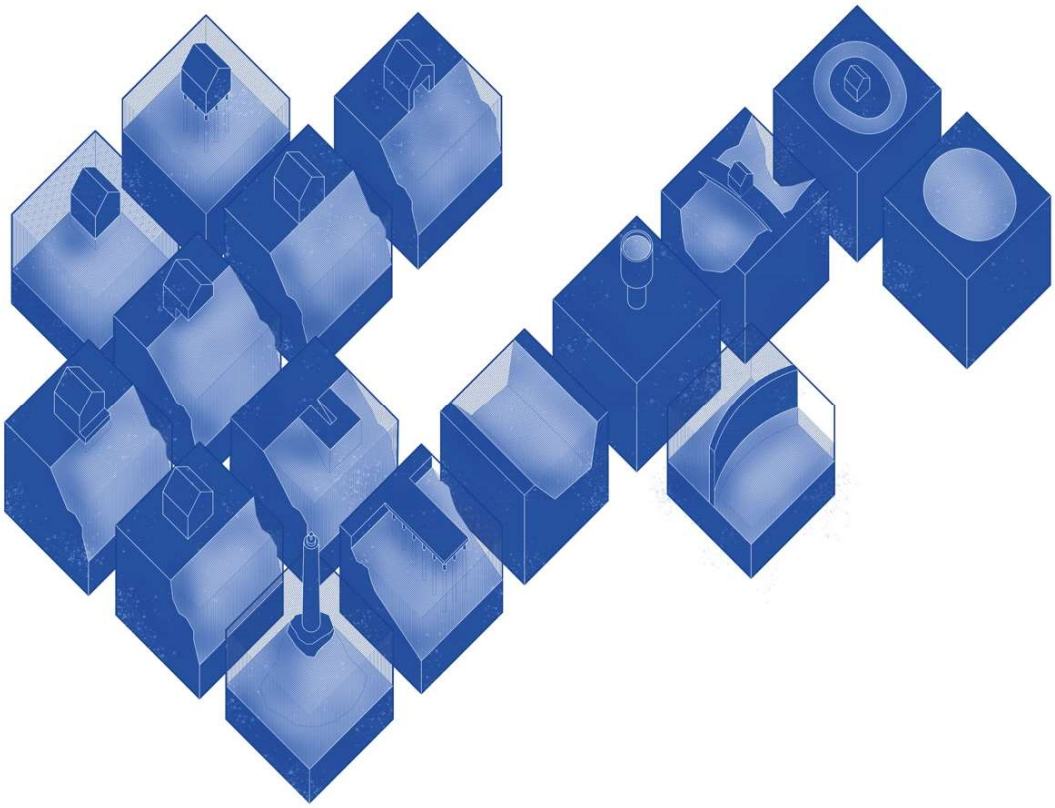

Figure 4. Compositional elements of the water landscape

Starting from the analysis of the individual elements, the scenario of the sea level rise was then projected onto them. Scenario practice is an exploratory methodology for probing future developments. Thanks to the cataloging undertaken, each single element can then be broken down and projected through the identifiable variables. In this research, we focused above all on compositional and relational developments, producing schematic bases through which to define and produce projects of visions and narratives for the future landscape. The scenario table will be tested for the production of design schemes in the Po Delta, which will be taken as a case study for the second phase of the research and on which design visions will be produced to test the results of the first research phase.

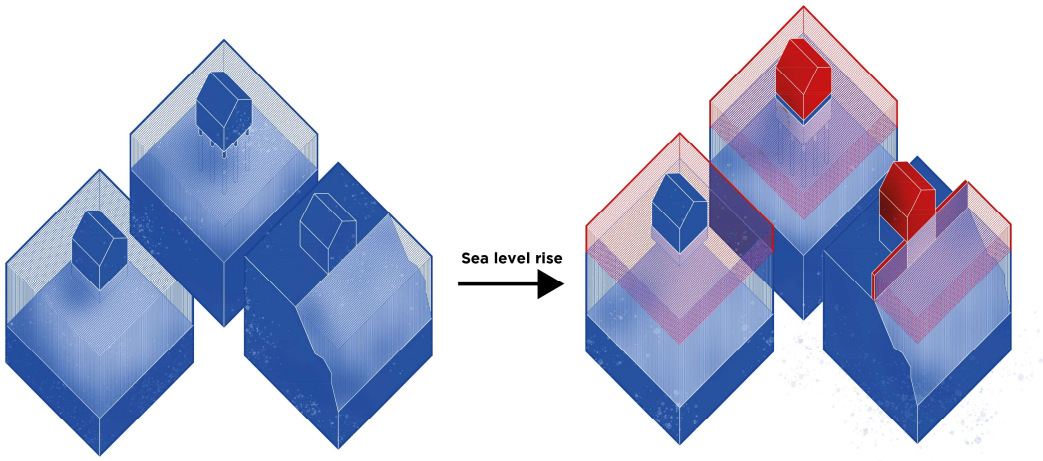

Figure 5. Projection of the sea level rise scenario on the compositional elements

The result is therefore that of a large table of elements that speaks of the territory and its transformation, of the current relationship between architecture and water and of what could come, an orientation abacus for the composition of the future water landscape. The research also wants to highlight how the cultural evolution towards the theme of the unexpected and the peripheral territories can be defined through the architectural composition, which from cultural and design margins find through what has previously been described a new dimension of interest for compositional, aesthetic and adaptation.

REFLECTION ON COVID-19

The indefinite nature of the project refers to the current socio-political structure, of which Covid-19 only amplifies the aspects of a crisis that is now well foreseen. Today we are faced with emergency challenges, posed in that global society of risk that pushes us to change our point of view with respect to our relationship with the planet. As Ulrich Beck argues, the challenge is that of the radical change that society is facing, always producing new and unexpected forms of the social and political, to adapt to the processes of globalization, individualization, gender revolution, underemployment and global risks. Above all thanks to this last aspect, risk becomes the control tool to predict human action, the basis for a cognitive map for the colonization of the future and its reflection on the territory, entering the context of a new land policy. which we all must adhere to. The climate crisis, the concept of anthropocene, the economic crisis as well as the pandemic we are experiencing make us confront in a more or less evident way with a future different from current living standards, to which we will have to adapt. It is increasingly necessary to place ourselves in a glocal perspective, in which we are aware that the risks generated on a global level know no boundaries and are reflected in a diversified, but traceable way, at a local level, requiring answers that refer to the planetary and circumstantial level simultaneously. The lockdown due to the spread of the pandemic did not particularly hinder the process of developing the thesis, but rather it strengthened its basic principles. The conviction that the global can now be anywhere thanks to new technologies has been confirmed, while at the same time the need for a high local environment standard has been rediscovered, far from urban life that often borders on enclosed spaces, different from those of the peripheral areas.

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REFERENCES

Anzani, G. Luoghi d'Acqua. Appunti per un'archetipologia dello spazio. (Electa, 1999)

Berselli, S. Il segreto di Mosè. Rapporti e forme tra architettura e acqua. *Espazium* (13-06-2019)

Femia, A. Fare il punto. Blue is lifeblood. *Percorsi in ceramica* (41.2020 edizione speciale)

Le giornate del progetto. *Percorsi in ceramica* (41.2020 edizione speciale)

Le giornate del pensiero *Percorsi in ceramica* (41.2020 edizione speciale)

Arpa, J. & Ovid, H. Water risks as opportunity. *Domus* 126–135 (2019).

Beck, U. World Risk Society. (Asterios, 2001).

Branzi, A. For a Post-Environmentalism: Seven Suggestions for a New Athens Charter. in *Ecological Urbanism* 110–111 (Lars Muller Publisher, 2010).

Clément, G. *Giardini, paesaggio, genio naturale*. (Quodlibet, 2013).

Ecological Urbanism. (Lars Muller Publisher).

Maas, W. Editorial. *Domus* (2019).

Maas, W. Water, please! *Domus* **1032**, 124–125 (2019).

Projective Ecologies. (ACTAR, 2014).

Reed, C. The Agency of Ecology. in *Ecological Urbanism* (eds. Mostafavi, M. & Doherty, G.) 338–343 (Lars Muller Publisher, 2016).

Rudofsky,B. Architecture without Architects. (New York, 1964)

Menis, A. & Pilia, E. J. Lezioni dalla fine del Mondo. Strategie urbane di sopravvivenza agli zombie ed alla crisi climatica. (Deleyva, 2014)

Ghosn, R. & Jazairy, E. H. Geostories. Another Architecture for the Environment. (Actar, 2019).

Maas, W. & Madrazo, F. City Shock. Planning the unexpected. (nai10 publisher, 2012)

Fabian, L. & Viganò, P. Extreme city. Climate change and the transformation of the waterscape. (Università IUAV di Venezia, 2010)

Groeskamp, S. The Northern European Enclosure Dam for when climate change mitigation fails. *BAMS* (07.2020)

Olthuis, K. Float! Building on water to Combat Urban Congestion and Climate Change. (Frame Pub, 2010)

Hermann, E. & Kempf, W. Climate change and the imagining of Migration: Emergind Discourses on Kiribati's Land Purchase in Fiji. *The contemporary Pacific* (08.2017)

Becklumb, P. Climate Change and Forced Migration: Canada's Role. *Library of Paliament*

(01.02.2013)

Koolhaas, R. & AMO. Countryside a report. (Taschen, 2020)

Koolhaas, R. Ignored Realm. in Countryside a report pp. 2-3, (Taschen, 2020)

Therrien, T. C. Along for the ride. in Countryside a report pp. 12-17 (Taschen, 2020)

Ovink, H. Forward. in Adaptive strategies for Water Heritage. Past, present, future. (SpringerOpen, 2020)

Hein, C. Introduction. in Adaptive strategies for Water Heritage. Past, present, future. (SpringerOpen, 2020)

Meyer, H. Vulnerability and Adaptation. in Adaptive strategies for Water Heritage. Past, present, future. (SpringerOpen, 2020)

Zucchi, C. Innesti/grafting. Il nuovo come metamorfosi. (Marsilio, 2014)

Tornieri, S. Interni al margine. *Officina n.30* (2020)

Orlandi, P. & Tozzi Fontana, M. Indagini sul Po. (Cluesb, 2008)

Frizzia, A. Memorie per la storia di Ferrara. (Abram Servadio Editore, 1848)

Andraghetti, G. F. Acquae condunt urbes. (Media News, 2007)

Climat Centraal website, coastal risk screening tool : https://coastal.climatecentral.org/map/12/12.0528/44.8018/?theme=sea_level_rise&map_type=coastal_dem_comparison&contiguous=true&elevation_model=best_available&forecast_year=2050&pathway=rcp45&percentile=p50&return_level=return_level_1&slr_model=kopp_2014

Diedrich, L. Landscape metropolis. Park politics. (TUDelft Open, 2019)