INTERNATIONAL DOCTORATE in ARCHITECTURE AND URBAN PLANNING

Cycle XXIX

IDAUP Coordinator Prof. Roberto Di Giulio

Thesis Title

SIZING LANDSCAPES
A Scenario-Based Approach Addressing Landscape Changes
due to Infrastructure Developments, Learning from Touristic Contexts.

Curriculum Urban Planning / Landscape Architecture (SSD ICAR/15)

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Abstract

This thesis investigates the opportunities and challenges of using a scenario-based approach, both as a negotiation and a performative format, for addressing landscape transformations in highly-complex and unstable contexts, where infrastructural works are needed to face environmental and socio-economic evolutions. By reporting the different steps which have brought to the consolidation of an operative model in collaboration with infrastructure developers, the thesis provides a framework for embedding alternative landscape scenarios into the decision making process since its very beginning. In fact, as stakeholders and developers need to rely on new tools for better communicating and imaging the prospective landscape their interventions will produce, researchers and professionals in the fields of landscape planning and architecture have to find new ways to assist them in building strategies which could adapt to potential different future scenarios.

At first, this work presents a selection of pilot experiences carried out within two exemplar and challenging contexts, chosen for their being pressured by extremely variable dynamics: riverscapes and touristic areas. The aim of these projects and researches was to understand how data and forecasts provided to infrastructural developers through quantitative and analytical models could effectively be converted into landscape dimensions, and so processed into exploratory scenarios.

Thereafter, by reviewing the T.H.ER.E. project experience, the thesis reports a first empirical attempt of sizing of a complex multipurpose infrastructure in touristic territories. In response to the issues raised by that experience and reworking other disciplines' workflows, an operative model based on the development of alternative landscape scenarios is postulated: the 'Sizing Landscapes Model'. A specific early-implementation of the model, concerning the infrastructural systems and contexts which a land reclamation authority has to manage, is then reported and analysed in order to test the instrument and its workflow, as well as its potential effects on strategic planning and the developer decision making.

Following a 'research-by-design' methodology, the research attempts to demonstrate the convenience of overturning the attitude towards landscape in the common process of designing and planning infrastructures. A scenario-based approach should promote a more prospective outlook allowing to encompass uncertainties, risks and strategic visions into the evolving boundaries of future landscapes.

Acknowledgements

The work presented here would not have been possible without the help, guidance and support provided by the many individuals I have had the pleasure of getting acquainted with over the course of the thesis. I would like to take this opportunity to thank them and to express my deepest gratitude for all that they have done. Firstly to my colleges in Italy and Albania, to the people at Polis University of Tirana. I would like to thank, in particular, the staff of the various companies and institutions involved in the research - such as Sis Spa, RomagnaAcque, RivieraAcque, Consorzio di Bonifica della Romagna Occidentale (CBRO), the Municipalities of Riccione, Cattolica, Gabicce Mare - for their assistance and cooperation during the course of the work. I would also like to extend my gratitude to the students and professors who have worked at the 'Final Laboratory on Landscape and Infrastructure Design' at the Architectural Department of the University of Ferrara for their assistance and guidance throughout various stages of the research. In addition, I would further like to acknowledge the people I have met while doing the field work, this includes the processionals and academics I had the chance to interview and share opinions with in Spain, France, Holland and Belgium.

Gianni Lobosco / January 2017

Publications

Portions of the thesis are derived from previously published or being-published works and master thesis dissertations of which I have been supervisor or co-supervisor during the last few years. More prominently, the pilot experiences reported in Chapter 2 are extended from previously presented articles, chapters in books and conference proceedings written during this doctoral research period at the University of Ferrara. Chapter 3, instead, reports and widens the provisional outcomes of the so titled 'HyperNatural Platform', an on-going research program in which I am involved as member of Sealine (Research Centre of the Architecture Department, UniFe), coordinated by Professor Luca Emanueli, founded and joined by institutions, companies and authorities operating on the field of infrastructures at regional and national level.

Contributions

Emanueli, L. and Lobosco, G. (2016). hyperNatural Vlora. In: B. Aliaj and L. Rossi, ed., *When a river flows*, 1st ed. Tirana: Botime Pegi, to be published.

Emanueli, L. and Lobosco, G. (2016). Disclosing Maritime Landscapes. In: *Enhancing sustainable tourism in Adriatic-Ionian region through co-creation. The role of universities and public-private partnerships.* Macerata: to be published.

Emanueli, L. and Lobosco, G. (2016). Tourism-Atlas: strategie di sviluppo e gestione delle trasformazioni indotte dal turismo in destinazioni consolidate ed emergenti. *Studi Costieri,* 23, pp. to be published.

Emanueli, L., Lobosco, G., Stefani, M. and Ferrarini, L. (2016). Leaving the Delta: a Selective Retreat Strategy for the Po River Lagoon system in Italy. In: *ICAADE, first International Conference on Amphibious Architecture, Design & Engineering.* Bangkok: to be published.

Lang, T. and Lobosco, G. (2016). Slow road to Butrinti. Time-based reflections for an emerging touristic territory. In: B. Aliaj and L. Rossi, ed., Albanian Riviera. *An alternative model of Progress and Development for a Next Generation Albania,* 1st ed. Tirana: Botime Pegi, pp. 140-151.

Emanueli, L. and Lobosco, G. (2016). hyperNatural Vlora. In: B. Aliaj and L. Rossi, ed., Albanian Riviera. *An alternative model of Progress and Development for a Next Generation Albania,* 1st ed.

Tirana: Botime Pegi, pp. 40-43.

Emanueli, L. and Lobosco, G. (2015). Infrastrutture e turismo: nuove relazioni e strategie di riconversione. In: *Atti della XVIII Conferenza Nazionale SIU. Italia '45-'45. Radici, Condizioni, Prospettive.* Venezia: Planum Publisher, pp. 1572-1579.

Master Thesis

Andrea Bit (2016). *Aquastructura. Una diversa infrastruttura idrica per il deserto di Atacama.* (Unpublished master's thesis). University of Ferrara, Italy. [Supervisors: Luca Emanueli, Gianni Lobosco. Co-supervisors: Arturo Scheidegger, Ignacio Garcia Partarrieu]

Silvia Corgiolu (2016). *Oltre mare. Verso l'interno della Sardegna, risorse e ospitalità del turismo alternativo alla costa* (Unpublished master's thesis). University of Ferrara, Italy. [Supervisors: Luca Emanueli, Gianni Lobosco]

Lucia Ferrarini (2015). *Paesaggi anfibi: una strategia di ritiro selettivo per l'area del Delta del Po.* (Unpublished master's thesis). University of Ferrara, Italy. [Supervisors: Luca Emanueli, Marco Stefani. Co-supervisors: Gianni Lobosco, Massimo Tondello]

Alessio Ghiselli, Virginia Melandri (2015). *Offshore life: alternative ways to decommissioning. Proposte per la riqualificazione delle piattaforme offshore in Adriatico.* (Unpublished master's thesis). University of Ferrara, Italy. [Supervisors: Luca Emanueli, Giovanna Bucci. Co-supervisor: Gianni Lobosco]

Thesis Structure

The thesis is organized into 4 different chapters.

Chapter 1 introduces the main drivers behind the research as well as outlines the underlying theoretical framework and the operative background the thesis builds itself upon. Detailing the methodological approach, the thesis takes in attempting to uncover the potentials of a scenario-based model applied to the infrastructural landscape planning and how it can affect and assist decision making procedures.

Chapter 2 reports the results of relevant pilot projects intentionally developed in highly dynamic contexts, such as riverscapes and touristic territories, with the aim of converting quantitative data and forecasts, pertaining to the technical approaches on infrastructure planning, into landscape dimensions in order to be processed for shaping new exploratory scenarios. To this purpose, river systems have been chosen for their inner morphological variability, moreover polarized by climate effects and anthropic interventions; while touristic areas for their being pressured by unstable usage flows and cycles so deeply affected by global uncertain trends.

Chapter 3 focuses on the general model set up and on its preliminary implementations. The project T.h.er.e. is here presented and reviewed, at the beginning, as a first empirical attempt of applying the scenario approach to the sizing of a complex multipurpose infrastructure. Also in response to the issues raised by that experience, and reworking other disciplines' workflows, a specific early-implementation of the model, concerning the infrastructural systems and contexts which a land reclamation authority has to manage, is then reported and analysed in order to test the instrument and its workflow, as well as its potential effects on strategic planning and the developer decision making.

Chapter 4 concludes the thesis by discussing the nuances of attempting to utilise such model in the infrastructure planning process as well as the outlook of the work in general towards feasible and desirable follow-ups.

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Chapter 1 / Introduction

This thesis investigates the opportunities and challenges of using a scenario-based approach, both as a negotiation and a performative format, for addressing landscape transformations in highly-complex and unstable contexts, where infrastructural works are needed to face environmental and socio-economic evolutions. By reporting the different steps which have brought to the consolidation of an operative model - the 'Sizing Landscapes Model' - in collaboration with infrastructure developers, the thesis provides a framework for embedding alternative landscape scenarios into the decision making process since its very beginning. In fact, as stakeholders and developers need to rely on new tools for better communicating and imaging the prospective landscape their interventions will produce, researchers and professionals in the fields of landscape planning and architecture have to find new ways to assist them in building strategies which could adapt to potential different future scenarios.

At first, this work presents a selection of pilot experiences carried out, during the last few years, within two exemplar and challenging contexts, chosen for their being pressured by extremely variable dynamics: riverscapes and touristic areas. The aim of these projects and researches was to understand how data and forecasts provided to infrastructural developers through quantitative and analytical models could effectively be converted into landscape dimensions, and so processed into exploratory scenarios. By doing so, it became clear that the accuracy of mathematical forecasts, even though often consistent in the short-term prediction, decreases exponentially as the time horizon increases; their capacity for guiding future changes is correspondingly reduced for long-term planning, especially within unstable and dynamic contexts where the number of data and uncertain variables is higher.

In order to fill this gap, the thesis has referred to the 'scenario thinking' as an effective tool for testing potential strategies against unknown and unpredictable futures. Successfully used in the business world, such procedure has been adapted and used for building a conceptual model: a workflow aimed at reducing uncertainty by creating and identifying possible alternative paths of landscape development whereby a limited number of possibilities are created, and systematically compared against one another. A model grounded on the main assumption that, by running multiple narratives within alternative frameworks of forthcoming social, political, economic, and environmental conditions,

Figure 1.1: A -16 m shaded relief image of the multibeam bathymetry data collected during a 1998 multibeam sonar survey of Southern California revealing new submerged landscapes generated by offshore sand-mining operations implemented for beach nourishments. (Source: USGS Coastal and Marine Geology Program)

unexpected outcomes could be anticipated, and complex feedback loops discovered.

Following the same 'research-by-design' methodology, fed back by a constant discussion with stakeholders and infrastructure developers, this model has been furthermore implemented and tested. A specific early-implementation of the model, concerning the infrastructural systems and contexts which a land reclamation authority has to manage, is reported and analysed in order to test the instrument and its workflow, as well as its potential effects on strategic planning and the developer decision making.

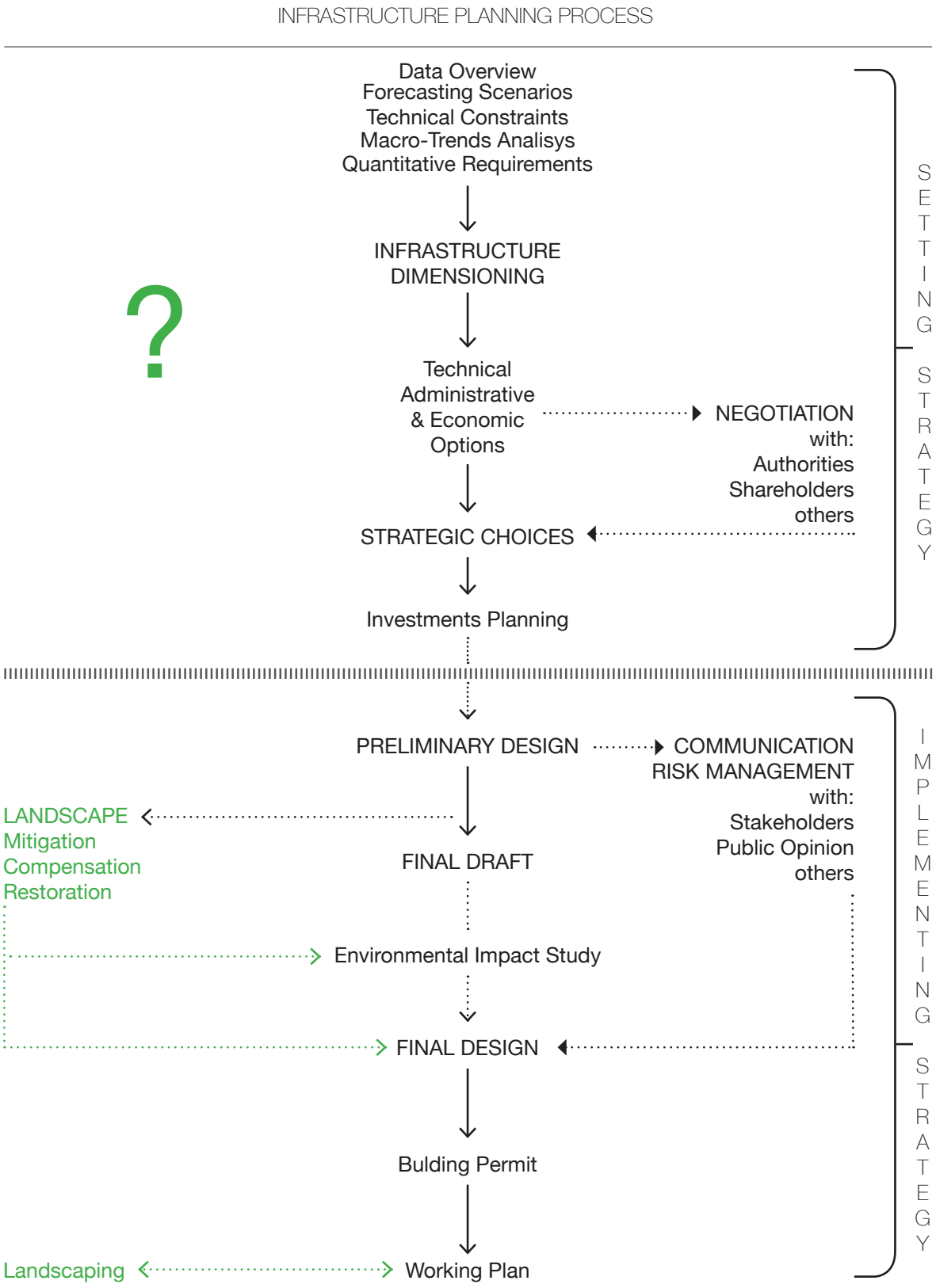
The thesis went so far as to outline four alternative landscape scenarios sizing their temporal and spatial field of action. As last step, according to the developed workflow and with the task of affecting also mid-term choices, such raw scenarios have been afterwards merged through different techniques so to be transferred to decision makers as a clear and synthetic landscape format addressing more adaptable, cost effective and reversible strategies.

In such perspective, the research follow-up will be dedicated to further questioning the model about at least two main topics: first of all, by checking the developers' response, its efficiency in setting up the infrastructure planning starting from landscape opportunities, rather than from its constrains; then, by collaborating with other disciplinary sectors, investigating the model aptitude for being cross-referenced with quantitative analysis and thus opened up to updating and validation.

Well aware of the theoretical and practical advances made by the landscape discipline on the infrastructure topic, the thesis' main contribution to this field lies in the formulation and in its consequent reception by developers, of an operative model capable of placing landscape issues at the top of decision making strategic reasoning. In fact, since major infrastructural works often result in very long-lead times and complex negotiations with local stakeholders, the advantage of relying on a tool providing physical representation of contextual outcomes may allow to better manage communication risks, as well as to set up more refined programs of ecosystem capital balancing.

Although this research work represents only a first approximation in all these directions, it attempts to demonstrate the convenience of overturning the attitude towards landscape in the common process of designing and planning infrastructures. A scenario-based approach -by leaving aside certain backward mindsets stuck in concepts like compensation, impact assessment, re-naturalization or restoration- should promote a more prospective outlook on infrastructural development allowing to encompass unce\\rtainties, risks and strategic visions into the evolving boundaries of future landscapes.

Figure 1.2: The flow chart exemplifies the general infrastructure planning process in the Italian context. For what concerns the developer's side, the landscape architecture advising (in green) is just limited to the implementation phase.



1.1 Operative Background & Motivations

The thesis starts from the operative background concerning the role of landscape architecture and planning within the process of infrastructure strategic developments in Italy and, by proposing a model affecting decision-making procedures, aims at improving the real impact of our disciplines on the topic.

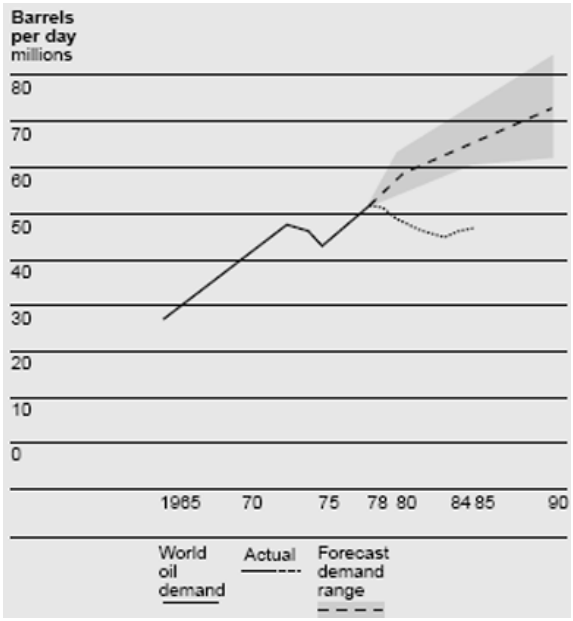
At the early stage of infrastructural planning, in fact, economic trends, forecasts and quantitative requirements normally drive the developers to consider some options above the others, while physical circumstances are basically analysed with relation to operative needs, threats and constrains. Even though perfectly integrated in the approval procedures and designing approaches, the assessment of landscape transformations and environmental impacts has played anyway a secondary role in addressing alternative scenarios and in affecting developers' strategic choices since the very beginning of the planning process.

This does not mean that the interest in landscape and in its consequences upon infrastructures development has not been increasing; as a matter of fact, during the last few decades, and especially out of Italy, research outcomes in these fields have contributed to set new collaboration modes between decision makers, landscape architects and a range of other specific expertises. But such achievement has only occasionally questioned the fact that landscape modifications are collateral implications of other well-established, provably and typical dimensions characterizing any sort of infrastructure.

Probably, such attitude at considering the landscape just under the filter of impacts grounds on two main believes: the first concerns a certain sense of guilt towards the Nature seen as an ideal and fixed entity that is going to be violated; the second, more practical, deals with the reassuring effect of data, numbers and statistics that engineering as well as other scientific-based disciplines are able to provide the developers with describing the infrastructure as a congruent body which can range inside a predictable array of circumstances. According to this mindset, environmental inputs are taken into account in so far as they are measurable and quantitative; on the contrary, since they cannot be processed, they will be analysed as derivate factors, indeed in terms of impacts.

So, it is actually during this following stages, when the basic strategic choices haven already been taken and the infrastructure layout has been dimensioned, that the landscape architecture contribu-

Figure 1.3: 'The Track Record of Macroeconomic Forecasts' analysing the track record of the best-known economic forecasters since 1965, shows how accuracy decreases exponentially as the forecasts' time horizon increases. (Source: McNees and Ries, 1983: 5)

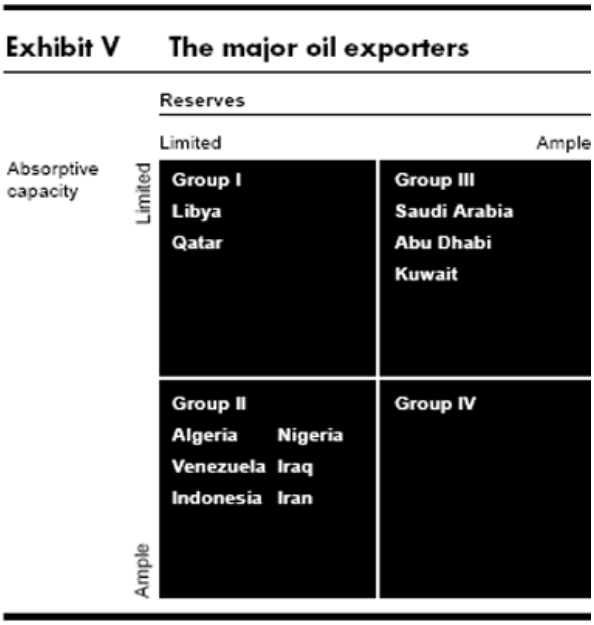


tion is normally required in order to mitigate side-effects, visual impacts and to restore some kind of 'natural' appearances. Landscape designers are mostly called to 'repair' or 'retrofit' the infrastructure project with additional systems or devices that have to fit in superior constrains and given standards. Even in those cases where landscape guidelines for the environmental integration of infrastructures have been set within regional or national plans and legislation the main issue seems to linger on the landscape preservation rather than its prospective visualization.

Against this partial but quite accurate picture of an actual and widespread situation, it has to be said that policy makers, territorial managing authorities and above all infrastructure developers and owners are increasingly realizing the strong limitations lying in such approach. Since infrastructural works require, according to their long life span, to be dimensioned in relation to complex trends of external variability, their adaption and resilience cannot only be attained through the adjustment of inner parameters and ratios. According to some studies (Hughes, Chinowsky and Strzepek, 2010), just climate change could add 10% to 20% to infrastructure costs by 2030 and 10% to 12% by 2080, under different projections and taking design adaptations into account. The same literature highlighting the impact of extreme events suggests that an effective response to these issues needs to be based on a location-specific approach and warns against standard solutions.

A further element weakening the developers' confidence in quantitative responses is uncertainty. Contemporary landscapes have been experiencing rapid and intense transformation due to techno-

Figure 1.4: One of the 2x2 matrixes employed in 1972 by the Dutch/Shell to analyze future scenarios about major oil producers by 1985. (Source: Wack, 1985: 82)



logical and cultural change, expanding globalization and new economic geographies. The dynamics of change and their environmental impacts are difficult for mapping, monitoring and coordination. The actors involved in infrastructural development need anyway some tools allowing them to anticipate future transformations and assess resources availability in order to be effectively prepared for dealing with complexity. As literature points out (Madanat, 1993; Feinberg and Genethliou, 2005; Flyvbjerg, 2005), mathematical forecasting has been long time the preferred method attempting to predict the future, in part due to its scientific credibility. However, although often effective in the short term, the accuracy of mathematical forecasts decreases exponentially as the time horizon - and the number of uncertain variables - increases. Their capacity for illuminating future changes is correspondingly reduced for long term planning and thus for infrastructure, especially today.

In order to fill this gap, the use of the 'scenario thinking' process has been emerging in the last few years as an effective tool for testing potential strategies against unknown and unpredictable futures. Successfully used in the business world, such approach is returning to infrastructural planning which is actually the field where it was consistently tested as a method for the first time, during the 1970s, at Royal Dutch/Shell. The advantages of scenario planning are reflected in the reduction of uncertainty by creating and identifying possible alternative paths of future infrastructures development. By running multiple narratives within alternative models of next social, political, economic, and environmental conditions, unexpected outcomes could be anticipated and complex feedback loops

discovered.

Deeply oriented at assisting the decision making process in business environment, scenario planning is increasingly gaining attention at institutional level for its effectiveness in understanding the factors that shape territorial changes and new ecologies. In the US, for example, the development and analysis of alternatives prior to the approval and commencement of projects is a requirement regulated by the National Environmental Protection Act (US EPA, 2015). Similarly, in the EU zone, the Environmental Impact Assessment Directive asks the developer to evaluate potential alternatives and deduce the least invasive solution through a systematic approach (European Commission, 2015). Even though such normative orientations persist somehow in a conservative vision of the landscape evolution, they also open up to a change in thinking and acting about the future of infrastructural works, shifting from the traditional planning to a more imaginative and innovative approach.

Within this framework the role of landscape architect and planners can actually be reconsidered at the light of a decision making process that needs to physically visualize different alternative future scenarios (Steinitz et al., 2003) whereby a limited number of possibilities are created and systematically compared against one another (Deming, 2011). In fact, an alternative landscape futures approach (Steiner, 2000) or more simply put, the development and evaluation of prospective landscape scenarios, should extends beyond data analysis and impact assessments to encompass the systemic relationships between the environment and the infrastructure.

The main hypothesis of the present work is that such ‘prospective landscape scenarios’ can address the infrastructure planning since its decision making process toward more adaptable, cost effective, reversible and resilient strategies. In order to attain this objectives, the proposed approach originates an operative model (i.e. the ‘Sizing Landscapes Model’) targeting infrastructure development companies. Such instrument should be able to design, visualize and compare the physical implications of alternative future scenarios processed upon the inputs and forecasts provided by the representative in the raw form of data and technical alternatives. In other words, it should be used as a parallel or just subsequent tool of other scenario-based analysis carried on by diverse other sectorial expertises: a sort of Landscape Format beside, and for, Scenario Planning. A kind of synthesis and conversion procedure aimed at integrating contextual issues and higher-level uncertainty into more comprehensive, clear and readable scenarios able to be successively compared, tested and updated according to different techniques.

1.2 Aims & Objectives

The work focuses on the relationships between infrastructure - in its variety - and landscape, on the mutual effects and potential disciplinary developments aiming at structurally linking the two fields. The starting assumption is that, especially in Italy, landscape architecture and landscape planning have not been paying enough care to the decision-making process leading infrastructure developers to choose for strategic directions. For this reason, the thesis proposes a potential model grounding on the scenario thinking approach applied to infrastructural interventions and their impact on landscape. Such work instrument should be applied since the very beginning of strategic reasoning, along with other specialistic contributions which can be also integrated.

Thus, even though the main output of this thesis is considered of being the 'Sizing Landscapes Model', other sub-outcomes can be considered, such as highlighting how dynamic contexts could represent an extreme field of experimentation of the scenario thinking techniques, especially due to their complexity and overall instability. With this aim, the thesis investigates two main kind of frameworks. The fist one is featured the most by morphological instabilities: riverscapes. The second kind of environment that this work addresses are the ones most characterized and affected by tourism and its dynamics. In particular, the thesis reports applicative case-studies located on the Italian and the Albanian Rivieras, highlighting the potentialities related to the transposition of landscape design experiences from a touristically mature destination to an emerging one. Such applicative case-studies have been useful to understand the infrastructural dimensions subtending the building of future landscape development scenarios.

A first application of scenario thinking techniques has been developed and tested in the THERE project with the main objective of identifying a planning procedure capable of sizing landscape starting from forecasts and data. The new knowledge deriving from this experience has been grounding on the Model which has been further set up on the basis of existing procedures applied in other disciplinary fields.

The model implementation experience, concerning a land reclamation authority, aims at demonstrating in the real world the potentials related to a scenario-based approach when applied to an infrastructure developers.

Figure 1.5: This picture. shot by the photographer Massimo Vitali, shows the crowded beach of Rosignano, near Livorno (Italy), whose withe sand and transparent waters are mostly due to the calcareous discharges produced by the near Solvay's chemical plants. (Source: www.massimovitali.com)

1.3 Theoretical Background

The thesis grounds its work on two main topics composing the theoretical background upon which applicative case-studies and the proposal of general scenario-based model have been developed.

The first topic concerns the landscape of touristic areas investigated for their peculiar inclination at emphasizing some dynamics affecting infrastructural networks dimensioning and operation.
Here, exploring the historical ambiguous connection between the mass-tourism phenomenon and infrastructure development has opened new prospects in the interpretation of urban space and landscape evolution.
The second topic regards the origins of 'scenario thinking' approach investigated with the aim of understanding its potential in dealing with highly uncertain and unstable phenomena to address strategic choices.
Mostly applied, at the beginning, within the context of infrastructure business, such methodology has reached a prominent position in urban and territorial planning only in the last decades. Its implementation on the landscape scenario building opens up interesting perspectives especially towards its application on the infrastructure field.
By relating the scientific review of these two topics and by attempting to understand their potential connection with the landscape architecture and planning issues, the research aims at specifying, from its very beginning, the main theoretical framework in which the applicative-case studies have been carried on.
Especially, the riverscape topic and the risk management landscape techniques have been specified in their theoretical roots during the proposals explanation. In fact, we have chosen to recall the specific references concerning the landscape discipline reporting the projects in order to emphasize their direct effects on the design and applicative research process.
Thus, the following paragraphs tackle mostly that part of the research dealing with those other disciplines which have contributed to drive our approach towards the possibility of using alternative scenarios to face the challenge of addressing future landscape transformations affecting the decision-making process of infrastructure developers.

Figure 1.6: Inaugurated in 1924, the Milano-Laghi Highway, born with the explicit purpose of connecting Milano with the touristic destinations of the 'Como Lake' and the 'Maggiore Lake', was probably the first 'by-price' highway in the world. (Source: Touring Club Italia Documentation Centre)

1.3.1 Landscape - Tourism - Infrastructures

Historically, tourism and infrastructure have common roots, but their causal relationship is in constant change: for example in Italy and France the Touring Clubs since the late XIX century strongly contributed to development and tracking of new roads and highways: the tourism led in some ways to the infrastructure. In this sense also Las Vegas is a good example of tourism-oriented-born city and its relationship with the infrastructural component in order to facilitate the consumers experience is well known. Nowadays the perspective is changing: global infrastructures in some ways makes the tourism happen in places that normally have had less propensity to it, just think about the effect of low-cost airlines on some former 'peripheral' cities.

The analysis of significant mass tourism destinations points out a progressive contraction of the public realm in urban landscape due to the proliferation of tourism-oriented facilities and real estate. Increasingly the residents' city drifts away from the tourists' one. In these territories, any kind of infrastructure is conceived to face massive incoming flows; its actual operational period is short, seasonal; it turns out to be 'oversized' for most of its lifetime cycle. Within this differential, it's possible to think back the infrastructure role: its impact on tourism territories as almost the ultimate residual public space.

Obviously working on infrastructure might involve different topics according to the consolidation of the tourism trade context by context. For example in emerging tourist destinations often we face to the problem of mobility and basic supply to manage increasing and dramatic flows of people during short times. The infrastructures we must deal with, here, are basically linked to transportation. On the other end within 'in transition' and 'consolidated' destinations, the challenge is to transform, reuse and think back existing tourism infrastructures, to give them a new role.

As far as Tourism, working at global scale, is able to radically 'shape' entire territories, it can be considered one of the most powerful agents affecting the futures of landscape. Tourism represents probably the first economy worldwide, it has a geopolitical dimension: it's a pervasive phenomena that deals with huge corporations, competition between territories and sometimes political and economical shaking events. In the last decades sociology, geography and economy in particular started to investigate this topic. Urban studies in general have paid less attention to it. Tourism seems to

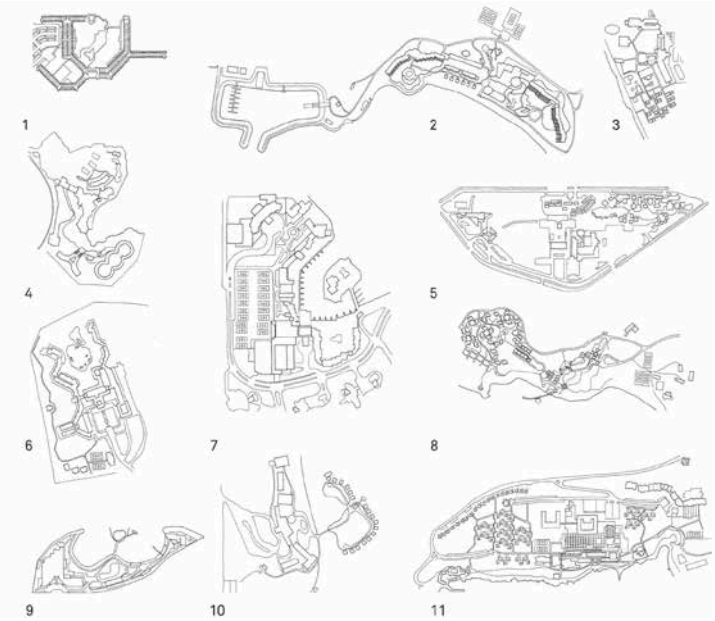
escape the conventional planning processes and governance policies.

By exploring the ambiguous connection between the mass-tourism phenomenon and infrastructure development, this paragraph's general aim is to point out how tourism impacts on territories especially in terms of landscape and urban realm. This impact is currently neglected, especially from the point of view of physical transformations. Studying the state of the art and the researches carried out during the last years, I realized that merging the most significant experiences in this field at international level is a necessity, yet beginning from those scholars who, before others, recognized the role of tourism as an agent capable of modifying both social relations as well as the physical features of the territory.

Since the mid-1970s, the work of American sociologist and anthropologist Dean MacCannell overturns a multitude of trivialized and self-blaming classifications of the 'touristic experience'; in fact, MacCannell (1976) undertakes an in-depth analysis of the relational dynamics characterizing the touristic experience, thus making it the privileged interpretation of contemporaneity. The author also clarifies the forces which usually mould the evolution -and at times also the establishment- of new touristic destinations and attractions. As argued by MacCannell, the tourist acts according to a true necessity of 'authenticity', which is put at stake, however, by his own travels: following such an interpretation, for defending or concealing their identities from the intrusive tourists' gaze -or simply for answering to the tourist's expectations, the local population will tend to hide behind the scenes, thence showing a theatrical version of itself.

Indeed, touristic places by becoming commercial products with the aim of attracting visitors, and in competition with other thousands of destinations, take the risk of resembling at all costs to their own image (Minca, 1996), even if they have to -at the same time- transform themselves for hosting the necessary structures of tourism economy: hotels and other hospitality-related structures, commerce, mobility and information systems, and so forth. This way, such places tend towards a so-defined 'schizophrenic dualism' (Minca and Oakes, 2006) which has often shown, as a result, the production of 'multiple identities' within blurred and increasingly undefined landscapes. Paradoxically, in this way tourism expresses one of the fundamental dimensions of contemporary 'de-territorialisation' processes: the loss of direct relation and contact between the people and their own environment, which is organized around certain apparatus such as the so-called 'environmental bubbles': protective and familiar places in which the tourist can feel at easy, as if he were at home (Cohen, 1972).

Figure 1.7: One of the analysis concerning 'touristic spatial units' proposed in 'Turismo Liquido'. In this case, holiday resorts in different part of the world are compared to highlight typological and dimensional variations (Source: Pié i Ninot and Rosa Jiménez, 2013: 35).



It is on these very spatial and system typologies that architectural research focused at first, in order to understand morphological characters and internal logics, and then to analyse their degree of permeability -both actual and potential- in relation to the urban and landscape environments. In the chapter 'Las piezas mínima' of the renown volume 'Liquid Tourism' (Pié i Ninot and Rosa Jiménez, 2013), many of the elements which have been creating, over time, such 'dystopian' and thematised landscape are reviewed and categorized (*Figure 1.7*): these are the minimum and functional spatial units for the tourism practice in the post-industrial era (i.e. golf courts, resorts, seaside destinations); all those systems rigidly organized by the many operators in the travel and entertaining industry, thus adhering to codified behavioural schemes (for example, summer seaside tourism with its repeated sequence 'hotel-beach').

Also because of the evolution and, to a certain extent, to the tourist's self-representation, we have been witnessing a progressive rejection of package holidays and organized group trips, inevitably associated to a de-personalized and mass-related image, also submitted to market forces. The severe opposition between sightseers and the so-called 'backpackers', as remarked by several scholars, has been much criticized for its intrinsic contradictions. Those same ones which can be found also in the 'romantic gaze' subtending to an experience looking for an authentic and uncontaminated site, whose paradox is that of compromising the very places a tourist 'discovers', thus often acting as a pioneer of other and much less romantic forms of tourism (Urry, 1990, 2006).

There are many reflections on these trends which could be mentioned; for instance, a first consideration could be about the term Tourism itself, and its usage evolution. In fact, this word, first used in the singular form, has soon been employed at plural -Types of Tourism, in order to better highlight the multifaceted composition of the phenomenon. Today, the attention is shifting from Tourism to the Tourist as an independent entity with specific and personal interests, planning one's trips and experiences on his own and in the way he prefers. Within this framework, the Connectivity Index of a destination is becoming more and more important to reach these kind of users, to show them the alternatives offered by a territory to improve its popularity. Such new way of access by the Tourist to a site, also questions the notion of 'identity' related to a destination. It seems more appropriate, in this perspective, to use instead the word 'character'.

A second consideration concerns the seasonal trends of tourism and the fact that many already well developed tourism-oriented territories are now striving for overcoming it. Their mission is to consider the fact that, often times, their whole urban and social system has been developed according to the classic vacation scheme derived from mass-tourism phenomena. One example could be represented by the seaside model which, especially in Italy, has been consolidating over the decades, grounding on a kind of economy mostly tied to personal or family investments which, however, if considered all together have been able to generate actual touristic districts renown at international level, such as the case of the Riviera Romagnola (Dallari, 2007; Savelli, 2001).

Thus, the rigid distinction between touristic and local citizens' settlements -corresponding to the same split between seasonal and all-year services, or the great density and property fragmentation, are only few of the problems slowing down the change. Emerging destinations, such as Albania, can instead programmatically tackle this topic from the very beginning, setting up more resilient development models. The negative consequences of touristic growth are sudden and fast, and they somehow need to be forecasted by planning strategies and, more important, they need to be managed over the time by a clear and flexible regulatory framework.

A third consideration deals with the boundaries in which strategic design can actually be effective in addressing touristic development. In such perspective, the 'landscape dimension' could be fundamental to approach the topic of tourism, especially if the landscape is interpreted with disenchantment: as a change-driver and not as victim of it. In this perspective, despite in the fields of sociological and urban studies such topic has been acquiring a growing importance (Mathieson and Wall 1982;

Figure 1.8: One of the dialogues organized in the framework of the International Symposium 'Tourism XXL' in Barcelona, on 2007, gathering the novelist Michel Houellebecq and the architect Rem Koolhaas. (Source: Gausa, Bianchini and Falcón, 2009: 34-35)

34 EL PAÍS

EL PAÍS / ARTICLE

TOURISM AND ARCHITECTURE, IN THE LIMBO OF THE LEISURE

SPAIN WILL BE A GREAT VACATION GERIATRIC; DUBAI, THE NEW MODEL FOR THE YOUNG PEOPLE. THE WRITER MICHEL HOUELLEBECQ AND THE ARCHITECT REM KOOLHAAS SEE THIS WAY THE TOURIST FUTURE AND DEBATE ON IT IN BARCELONA.

IGNACIO VIDAL-FOLCH. Barcelona, 24/07/2007

Rem Koolhaas, the most important architect nowadays and the novelist Michel Houellebecq, famous for his provocatively amoral theories on tourism and pleasure, held a dialogue in the frame of the I Symposium "Tourism XXL", that is to say, extra-large size, what needs which is considered by many people, the most important industry of the world and by others a paradigm of excess of hedonism in which the tourist lives in the limbo of leisure.

Michel Houellebecq- Ibiza will remain, because Ibiza means party and sex and it will always attract masses; but high quality tourism finds and will find more stimuli in different destinations, like for example, Italy and Croatia. I believe that the only opportunity that Spain has to support this great business of tourism is retired people, who are sensitive to safety conditions. In Spain there is an excellent service of health. It is fundamental for this target. Fantastic hospitals, good doctors. I speak about tourism of foreigners at an advanced age who buy apartments to come and die here.

TURISME I ARQUITECTURA, EN EL LIMBE DE L'OCI

ESPANYA SERÀ UN GRAN GERIÀTRIC VACACIONAL; DUBAI, EL NOU REFERENT PER ALS JOVES. L'ESCRIPTOR MICHEL HOUELLEBECQ I L'ARQUITECTE REM KOOLHAAS VEUEN AIXÍ EL FUTUR TURÍSTIC I DEBATEN SOBRE AQUEST A BARCELONA

Rem Koolhaas, l'arquitecte més influent actualment, i el novel·lista Michel Houellebecq, célebre per les seves tesis provocativament amorals sobre el turisme i el plaer, van mantenir un diàleg en el marc d'un simposi celebrat aquests dies a Barcelona sobre «Turisme XXL», és a dir, talla supergran, que és ta que li cal a aquella que, per a molts, és la indústria més important del món i, per a d'altres, el paradigma de l'excés i l'hedonisme en què el turista viu en el limbe de l'oci.

MICHEL HOUELLEBECQ. Eivissa romandrà, perquè Eivissa és la festa i el sexe, i això sempre atraurà les masses; però el turisme d'alta gamma trobarà més estímuls en escenaris diferents com, per exemple, Itàlia i Croàcia. Crec que l'única oportunitat que té Espanya per mantenir aquest gran negoci del turisme són els jubilats, que són sensibles a les condicions de seguretat. A Espanya hi ha un excel·lent servei sanitari. Això és fonamental per a aquest objectiu. Hospitals fantàstics, bons doctors. Parlo d'un turisme d'estrangers d'edat avançada que compren apartaments per venir a morir aquí. Durant els anys cinquanta, Espanya fou pionera en la indústria del turisme. En aquells anys els vols d'avió no eren accessibles a tothom, de manera que les primeres maneres turístiques venien a Espanya en cotxe. Però com ara els vols en avió són barats, les noves masses es desplaçaran a territoris nous, més llunyans, amb la mateixa facilitat. Penso en Líbia, per exemple, on el clima és més càlid, és millor...

REM KOOLHAAS. En efecte, podem anar a qualsevol lloc del món i així inicia la nova etapa de la globalització, l'última, la «democràcia de l'hedonisme». Però així plantegi la pregunta: democràcia o hedonisme? Potser l'intent d'abraçar el món amb generositat i certa conveniència en un dilema, tema que avui ens trobarem amb el moviment en què hauríem engolat tot l'hedonisme possible del món, i a costa de tot el que tenim fins ara. El que acaba de dir Michel em sembla raonable, una proposta precisa i econòmicament viable en quant a demografia i tendències futures.

35 EL PAÍS

In the fifties, Spain was pioneering in the industry of tourism. In those years, the flights were not accessible to everybody, so that the first tourist masses came to Spain by car.

But as nowadays flights are cheap, new masses will move to new, more distant territories with the same facility. I think, for example, about Liberia, where the climate is warmer, it is better...

Rem Koolhaas- In effect, we can go to any place of the world and this initiates the new stage of the globalization, the last one, the "democracy of the hedonism".

Per què hauríem de considerar depriment la idea del turisme de la gent gran? Per què no pensem que és la primera vegada en la història que persones d'aquesta edat té meravelloses possibilitats de vida?

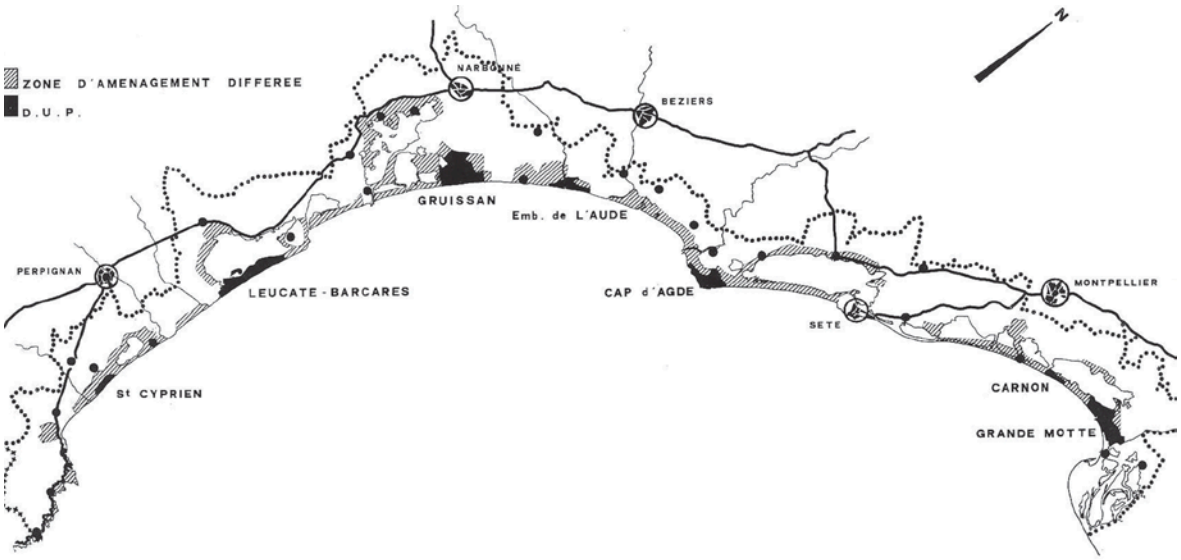
M. H. Efectivament, el fet que l'esperança de vida hagi augmentat és més aviat una bona notícia. L'edat mitjana de la humanitat es mou cap amunt; els fills es queden fins ben avançada la joventut a casa dels seus pares i els vells moren cada vegada més tard, augmenta incessantment la població marítima de turistes de més de seixanta anys. Crec que si el futur del món és els vells, la gent gran, val a dir que Espanya està molt ben situada per a aquest futur i aquesta és una bona notícia per a Espanya.

R. K. Michel, per què esmentes Croàcia com a propera «conta XXL»?

Ryan, 1991; Hall, 1994; Shaw and Williams, 1994), within the architecture and landscape disciplines we are witnessing, yet with some exceptions (Gausa, 2004; Goula, 2007; Goula et al. 2012; Pié Ninot and Vilanova Claret, 2012; Martí Manrique, 2014), to a certain reticence and delay in recognizing the value and potential outcomes of such a conception, especially in investigation and scientific terms. A milestone in this sense have been the two International Symposiums 'Tourism XXL. The European Megalopolis' organized in Barcelona in 2007 and 2009 by Manuel Gausa, Silvia Banchini and Luis Falcón (2009; 2011) from the Master Program Intelligent Coast. Here, thinkers, businessmen and politicians debated about new models of development for coastal territories, as a privileged land of tourist economy and new society. The debate focused on the emergent phenomenon concerning the Spanish Mediterranean coast as the first European megalopolis in Europe, comparing with Tokyo, Mexico City and Shanghai. The Symposium, organized over 3 days, gathered for the first time around the topic of tourism, experts, politicians and directors of private companies.

Finally, a fourth reflection -which could also be seen as a warning- concerns the unpredictability of tourism, given its global dimension and the influence of geopolitical issues on its trends. Fundamental turning points such as the consolidation of a global market, and the greater simplicity in travelling and communications, have exposed the touristic sector to a number of 'risk factors' both economic and geo-political which resulted to be locally uncontrollable, and capable of determining major variations and unexpected shifts in the choice of touristic destinations (Sönmez and Graefe, 1998; Hall,

Figure 1.9: The 'Mission Racine' territorial planning chart in the Languedoc-Roussillon coast. (Source: 'Aménagement touristique du littoral Languedoc-Roussillon'. Techniques et Architecture. 1969, n° 2, série 31, novembre)



2010). For example, during the last few years, several major events as Middle East and North Africa political instability, civil wars, natural disasters, trade sanctions, or also the most recent terrorist attacks (for instance in France and Belgium) have been shifting Mediterranean touristic flows from one area to another. Such trends are also having an impact on the abandon of emerging touristic sites, in favour of alternative ones, or to the return to traditional and 'safer' sites; even though apparently more consolidated on infrastructures and overall touristic offer, many of these territories -which have long been organizing according to a specific and well codified kind of tourism- are now facing radical changes in both quantitative and qualitative flows. New users with new and diversified needs and, most of all, impressive numbers also beyond the sustainability limits, are today pressuring cities like Venice and Barcelona, or fragile territories such as the Cinque Terre, witnessing an exponential increase in touristic presences.

All in all, the distinctions between different 'Tourisms' are not always so evident and clear, and this is true also because immersed within the touristic industry system which is proving of being particularly reactive in institutionalising new destinations and new travelling forms, with the aim of responding to the progressive market saturation; to the increase in competition; and for satisfying the increasingly demanding styles and requests of consumers (Borghi and Celata, 2009).

Evidence emerging from these studies represents more and more distinctively the 'liquid' condition of touristic practice (Pié, 2014). Grounding on such basis, the interpretative categories of the physical

transformations which such a condition has on territories are disconcerted, because the 'tourism-phenomenon' avoids traditional typological representations, assuming almost an elusive scale.

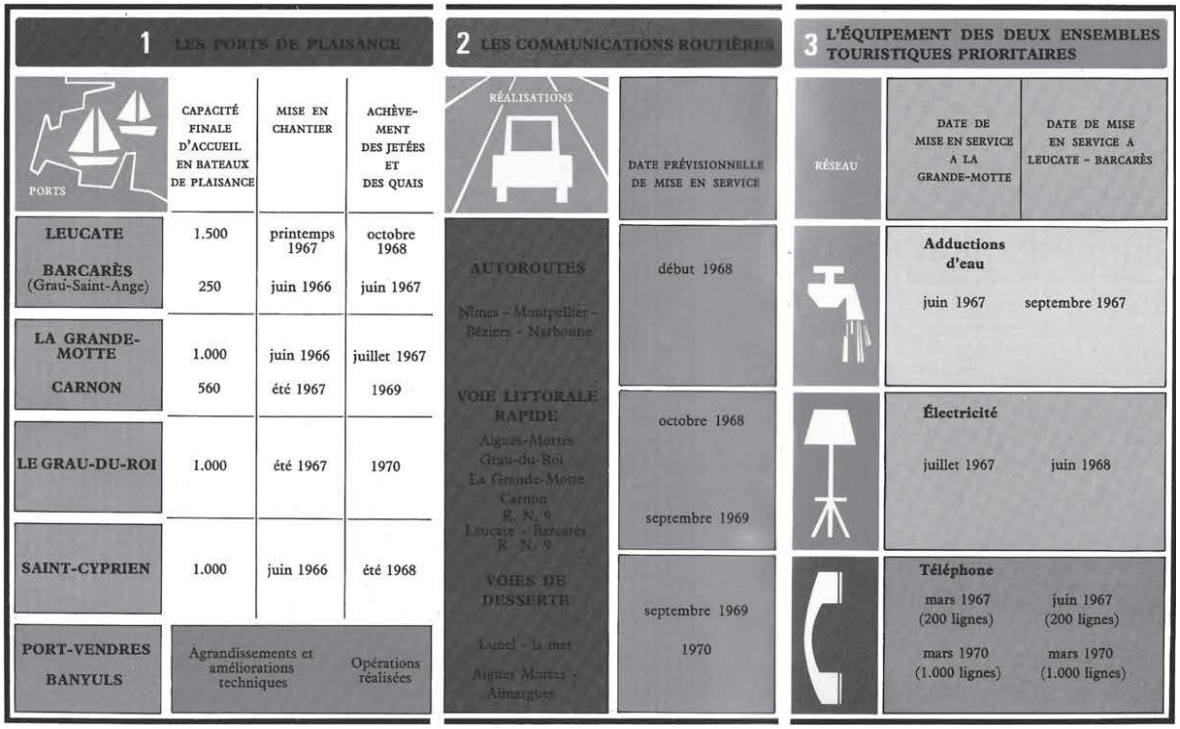
I argue that tourism could actually be considered in the same manner as what philosopher Timothy Morton (2013) defines as 'Hyperobjects': entities such as climate, hydrocarbon reservoirs, the English language, and so forth; in fact, as explained by Morton, hyperobjects' pervasiveness does not allow any sort of exhaustive or reductive classification, for they are understandable only through markers.

This way, infrastructures could be considered as markers of the hyperobject-tourism, which as such has acquired a geopolitical dimension, as well as global-scale implications: in economic terms, it represents one of the most lucrative planetary industries, as estimated by the World Travel & Tourism Council (WTTC, 2015) when stating that about 10% of the world GDP derives from tourism, an such trend is rapidly growing. It is the driving force of some of the most relevant interventions of landscape modification, and also a primary competition factor among cities and entire territories; tourism is capable of moving numbers of people comparable to the greatest migrations of the past centuries, and it changes in relation to geo-political events, soon adapting to new geographies and social structures.

Infrastructures are, at the same time, cause and effect of such prolific character of tourism. Historically, the causal relation between touristic and infrastructural development has been both quite strong, and yet ambiguous. By simplifying, one can affirm that such relationships is constantly undergoing an alternating reversal of factors and forces.

In Italy, for instance, of particular relevance has been the role of the Touring Club which, as well as in France at the end of the XIX century, has contributed to the realization of the first motorways, and the many studies carried out since the early 1920s for the Milano-Laghi highway -the first European highway- are a clear example of how the touristic practice, even though at its early stages, has somehow physically defined an infrastructure (Moraglio, 2009). Another and yet more complicated example could be represented by the so-called 'Mission Racine' (officially 'Mission interministérielle d'aménagement touristique du littoral du Languedoc-Roussillon') which, between the 1960s and '80s, brought to the brand new construction of 5 'new town' -or unités touristiques- in the souther part of France (Racine, 1980). Such massive intervention was initially launched with the aim of intercepting touristic flows which, from France, were moving towards Spain, with a newly-consolidated

Figure 1.10: Advertising insert of the Languedoc-Roussillon touristic development emphasizing the infrastructural features of the area: marinas, roads, and water, electricity, communication supply networks. (Source: Pié i Ninot, Rosa Jiménez, 2013: 224)

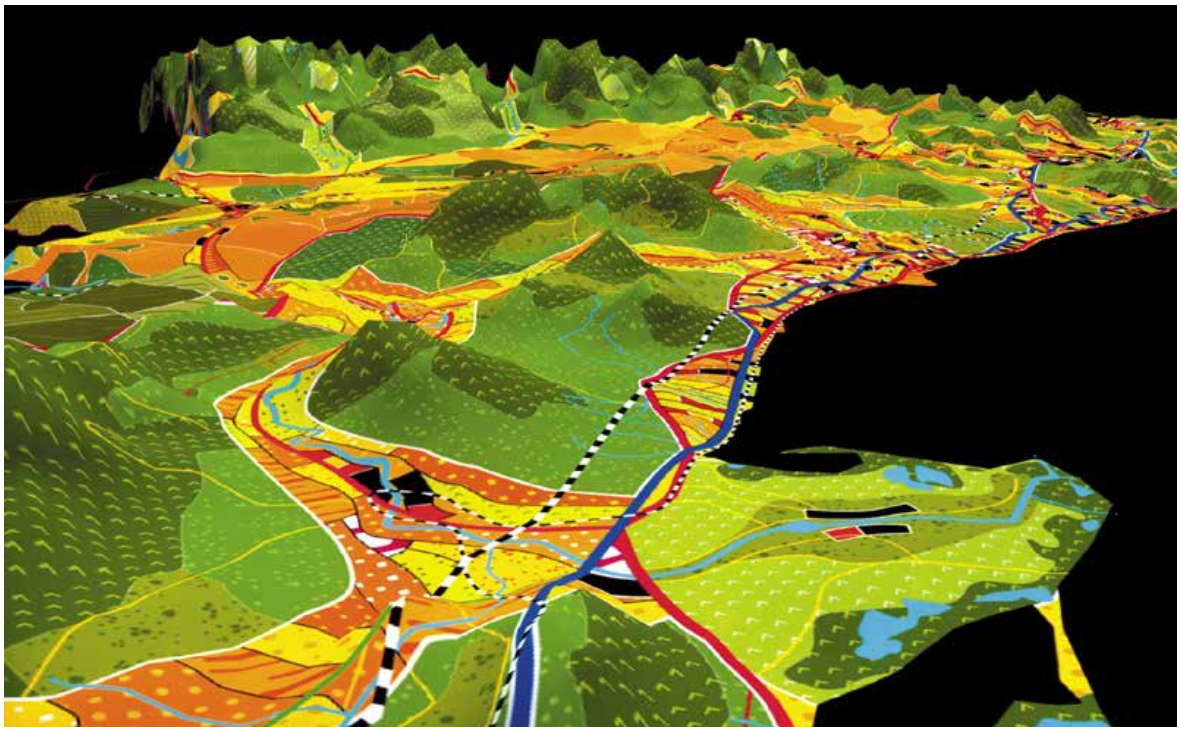


middle-class searching for less expensive sites; of slowing down urban development in the French Riviera (i.e. Côte d'Azur); and of giving new impulse to employment in a region harshly struck by the crisis of the wine industry. However, despite such objectives, one of the most evident result was how such tourism-oriented new developments led to the realization of many and varying infrastructures (*Figure 1.10*).

Such a phenomenon could be also found in principles, even though in other forms, in another touristic milestone: Las Vegas. A city born and developed around criteria of touristic experience's maximization, the city which invented and codified the Strip: more than just a street, but a system whose degree of sophistication is so high (in the dimension of the street section, of the parking, transition, communication systems, etc.) to almost seem prosaic, or resulting so 'invisible' as much as an infrastructure exclusively oriented towards the facilitation of an overwhelming touristic fruition (Venturi, Scott Brown, Izenour, 1977).

Especially during the past few decades, an inversion of such causal relation has happened: somehow infrastructures -in their broader meaning, therefore comprising both physical and immaterial ones- have contributed to trigger new processes of touristic development. One obvious example could be given by the impact that low-cost flying companies have had on the touristic conversion of certain

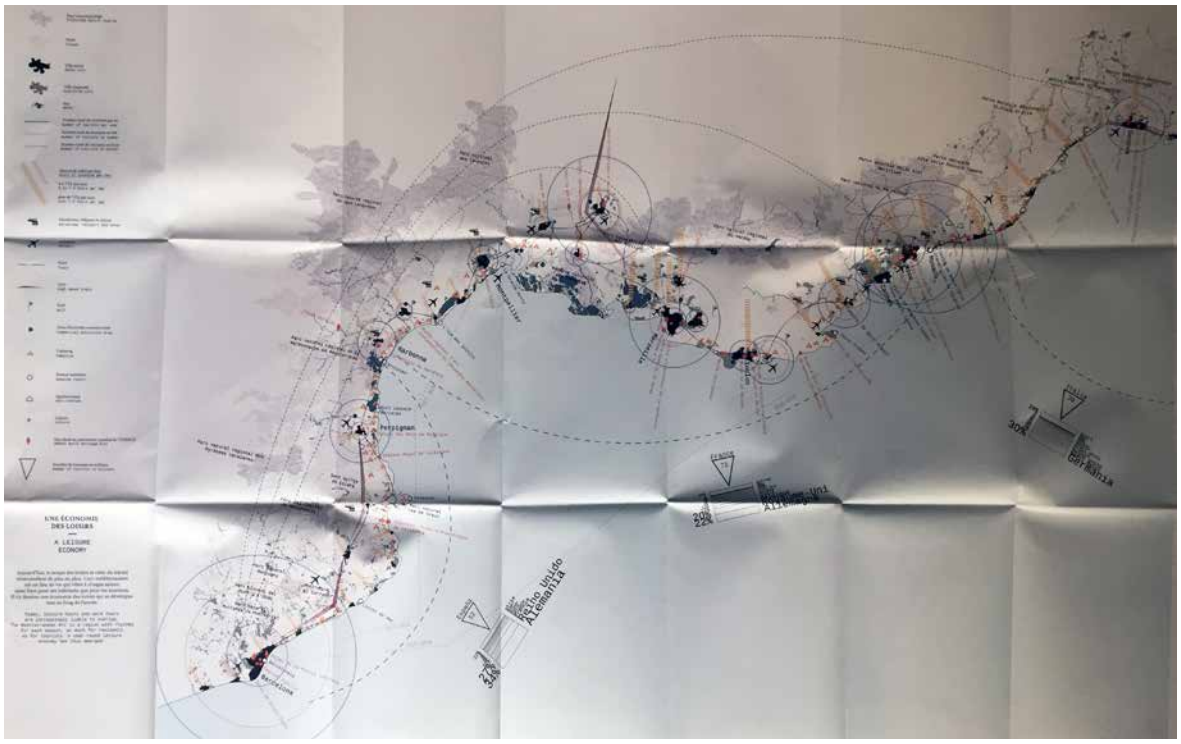
Figure 1.11: 'Catalunya Land-Grid', by Actar Arquitectura, combines different strategic levels of action, identifying the multiple dimensions of territorial relationships in the representation of 'multi-cities' or 'geo-urbanities' by datascapes. (Source: Gausa, 2004: 38)



peripheral destinations in relation to metropolitan cores. Or also, we could consider how some projects envisioning the reuse of neglected infrastructural systems have contributed to increase the level of touristic offer, often becoming themselves a sight within the touristic framework of several cities (Nuric et al., 2015). The most immediate example could be the transformation of New York's high Line and the effects such conversion had on the neighbourhood and the whole city. In its first week, the High Line attracted more than 70,000 visitors. According to the New York Times, City officials have predicted that development sparked by the High Line as a public park will bring $4 billion in private investment and $900 million in revenues to the city over the next 30 years.

Thus today, in a global world and having reached a global dimension of tourism, new tools and strategies need to be conceived and tested, especially in order to plan and implement infrastructures at the service of complex and highly unstable touristic territories. During the past couple of decades, some experimentations have been carried out in this perspective -even though not directly addressing infrastructural landscapes- and one of the most important examples could be represented by the Datascapes approach. Pioneer in this field since the 1990s is the Dutch firm MVRDV which has sought to broaden the visual vocabulary of architecture by mapping urban phenomena through digital experimentation (Amoroso, 2010). Especially through their work 'Metacity/Datatown' (Maas,

Figure 1.12: One of the charts provided by Sensual City Studio and attached to the book 'Belle Méditerranée: La métropole sensible' representing the 'Leisure Economy' of the coast between Genoa ad Barcelona. (Source: Marchetti et al., 2015)



1999), MVRDV have brought to the forefront the idea of using data to generate alternative urban and architectural forms as a means to support planners and designers in their decision-making process; in fact, their theoretical study on datascapes has provided new ways of visually examining and then conveying urban information not normally visualized in a spatial manner (i.e. land value; waste production; carbon dioxide emissions from car use; water consumption). Through visually applying urban data to digital mapping for investigating urban situations, they came to the definition of datascapes as a sort of new architectural language, defined by Steele (1998) as: *"visual representations of all quantifiable forces, which can have an influence on the work of the architect or are even able to determine and to steer them" (p.10)*.

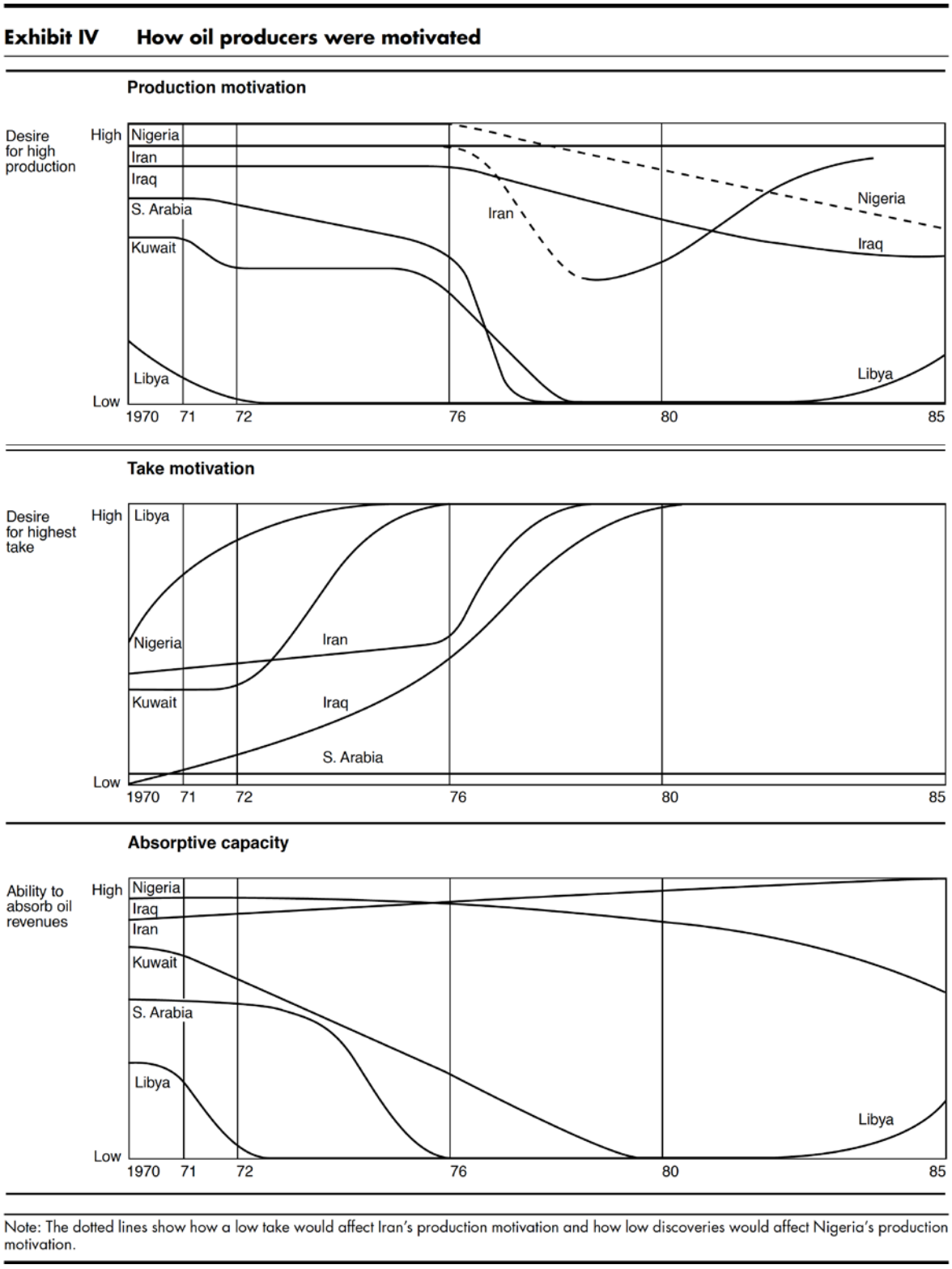
Landscape architectural theorist James Corner (1998) also described datascapes as *"images constructive and suggestive of new spatial formations (...) so 'objectively' constituted (from numbers, quantities, facts, and pure data) that they have great persuasive force in the bureaucratic and management aspects of contemporary city design. They differ from the quantitative maps of conventional planning in that they image data in knowingly selective ways. They are designed not only to reveal the spatial effects of various shaping (e.g., regulatory, zoning, legal, economic, and logistical rules and conditions), but also to construct a particular eidetic argument" (p.25)*. Corner further high-

lighted datascapes innovative role as new tools revising the most traditional analytical and quantitative mapping and charting for building the different shape-forms of both forces and processes operating on a given site.

Although the overall attempt of introducing datascapes in the architectural and planning debate was to create a hybrid 'map-landscapes' capable of visualizing also the so-defined 'hidden' forces (i.e. numerical data) into new 3d mapping styles (Amoroso and Sechter, 2013), mixing art, spatial form, and site-based data to create a new kind of 'landscapes', I argue that the use of such an approach to forecasting futures in highly unstable contexts such as the touristic ones is not sufficiently accurate. In fact, the accuracy of such quantitative and data-based forecasts, even though often consistent in the short-term prediction, decreases exponentially as the time horizon increases; datascapes capacity for guiding future changes is correspondingly reduced for long-term planning, especially within unstable and dynamic contexts where the number of data and uncertain variables is higher.

Many other researchers and professionals have given their interpretation of futures planning and data use applied to territorial and infrastructural matters. A case worth citing is the most recent work carried out by Marchetti and colleagues (2015) on the Mediterranean coast, yet proposing a different approach neither relying on scenarios, nor only on hard data. In the publication 'Belle Mediterranée: la metropole sensible', the authors approach the topic of sustainable urban and territorial growth by first assuming the mediterranean coast in its multi-national character as one, unitarian territory (from Barcelona to Genoa), displaying and sharing the same landscape features, urban forms, climate, and culture. Their works is thus built on the envisioning of the construction of a new, cross-national infrastructure (i.e. a high-speed railway system) connecting the whole coast, and the study of how such new realisation could impact on the use of the territory by the citizens and tourists; on the potential consequences and changes in the habits of transport and movement; of living, working and 'consuming', as well as energy, resources and technology use. The authors construct their own one scenario grounding on a 'perceptive' approach, defining the Metropole Sensuelle representing both a city and a technique grounding on the use of the five senses -and pursuing an anthropocentric ideal- for depicting a possible future territorial configuration.

Figure 1.13: The chart shows one of analysis performed at the Dutch/Shell by Pierre Wack about oil producer countries' need and ability to spend oil income productively. (Source: Wack, 1985: 81)



1.3.2 Scenario Thinking

As highlighted by Amer and colleagues (2013), the systematic use of scenarios for clarifying thinking about the future started after World War II in the United States; in fact, it was first the US Department of Defence which used the scenario process as a method for military planning during the 1950s (Kahn and Wiener, 1967; Joseph, 2000; Durance and Godet, 2010). The word 'scenario' was actually borrowed from performance theatre, where it refers to the sequential elements of a screenplay such as the actions of its performers, or changes in the stage setting (Alcamo, 2001), then taken over by strategic planners and 'futurists' for a method for war game analysis.

After the first military implementations and during the following decades, scenario planning -also known as 'scenario thinking' or 'scenario analysis'- was further developed and extensively used also for social forecasting, public policy analysis, and decision making, for it had the influence of exerting a strong influence on human thinking and the decision-making process, while being able of initiating public debate (Wieck, Binder and Scholtz, 2006). Scenario planning techniques acquired progressive importance especially in the economic fields, where used for articulating mental models about the future, in order to drive the decision-making praxis (Martelli, 2001); and also in technology planning, forecasting strategic analysis and foresight studies, while incorporating and emphasising those aspects of the world that are important to the forecast. Scenario planning was transformed into a business tool in the late 1960's and early 1970's, most notably by Pierre Wack (1985) who developed the scenario planning system used by Royal Dutch/Shell. As a result of these efforts, Shell was prepared to deal with the oil shock that occurred in late 1973 and greatly improved its competitive position in the industry during the oil crisis and the oil glut that followed.

Planning has long meant 'conceiving of a desired future' as well as the real means required to achieve it (Ackoff, 1970). In fact, the concept of 'strategic planning' launched by Ansoff in the mid-1960's referred to the fact that corporate planning should take more into account the 'turbulence' possibility in the company's environment, thus adapting its goals accordingly. Likewise, strategic management was also promoted, during those same years, in order to emphasize the conditions enabling companies, organisations and institutions to adapt to that increasingly turbulent world (Ansoff, 1976).

Scholars recognize in the figures of three 'futurist' thinkers -i.e. American military strategist Herman

Kahn, and French pioneers Gaston Berger and Bertrand de Jouvenal- the role of 'fathers' of scenario thinking; the first one expanding, in the 1960's, his scenario work to social forecasting and public policy (Schwartz, 1991; Chermack et al., 2001), while the others developing normative scenarios of the future which were to be used as a guide in formulating public policy (a method which they called 'La Prospective').

Meanwhile, scenarios were also being applied to urban and territorial planning, stressing how the consideration of multiple potential and future alternatives could help to conduct planning in a holistic manner (Jetter, 2003; Burt and van der Heijden, 2003), also significantly enhancing the ability to deal with uncertainty, as well as their usefulness in the overall decision-making process, as argued by Varum and Melo (2010). The use of such techniques in urban and regional context mainly refers to modelling, planning, and learning about alternative spatial development with consideration of uncertainties, also providing insights into the preferences and decision-making of urban and regional planning stakeholders, as discussed by von Wirth and colleagues (2013).

When addressing the use of scenario thinking in urban, territorial, and environmental studies, Volkery and Ribeiro (2009) argue that the different methodological approaches to scenario planning have been largely discussed in literature, even though much less attention has been paid to their potential use and impact in the field of policy-making. As illustrated by Alcamo (2001), especially in environmental studies, 'scenarios' have been defined slightly differently; for instance, the Intergovernmental Panel on Climate Change (IPCC) described scenarios as 'alternative futures' which are neither predictions nor forecasts, but an alternative image of how the future might unfold (Nakicenovic et al., 2000). There are also specific types of scenarios -e.g. emission scenarios- which have been defined by the IPCC as *"projections of the future state of the society and environment based on specific assumptions about key determinants such as population, economic growth, technological change, or environmental policies"* (Alcamo et al., 1995; Alcamo, 2001).

Rotmans and colleagues (2000) applied the use of scenarios to the concept of 'sustainable Europe', debating how sustainable development introduces new sources of uncertainty and conflicts, therefore requiring the application of scenarios. The authors presented a project named VISIONS, aiming at developing different possible futures of Europe, for better understanding the potential connections among socio-economic, ecological, and institutional processes. Mahmoud and partners (2009) proposed a framework for the development of formal scenarios to be applied in environmental studies,

consisting of five progressive phases: defining scenario; scenario design; scenario analysis; scenario evaluation; and finally risk management. Joseph Alcamo (2001) in his work for the European Environment Agency, argued that *"Scenarios can serve as useful tools in international environmental assessments for evaluating future environmental problems and assessing policies to resolve them" (p.6)*, suggesting several tasks that such process could fulfil:

/ provide a picture of future alternative states of the environment in the absence of additional environmental policies (i.e. 'baseline scenarios');

/ raise awareness about the future connection between different environmental problems (e.g. between climate change and threats to biological diversity);

/ illustrate how alternative policy pathways can achieve an environmental target;

/ combine qualitative and quantitative information about the future evolution of an environmental problem;

/ identify the robustness of environmental policies under different future conditions;

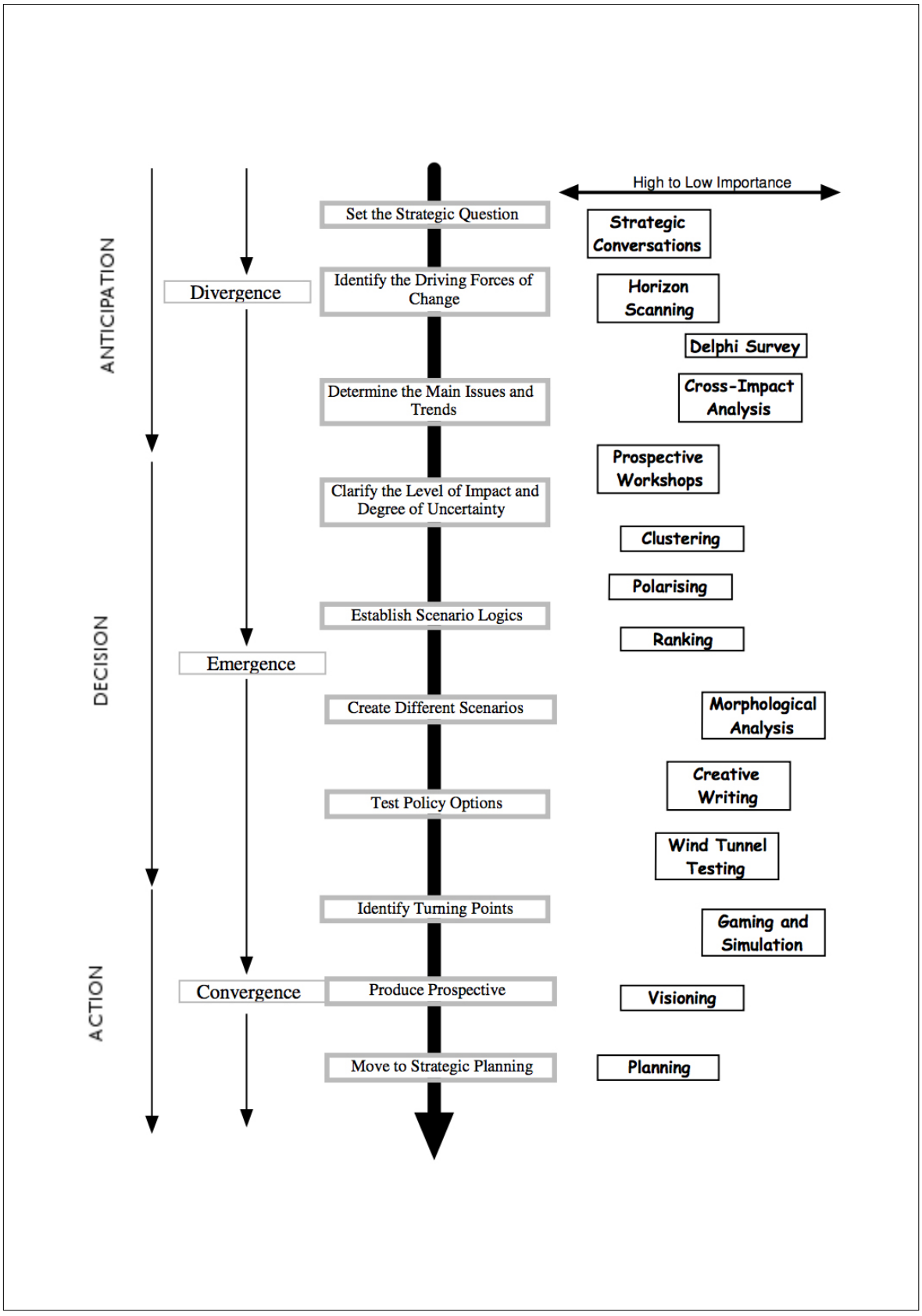
/ help stakeholders, policymakers and experts to 'think big' about an environmental issue;

/ help raise awareness about the emergence of new or intensifying environmental problems in Europe (e.g. scenarios applied to acid rain (Hordijk, 1995), or climate change issues (Alcamo et al., 1996; van Daalen et al., 1998) which have been used in the 1990s to raise the awareness of policymakers about such emerging issues).

In the case of urban planning, several studies as well as various institutions involved in urban and regional planning practice complained about the lack of specific skills in terms of the use of futures methods and approaches; and about the insufficient capacity to adopt new approaches and ways of thinking, acting and collaborating, as also underlined by Krawczyk and Ratcliffe (2006). Despite the availability of many different scenario approaches, a technique to build scenarios of urban future in uncertain conditions has not yet been developed (Stojanović, Mitković and Mitković, 2014). As debated by Khakee (1991), such techniques should be based at least on the following methodology requirements :

/ scenarios should provide perspectives for policies or proposals within an urban plan. The objective when linking scenarios to urban planning is not only to provide results that would serve as inputs for the planning process itself, but also to encourage planners to embrace new ways of thinking in the

Figure 1.14: 'Perspective through Scenarios'. (Source: Ratcliffe and Sirr, 2003: 8)



process of creating scenarios;

/ images of the future should be present, so that development analysis could be phased out in time intervals corresponding to the middle-term planning. The knowledge this way generated could then be used as a useful input for the planning process;

/ a city represents a complex system, strongly affected by changes in the external environment (e.g. national and international conditions); for such reason, making explicit assumptions about future environmental development becomes of fundamental importance.

Scholars John Ratcliffe and Lorcan Sirr (2003) of the Futures Academy at DIT, developed a methodology for scenario planning in spatial and urban planning: the 'Prospective Through Scenarios Process', extensively building on the earlier studies carried out in 'La prospective'. Their methodology envisions a process subdivided into 10 steps (*Figure 1.14*), also associating to every phase different exploitable techniques (i.e. horizon scanning, cross-impact analysis, morphological analysis, etc.). Using such methodology, several scenario studies have been conducted; for instance, the possible futures of the city of Dublin, or the country of Ireland have been explored, while other and more global studies have also been developed, such as the 'Competitive global city 2030' conducted for considering alternative future scenarios of global cities (Kelly, Ratcliffe and Gannon, 2006).

Literature on the matter reports more examples of successfully conducted scenario planning. For example, Vasteras urban government, in Sweden, implemented the method for building alternative urban scenarios under the economic and political uncertainty of 1985 (Khakee, 1991); these scenarios were mostly qualitative, with the use of few quantitative data, and because of the use of 'intuitive imagination', a certain amount of incompatibility could be found in each scenario. However, writing the scenarios helped to identify key areas which required more detailed and specific strategic studies (Stojanović, Mitković and Mitković, 2014).

Another example could be given by the scenario method applied to the Limmattal region, a Swiss suburban agglomeration near Zurich; with the 2030 horizon, the goal was to integrate knowledge from science and practice into the planning process, for acquiring a better understanding of the complex interactions between impact factors in the Limmattal urban fabric (Wirth et al., 2013). In this case, formative scenario analysis has been applied, combining qualitative and quantitative data to analyse the direct variables impact, and explore potential futures.

A 'backcasting' study (i.e. a planning method which starts with defining a desirable future, and then

Figure 1.15: Differences between scenarios, forecasts and visions. (Source: Lindgren and Bandhold, 2009: 9)

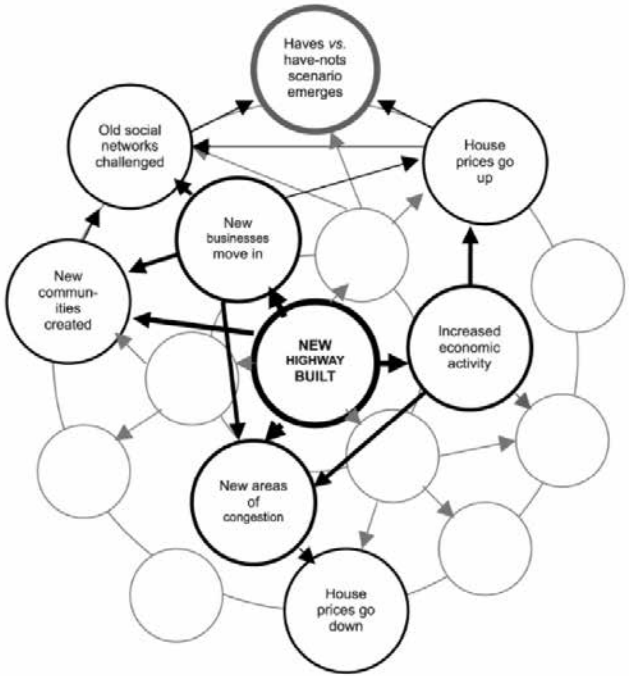
Scenario	Forecasts	Visions
Possible, plausible futures	Probable futures	Desired future
Uncertainty based	Based on certain relations	Value based
Illustrate risks	Hide risk	Hide risk
Qualitative or quantitative	Quantitative	Usually qualitative
Needed to know what we decide	Needed to dare to decide	Energizing
Rarely used	Daily used	Relatively often used
Strong in medium to long-term perspective and medium to high uncertainties	Strong in short-term perspective and low for degree of uncertainty	Functions as triggers voluntary change

works backwards to identify policies and programs that will connect the future to the present) for the city of Stockholm 2050, Sweden, was conducted to gather a vision of the future of the city whether successfully reaching its climate change goals (Hojer, Gullberg and Pettersson, 2011). Target-oriented backcasting was applied in order to develop images of the future showing how certain targets could be achieved in different ways.

Even though examples of scenario planning exercises specifically applied to urban ans territorial planning may differ in a variety of ways (i.e. having specific environmental context; being undertaken for different reasons and with different objectives; and potentially using diverse methodological approaches), they showed that the scenario method can be successfully used for understanding the forces which are 'drivers' of change in the urban environment, as well as to stimulate thinking and discussion about the future.

However, scenario planning is not the only existing forecasting method, yet it differs from most of the other future-oriented approaches for it usually provides more qualitative descriptions of how the present will evolve into the future, rather than requiring numerical accuracy (Stojanović, Mitković and Mitković, 2014). In fact, while the use of scenarios gives a range of possible outcomes resulting from uncertainty, the purpose of forecasts is that to identify the most likely paths, and actually 'estimate' uncertainty. Another additional method which, however, differs from scenarios, is to create a vision is another future; such approach builds a sort of a picture of the desired future, together with outlining strategies for achieving goals. Simulations also exist: systematic quantitative models of the future, yet without the assessment of probability, possibility or desire; simulations could also be used within the scenario process for increasing its value. Lindgren and Bandhold (2009) made a resume, showing the main differences among the several forecasting methods (*Figure 1.15*).

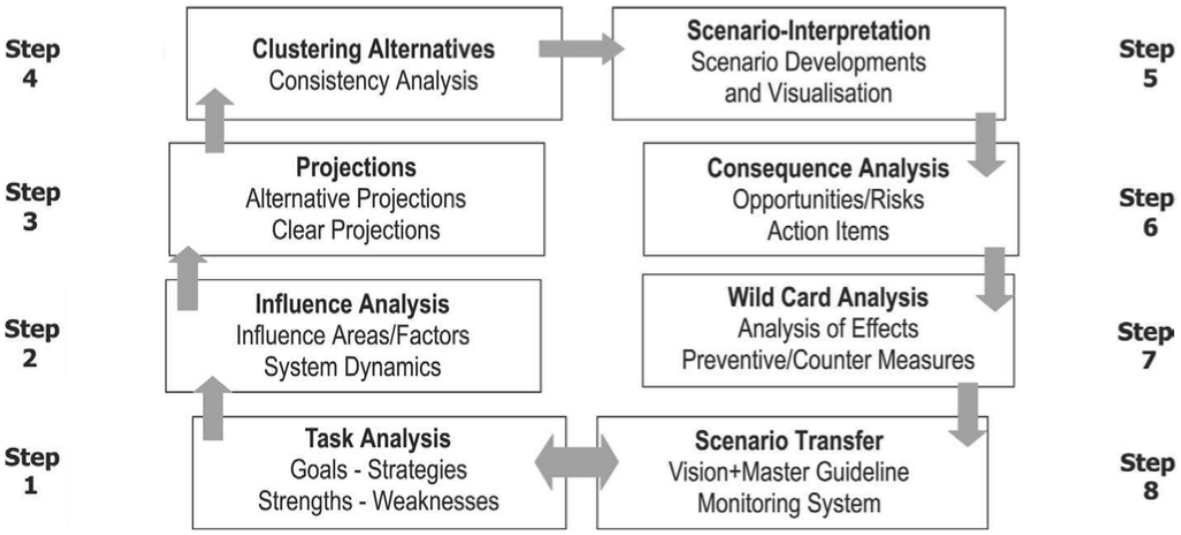
Figure 1.16: 'The Futures Wheel' method applied by developing the example of a highway construction: the unintended consequences which this infrastructure might have on the territory in the long term are drafted. (Source: Inayatullah, 2008: 10)



The existence and use of many different scenarios techniques suggest that the ways and methodologies of scenario constructing are flexible, and they all can be adapted to specific situations and needs. For instance, the model proposed by Shoemaker (1995) displays a comprehensive and detailed scenario building consisting of 10 fundamental steps, also recommending to start the process by developing two scenarios which the author defines as 'extreme': optimistic and pessimistic scenarios. Schwartz (1996) also describes in detail each step of his scenario building model -which is made of 'only' 8 steps- while also suggesting plotting scenario drivers to develop the different scenarios. The work of Keough and Shanahan (2008) also presents a generic scenario building model, after having reviewed several prominent scenario planning models; in general, such scenario building techniques put the emphasis on defining the issues, identifying key drivers, stakeholders, trends, constraints and other important issues in a systematic way (Amer, Daim and Jetter, 2013), and then ranking these factors by importance and uncertainty.

According to Sohail Inayatullah (2008)- *Figure 1.16* - futures thinking can be divided into 6 concepts (i.e. the used future; the discarded future; alternative futures; alignment; models of social change; and uses of the future), 6 futures questions (i.e. will; fear; hidden assumptions; alternative futures; preferred futures; and next steps), and also 6 pillars (i.e. mapping; anticipation; timing; deepening; creating alternatives: and transformation). The author's method is often considered a sophisticated

Figure 1.17: 'The 8 steps of the scenario technique'. (Source: Schwab, Cerutti and Von Reibnitz, 2003: 56)

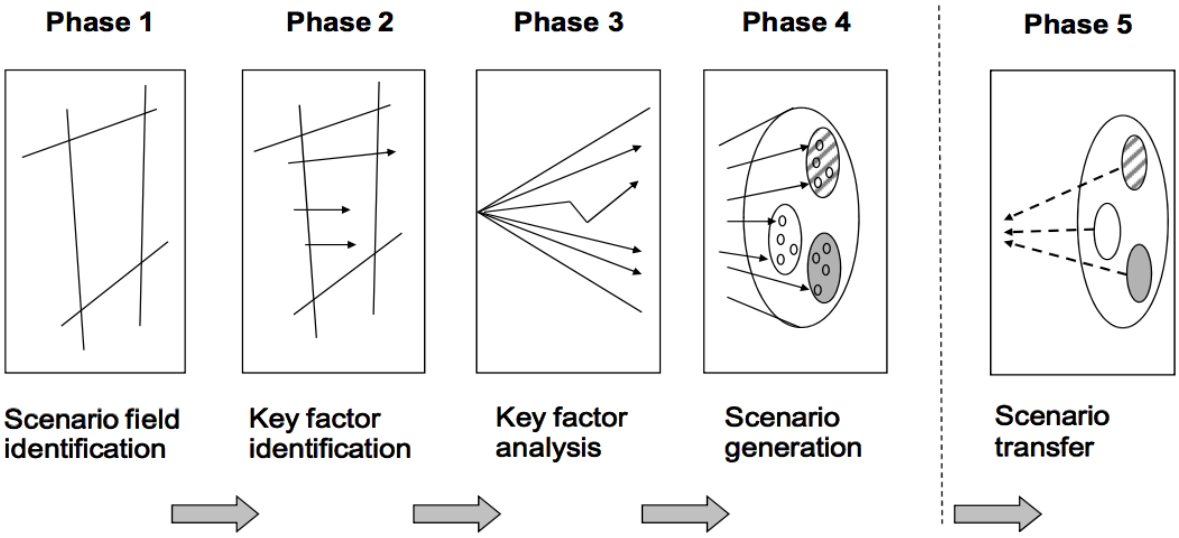


way to categorize and organize different views and concerns about the futures, helping to effectively think about the futures.

Also, Schwab, Cerutti and Von Reibnitz (2003) proposed a model (*Figure 1.17*) -mainly applied to agricultural research- consisting of 8 phases also grounding on a participatory approach involving an interdisciplinary team of experts from as many disciplines as possible. In their review of the methods of future and scenario analysis, Kosov and Gaßner (2008) acquired as the most 'concrete' model's subdivision the scenario process in its 'ideal-typical fashion' of 5 phases, as proposed by the German Institute for Futures Studies and Technology Assessment (IZT, 2007): identification of the scenario field; identification of key factors; analysis of key factors; scenario generation; and -if needed- scenario transfer, as illustrated in *Figure 1.18*.

The above mentioned models and tools are only a few of the many existing ones, for various typologies of scenario thinking have been suggested during the years, although without a shared consensus on them (Börjeson, Höjera and Dreborgb, 2006). Two are the existing main scenarios categories: 'exploratory' scenarios, starting from past and present trends and then envisioning likely futures (i.e. what could happen); and 'anticipatory' or normative scenarios, describing either the desired or the dreaded futures (Godet, 2000; van Notten and Rotmans, 2003); moreover, scenarios can also be created retrospectively -i.e. 'backcasting'. Börjeson, Hoyer and Dreborgb (2006) added a third category:

Figure 1.18: 'The general scenario process in 5 phases'. (Source: IZT, 2007; reported in Kosov and Gaßner, 2008: 25)



the 'predictive' scenarios, describing which will be the most probable future (i.e. what will happen). Literature also classifies scenarios on the basis of their topic; on the dimensional scale (e.g. global vs national, regional, local, problem specific, etc.); extension and viewpoints of the scenario scope (e.g. single-sector vs multi- sector); focus of action (i.e. environmental or political); and level (i.e. micro vs macro). Data and information used for scenario development can be both qualitative and quantitative and, depending on such prerequisite, scenarios can also be qualitative or quantitative.
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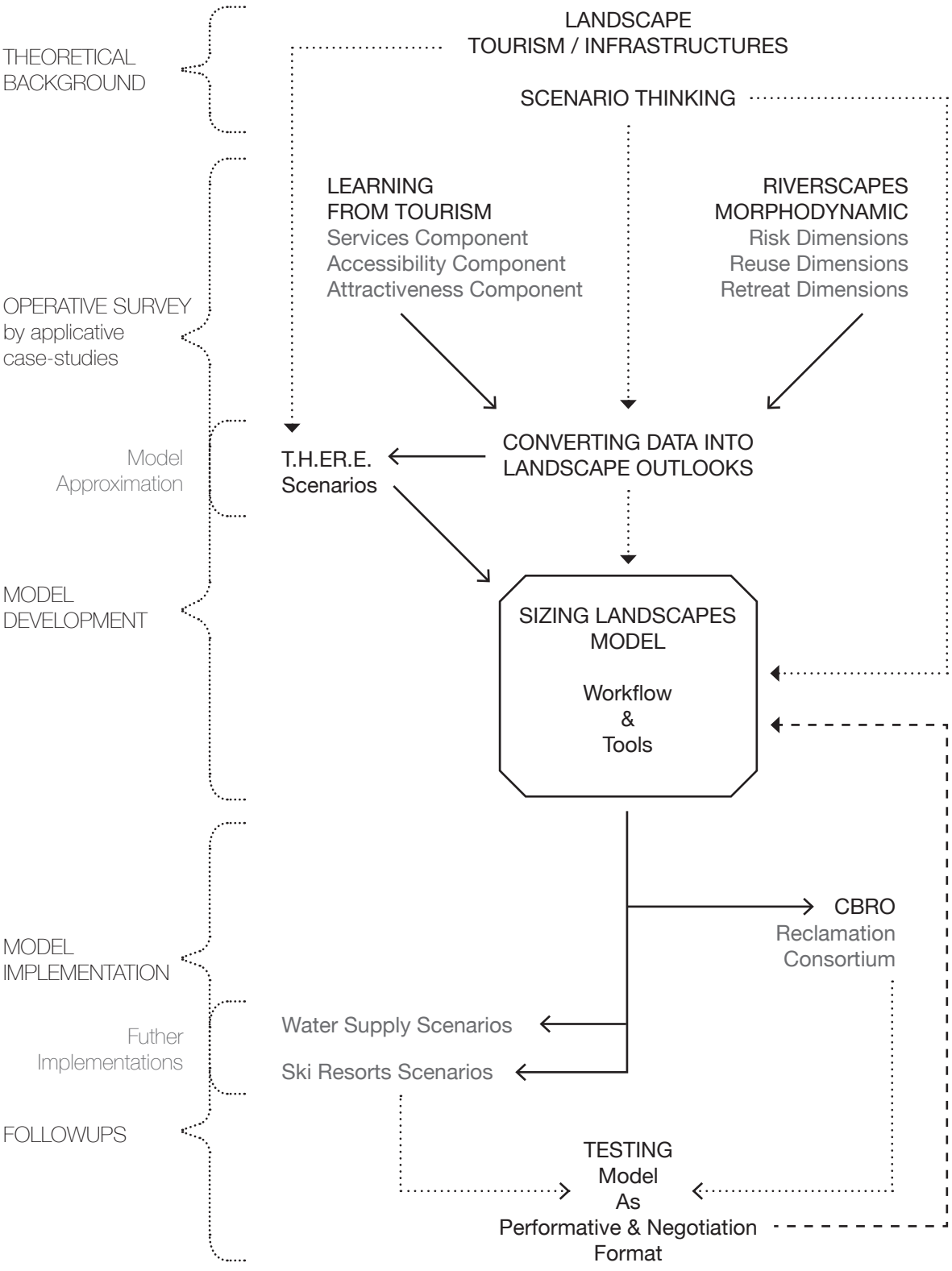
Figure 1.19: A flow chart indicating the sequential steps being taken by the thesis corresponding to the adopted methodology.



1.4 Methodology

The main subject of this thesis, as already stated, is landscape in its relations with infrastructural transformations. Scientific literature on the matter is extremely wide, however, this work focuses more on the operative and process-related dimensions, rather than on the theoretical one. This is the reason why the latter have been referred during the applicative case-study dissertations, while the theoretical background of the research has been instead oriented to clarify the positions grounding the 'Scenario Thinking' approach and, in parallel, the choice of tourism as the 'borderline case' from which learning at operating such reasoning.

The thesis works out the landscape-related possibilities of infrastructural development in the form of design and planning applications. The method used in such case-studies is 'research by design' which has evolved in the last decades (Lenzholzer, Duchhart and Koh, 2013) as a useful tool for research into the future, because it had turned out to be capable of bringing together the world of science (facts, forecasts) and politics (involvement, choices) by means of design and imagination.

The research concerns mainly Italian cases due to the fact that it aims at affecting the way in which decisions about their development are taken in our country. In fact, in this sense, Italy still struggles to shape a coherent set of rules as well as an mindset, aimed at effectively integrating the landscape practice into major territorial transformations. That is even more clear if we look at the last huge infrastructure developments related, for example, to the high speed train networks which have been planned and built clearly without any ex-ante landscape-oriented sensitivity. Nevertheless, some case studies have been intentionally developed in foreign countries due to their exemplar meaning or with the aim of comparing similar, even though far, situations affected by a same phenomenon.

As far as projects dealing with complex infrastructures require team-work and multidisciplinary skills, proposals and research presented in the following chapters are the result of a collective work carried out within the Sealine Research Centre's activity and within several Master Degree Thesis of which I have been tutor. Their themes and topics have been addressed to investigate two types of complex and highly dynamic contexts: riverscapes and touristic territories. They have been chosen to explore the use of a scenario-based approach in extreme conditions, dealing, from time to time, with a particular aspect of the problem.

The methodological workflow is structured in an almost circular way. It starts from applicative case-studies concerning riverscapes reporting an increasing orientation at solving environmental-related issues by the means of more and more radical strategies. Then, touristic territories are investigated as extreme contexts in which infrastructural dynamics are affected the most, not only by environmental forces, but also by unstable and uncertain usage conditions. Case-studies are presented through the filter of the main components affecting the touristic performance of an area. The applicative case-studies' climax, in terms of scenario design complexity and uncertainty, is reached by reporting the THERE project, whose critical review has brought to set the 'Sizing Landscapes Model' and its main features. Finally, the general model has been implemented collaborating with infrastructure developers like the CBRO, a land reclamation authority based in the Emilia-Romagna (Italy), whose case-study has been briefly reported as more exemplar than the others because it involves the same topics, such as the hydrographic risk management, from which the dissertation began.

In summary, the method applied can be described by the following steps:

Operative Survey

A sort of operative survey, aimed at understanding how design procedures might better exploit data and forecasts, is put in place through applicative case-studies dealing with riverscapes and touristic territories. Referring to 'landscape urbanism' approaches and to the more recent advances about 'landscape infrastructure', such proposals have been the means to convert some infrastructural dimensions and tourism components into landscape strategies.

Model Approximation

The outcomes concerning these first applicative researches have been successively used in developing THERE, (i.e. 'Touristic Hub Emilia-Romagna East'): an ambitious proposal for an offshore multipurpose infrastructure in front of the Emilia-Romagna coast. Here, touristic components and infrastructural dimensions have been manipulated to design an explorative scenario for a brand new territory in the sea. Such example is useful to clarify, within an apparent 'tabula rasa' context, the procedures that can be developed for sizing a new landscape. The tourism phenomena is here the driving force affecting forecasts and expectations.

Model Development

Even though THERE experience has been useful to develop a process concerning the scenario sizing and design, it lacked some basics and essential assumptions affecting decision-making procedures. It

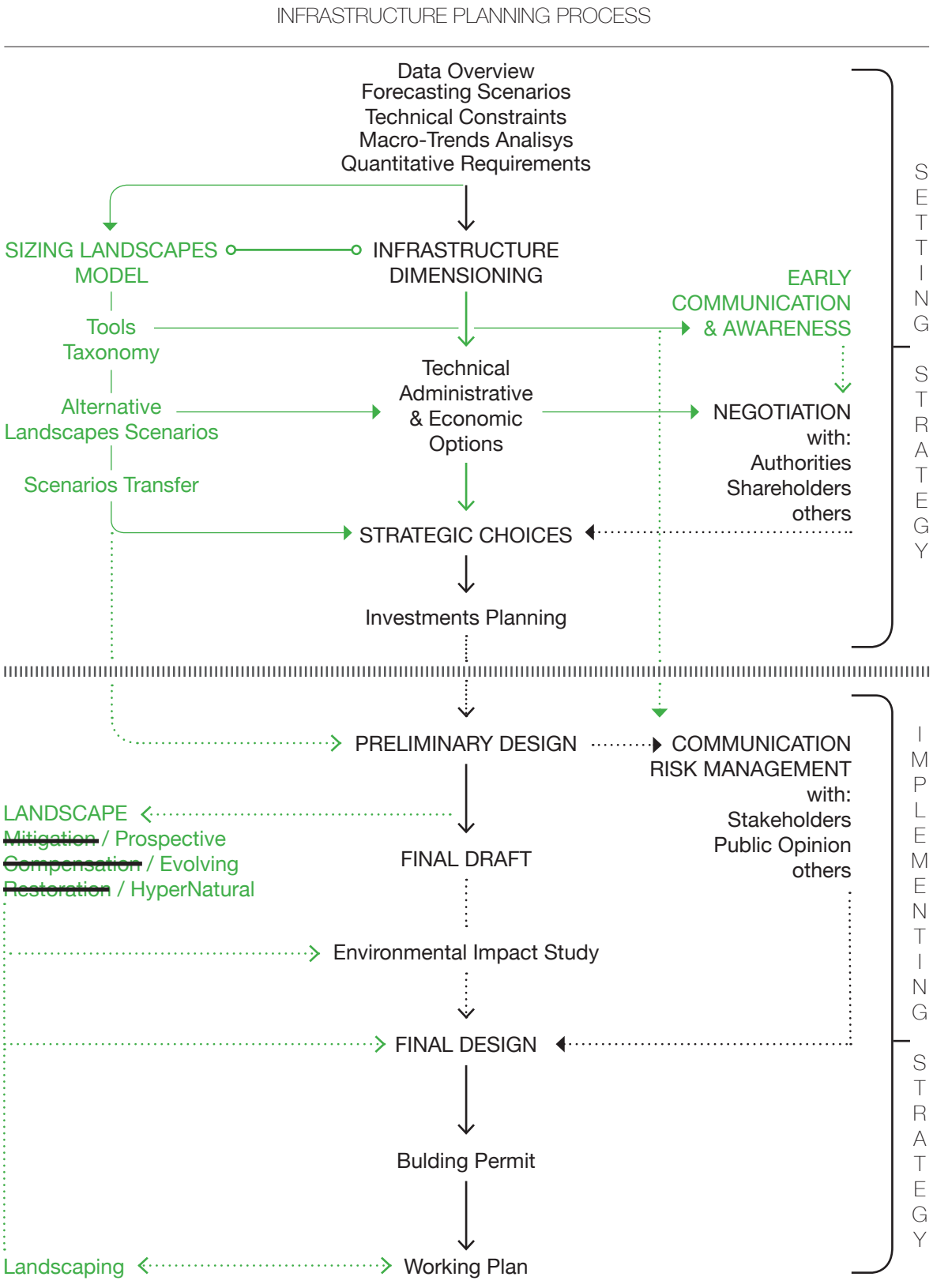
has highlighted the necessity of developing a structured model to relate with decision-makers since the beginning of strategic reasoning. During the research period, such model idea has been proposed to several developers which have accepted to support its development. In particular, they asked for an instrument aimed at integrating performative and negotiation issues related to the future infrastructure impact. On this basis, reworking other disciplines' workflows, the thesis has postulated an operative model based on the development of alternative landscape scenario: the 'Sizing Landscapes Model'. By introducing some landscape-oriented features into the well-established 'scenario planning' procedure, the model enables to outline a more immediate and communicative implications of the infrastructure developments to be used in negotiations with administrative institutions and stakeholders.

Model Implementation

Among the model implementations carried on, a specific one, concerning the CBRO land reclamation authority, is reported. In particular, such implementation aims at demonstrating the model effectiveness in addressing long, medium and short terms strategies in a context where macro and micro phenomena operate both on environmental transformations and on economic dynamics. As this experience concerns the very beginning of a potential infrastructure development assessment, we have been able to work on a restricted number of existing data and forecasts which has facilitated the design of synthetic scenarios and, most of all, has allowed to address further data collection, more tuned with the proposed alternatives.

All things considered, the thesis methodology can be described as inductive process headed to set a model. Even though such aim might be interpreted as ambitious, it is worth highlighting that models, affecting investigations and data collections, have the power to address the representation of reality on the basis of which decision-makers choose. This point is crucial to overturn the landscape architecture role in the infrastructure development process. In fact, by quoting P. N. Edwards (2010), we can state that *"without models, there are no data" (p. xiii)*, and add that if we aim at building landscape-oriented scenarios, we need to process data according to landscape-oriented models. The present work, step by step, attempts in achieving such objective.

Figure 1.20: The flow chart reports the thesis' contribution to the infrastructure planning process in the Italian context, showing especially the 'Sizing Landscapes Model' impact on the strategy set up phase.



1.5 Contributions & Constraints

The thesis lays the ground for further work to be carried out with regards to the application of the 'Sizing Landscapes Model' in infrastructure development process. Specifically, the thesis has found that a landscape-based model integrating alternative scenarios representations and performance testing is indeed a possibility. In the process, the thesis has highlighted certain key areas which contribute to the discipline of landscape architecture:

/ The use of forecasts and data for building landscape scenarios, even though effective in a short and medium term period, is increasingly useless when we refer to complex territories affected by unstable phenomena or almost unpredictable evolutions such as tourism or climate change. For this reasons, an alternative way of building scenarios could be represented by the 'scenario thinking' approach - more narrative-oriented - whose application to the landscape field might change the moment in which infrastructure developers take into account the discipline contribution.

/ The Scenario thinking potential has been exploited into an operative model which developers may recognise as an effective tool to communicate with institutions, stakeholders and people about their strategic directions avoiding ideologic conflicts. In this sense, the so called 'communication risk', that managers have increasingly to deal with, may find into the model a possible solution enabling to set the debate around clear prospective visions.

/ The thesis focuses on building an instrument addressing strategic decision only if applied at the very beginning of the infrastructure planning. It is not intended as a design process, but it is mostly aimed at opening the interlocutor 'visual field' on unexpected opportunities and risks. Such feature may allow also to prevent strategic mistakes addressing more adaptable short and mid-term choices.

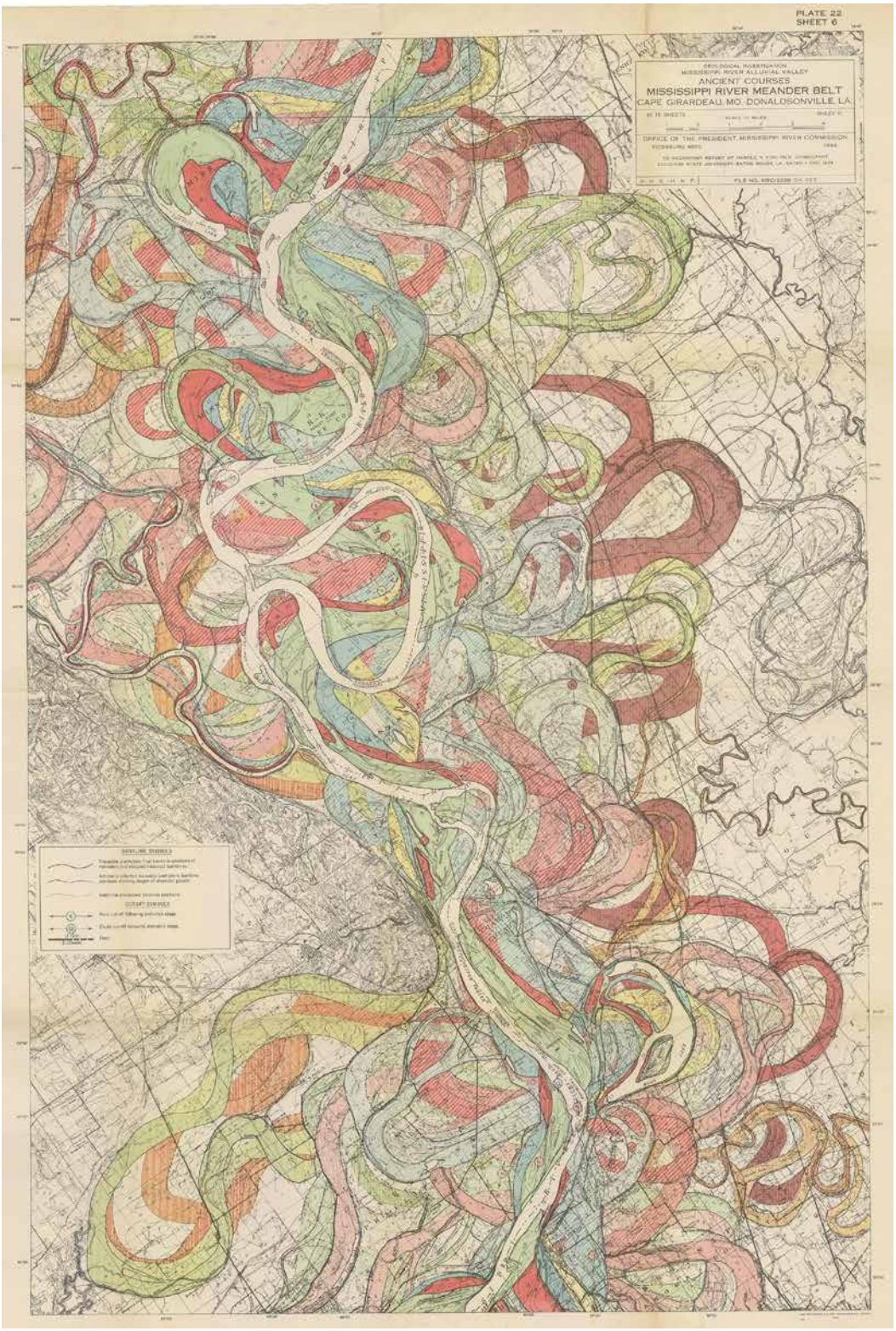
/ The model provide a framework within which other specialistic contributions may apply refining the alternative scenarios according to a constant updating. This potential development is one of the principal research followups.

/ Regardless of the debated issues, the thesis points out, especially within the Italian context, the necessity in the fields of landscape architecture of engaging to tackle the most significant environmental transformations by directly operating on the decision-making processes, and by influencing and shifting developers' sensitivity towards a landscape-based approach.

Chapter 2 / Converting Data Into Landscape Outlooks

This Chapter reports the results of relevant pilot projects intentionally developed in highly dynamic contexts, such as riverscapes and touristic territories. The aim was to convert quantitative data and forecasts, pertaining to the technical approaches on infrastructure planning, into landscape dimensions to be processed for shaping new exploratory scenarios. To this purpose, river systems have been chosen for their inner morphological variability, moreover polarized by climate effects and anthropic interventions; while touristic areas for their being pressured by unstable usage flows and cycles so deeply affected by global uncertain trends.

Figure 2.1: Geological map of the Lower Mississippi Alluvial Valley - Plate 22, Sheet no. 6. (Source: US Army Corps of Engineers)



2.1 Inspiring Riverscapes Morphodynamic - Case-studies

An intricate combination of factors has contributed to shaping river systems, as we observe them nowadays. Also, their current layout is only a phase of an unstable process where modifications happen according to different spatial and time scales due to climate and geological changes, human landscape alterations, and the respective ecological adaptations. Representation methods - used by cartographers, geographers or landscape and urban planners - have long struggled with seizing such features whose study is fundamental to manage predictive development scenarios and risk assessment analysis.

The Second World War marked a turning point in this regard since in 1941 the US Army Corps of Engineers' Mississippi River Commission commissioned the geological survey of the Lower Mississippi Valley to the geologist Harold N. Fisk. His full technical report (Fisk, 1944) contains 33 map plates most of which succinctly present the complicated historical courses of the river, colour coded for different ages of point bar migration, chute cutoffs, and avulsions (*Figure 2.1*). This massive work, completed in just over three years, is a cartography milestone and probably the first example of fluvial morphodynamic representation.

Just in the last few decades, the improvement of remote sensing surveying techniques - such as aerial photography, airborne or satellite digital imagery and LiDAR - has allowed a more accurate knowledge of rivers' dynamics increasing the awareness of their passed and future impact on landscape morphology. The LiDAR-derived digital elevation model of the Willamette River (*Figure 2.2*), for example, visually replaces the relatively flat landscape of the valley floor with vivid historical channels, showing the dynamic movements the river has made in recent millennia. It displays a 50-foot elevation range (i.e. 15,24 m), from low (displayed in white) fading to higher elevations (displayed in dark blue), providing a deeper landscape characterisation that shifts our attention from the river itself into the topographic system it has been able to generate.

Such representations reveal how river basins are the result of overlapping forces acting at different levels. At the geological time-scale, huge modifications cover very long periods and allow ecosystems to adapt progressively consolidating the relationships between their biological and morphological components. On the other hand, human alterations operate in a shorter time perspective, generally

Figure 2.2: LiDAR imagery by Daniel E. Coe. of the Willamette River. (Source: Oregon Department of Geology and Mineral Industries)

according to functional needs and economic interests which feed a competing demand for limited river-based services, central to the growth of a territory's economy and quality of life.

Water supply for industry, agriculture and mining, quarries, hydropower plants and navigation infrastructures or recreation facilities, just to name a few, are all factors that over time have affected rivers' hydromorphology as well as the necessity to keep a strict control on it. Furthermore, the vast range of productive areas and settlements accumulated around rivers requires a constant updating of defence, as well as maintenance works which perpetually reshape embarkments, riverbeds and vegetation. Even though trade-offs between the impacts on ecosystems, sustainable allocation of water resources, and economic interests are often at the centre of regional management policies and river science's researches (National Research Council, 2007), the recurring operative approach to the topic seems to ground on a paradox.

In fact, it deals with the misleading expectations to freeze, maintain or restore the 'natural' functioning of the river ecosystems, while indeed they are inherently on-the-move, due to anthropic interventions and environmental transformations. It seems that all the forces operating in this sense should be someway balanced by the picturesque idea of an 'authentic landscape' which is as reassuring as unhistorical. This attitude is likely to reduce the landscape project to a kind of vintage 'maquillage' aimed at concealing the territories' structural evolution behind a fake postcard image. The concrete result of such a mindset is an increasing disjunction between technical developments and landscape outlooks: the first looking ahead, the second backwards.

Starting from these considerations, during the last few years, we have faced the problem working on the 'waterscape' topic through an integrated design approach, based on the early combination of diverse expertises such as landscape planners and designers, energy and hydraulic engineers, geologists, ecologists and geographers. This has produced a vast range of studies and proposals aimed at matching infrastructural works with new landscaping procedures (Emanueli and Lobosco, 2015). Our main objective was to investigate the way landscape devices may contribute to drive rivers' system transformation towards new modes of exploitation, fruition and relationship with the context. For what concerns this thesis, three different procedures - for scale, background and implications - of dealing with such dynamic topic are presented in the following paragraphs. The first one, by comparing two applicative key studies in the Sardinia region (Italy), aims at highlighting the opportunities that could raise from environmental risk control if safety measures and dimensions are converted into

more articulate landscape systems. The second paragraph investigates two proposals aimed at shaping multipurpose infrastructures related to artificial river systems in Italy and Chile reasoning around the concept of 'inverse hydrography'. The third paragraph reports an extreme, but plausible, retreat strategy from the Po Delta's area in Italy as a radical answer to visible environmental degradation processes and climate change effects.

In summary, these proposals are aimed at developing an original interpretation of the 'cultural landscapes' idea (Sauer, 1925) regarding how it has been adopted by the World Heritage Committee (UNESCO, 2005) and successively discussed by the scientific community given the nature-culture distinction that it implicitly subtends. As Pannell (2006) observes, such nature-culture dichotomy, and the complex of values it engenders, risks to polarise the debate and simplify the framework within which social and environmental processes take place and mix up. She demonstrates, in World Heritage contexts, how the attitude at establishing sliding scales of value or cultural properties listed as illustrative of a *"significant stage in human history"* (UNESCO, 2005: 20) can bring to *'the sanitisation of history or the complete erasure of certain historic events"* (Pannell, 2006: 4).

The same critique may apply to the aforementioned way in which landscape planning is commonly carried on and arbitrary referred to a singular moment in the history of the territory to which it belongs. River systems perfectly show the impossibility of such approach: unless we want to perpetuate the nature-culture distinction and its consequences, we should attempt to conceive the landscape as a stratification of always new arrangements, layouts and usages. For this reason, we assume that projects and proposals aiming at this objective should:

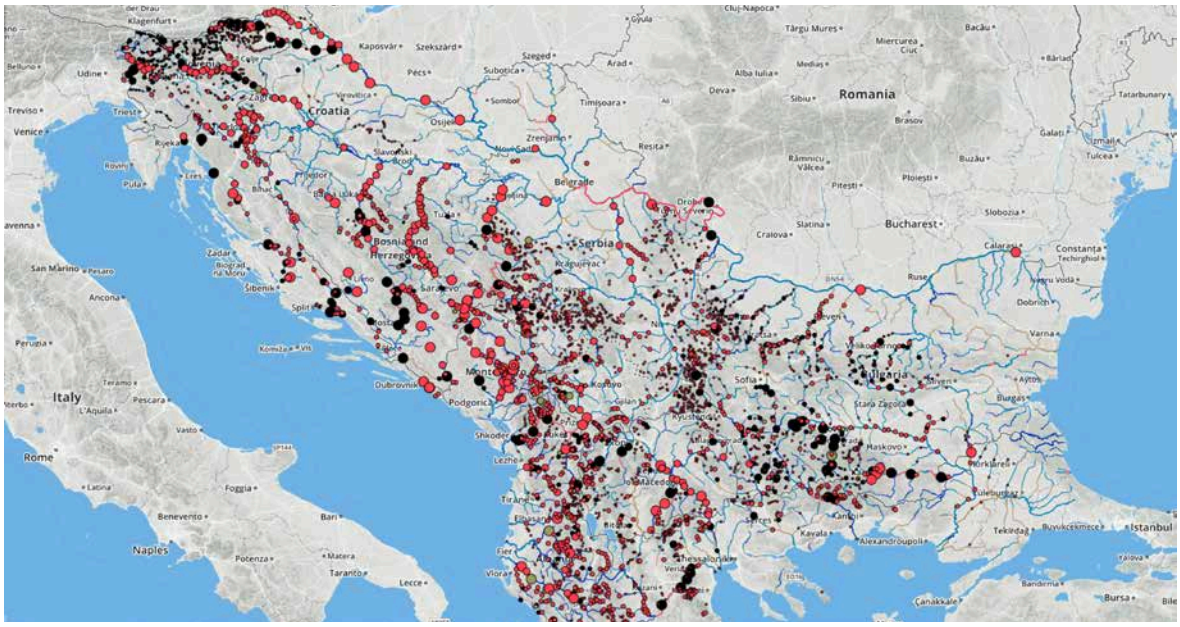
/ consider river engineering and infrastructural works as a stage of the incessant re-configuration of rivers' systems, going beyond the opposition between natural and artificial landscapes;

/ recognise activities like tourism and recreation the same way as agriculture or industrialisation, as prospective producers of unprecedented and brand new landscapes;

/ emphasise the multiplicity of landscapes and environments that over time and space overlap along river basins.

Such theoretical guidelines may find further and interesting applications in those territories which are now experiencing huge hydro-morphological developments, due to the increasing demand of water or energy supply, as well as the necessity of floods control. Under this perspective, the Balkan Peninsula, for example, represents probably the most relevant area in Europe where the conflict between

Figure 2.3: Existing (black), under construction (grey) and planned (red) hydropower plants of the Balkan Peninsula. (Source: Save the Blue Heart of Europe, www.balkanrivers.net)



socio-economic interests and environmental preservation requirements is about to explode. According to the study produced in 2012 by the Austrian agency FLUVIUS, providing the first comprehensive large-scale overview of Balkan rivers, almost the 80% of the 35.000 Km of the examined watercourses were in a very good, good or acceptable morphological condition (Schwarz, 2012). Such data collide, for example, with the fact that almost 2.700 hydropower plants (including small systems with a capacity of 0-1 MW) are planned to be built on the entire area (*Figure 2.3*) in order to guarantee additional energy sources for these young democracies' developing economies. Such circumstances get more complicated by the existence, along rivers, of hazardous industrial areas and infrastructures inherited by the Communist era and now dismissed. Here, the whole hydrography is set to change radically over the next few decades and the speed at which this is happening threatens to reiterate a mere technical-oriented approach leaving out more systemic opportunities aimed at reshaping social, cultural and economic networks. In this framework, blurring the boundaries between disciplines - such as engineering, landscape planning, geography, economy, etc. - is a paramount concern to shift the viewpoint having a more holistic approach to the subject of waterscapes evolution. Furthermore, even though a spatial planning approach needs to be implemented in order to evaluate environmental cost-benefits of infrastructural works, the forthcoming landscape that such inevitable transformations underlie will be also the result of a cultural attitude towards the concepts of instability and change which mark - as we are trying to demonstrate - the inner essence of river systems.

Figure 2.4: At the bottom, the Piscinas (in Red) and the Naracauli (in white) rivers passing through the plain before reaching the sea. Above, The Piscinas' red waters passing through the dunal system. (Source: Sara Cuccu's Master Thesis)

2.1.1 Risk Dimensions

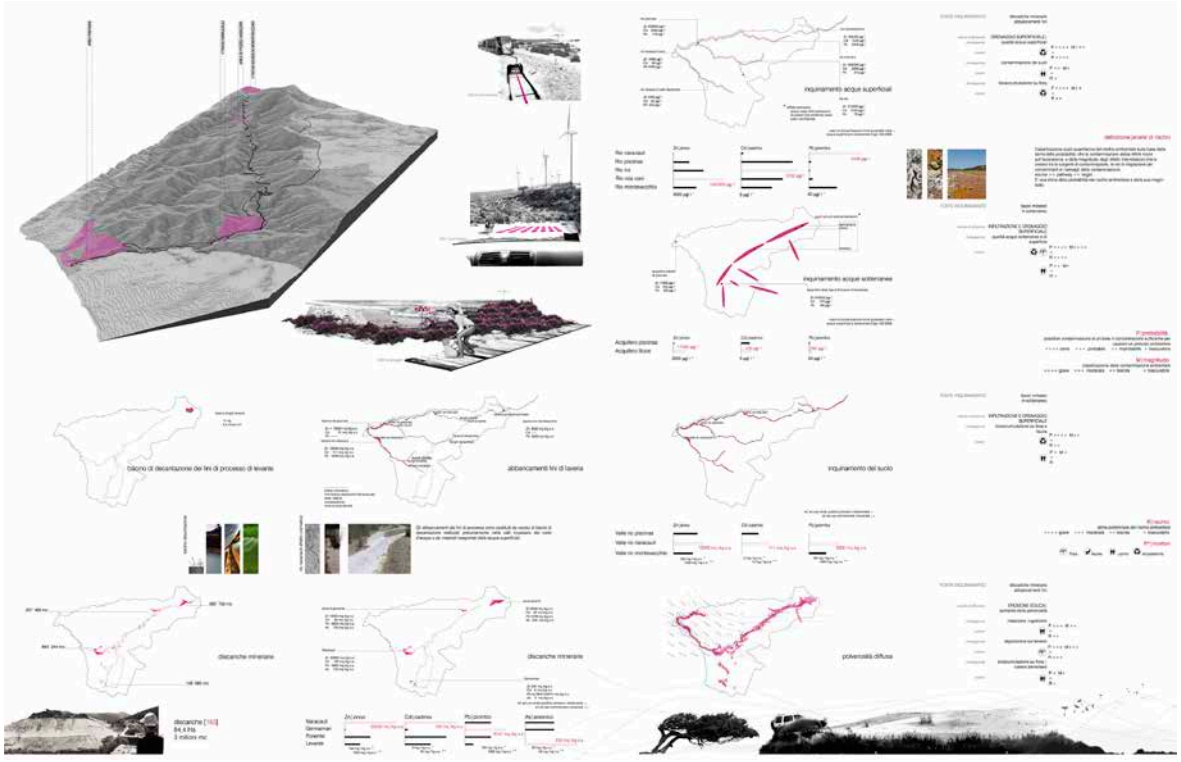
In both the applicative key studies presented below, the environmental risk management related to pollution and flood control, as well as the prospective of tourism developments, acts as strategic drivers motivating landscape transformations. The first project elaborates, within the context of a Geological and Mining Park, a step by step strategy aimed at combining polluted rivers' remediation works with new fruition and usage opportunities tied to recreational and cultural tourism, as well as to new production chains based on renewable energies. The second project deals with a set of problems affecting the Coghinas River's catchment area for which it proposes, along with an alternative approach to floods control, a strategy to involve the fluvial system within the territorial touristic offer, until now only focused on the coast.

From pollution hazard towards new 'repairing landscapes': the Piscinas and Naracauli proposal

The Piscinas and the Naracauli rivers, along with other minor ones, underlie the orographic and hydrographic system which stretches from the Piscinas's sandy beach to the dismissed mining area of Montevecchio-Ingurtosu-Gennamari. A wide project area where the traces of the ancient mining activities are still visible, not so much for the industrial heritage which is mainly concentrated around the mines and the abandoned villages, but as for the anomalies that occasionally mark an apparently uncontaminated landscape, considered one of the most outstanding natural reserves in the Mediterranean. The so-called 'Red' and 'White' Rivers (i.e. the Piscinas and the Naracauli rivers) crossing the reserve's extensive dune system (*Figure 2.4*) witness one of the main environmental problems affecting the area: the presence, in surface and ground waters, of cadmium, lead, arsenic, zinc, nickel and other heavy metals, due to infiltration and surface drainage from underground mining operations, landfills and dust accumulations.

Pollution problems have also affected the economic feasibility of the whole Geological and Mining Park area's regeneration, promoted by local authorities during the last few years: the attempt to involve private corporations in the industrial heritage recovery and real estate re-development has failed mainly because of remediation high costs. Anyway, such enduring status of abandon has gradually created a peculiar landscape where things and habitats blend into a whole ecology (Morton,

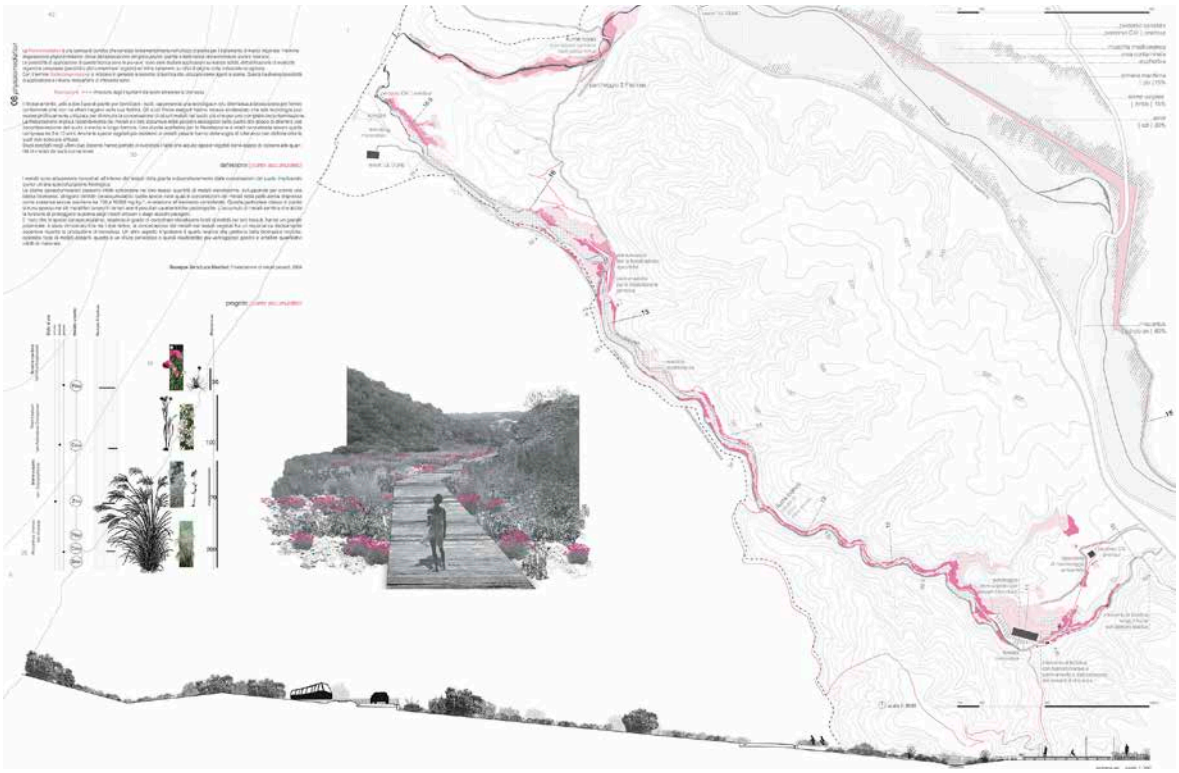
Figure 2.5: The expected risk assessment pinpointing priority remediation areas. (Source: Sara Cuccu's Master Thesis)



2007) whose charming balance already attracts a certain type of tourism that would grow if sustained by a proper strategy. Following these assumptions, the project addresses the site reclamation spotting those areas where existing tourist flows overlap major risk zones, pinpointed by a carefully expected risk assessment (*Figure 2.5*). This way, re-organising the Park services such as parkings, tourist facilities, sightseeing paths, etc., the strategy enables to start a progressive remediation process, economically more sustainable and well-targeted on real site fruition behaviours.

A set of additional functions and infrastructural works aims at enhancing the Park's visitors experience providing new elements on the landscape, reinterpreting under a contemporary perspective the site ancient productive purpose: exploiting, this time, those renewable resources -such as wind and sun- the territory is so rich in. The old mining street, that runs through the area crossing its main rivers until the beach, is converted in an Energy route characterised by the presence of wind turbines and photovoltaic fields, corresponding to rest areas and parkings. The latter are placed in those brown-fields where soil containment, stabilisation and solidification have been chosen as the faster and most effective remediation techniques, given the users' concentration and the more extended periods of time that people spend there.

Figure 2.6: The phytoremediation 'repairing landscape' along the Piscinas and the Naracauli rivers. (Source: Sara Cuccu's Master Thesis)



Among the other cores of the system, and especially along the new trails bordering the waterways, the approach is based on more progressive and cost-effective procedures, such as phyto-remediation or the application of permeable reactive barriers (i.e. PRBs) aimed at preventing pollutants migration and therefore the contamination extent (*Figure 2.6*). In summary, by adding further 'repairing' layers to the landscape (Lobosco, 2016), the project attempts to steer the area towards an improved morphological and ecological configuration which will be possibly able to engender new meanings and opportunities for its sustainable development.

From flood risk towards new 'performative landscapes': the Coghinas proposal

Sardinia's northern littoral hosts more than half of the regional touristic overnight stays (according to data provided by the Sardinia Region Statistics Service in 2014) and it is by far the area where the Tourism Pressure Index, as defined by Hadwen, Arthington and Mosisch (2003), reaches the higher scores. Here accommodation facilities and tourism settlements follow the established pattern of the resort-oriented sunbathing holiday, whose basic relationship with the context deals with static gazes upon a reassuring landscape. The need and the will to attract different types of tourists (like back-

Figure 2.7: The Coghinas River flowing into the Asinara's Gulf. (Source: Silvia Corgiolu's Master Thesis)

Figure 2.8: The Coghinas Rives basin placement among the the two main tourist destinations of northern Sardinia. (Source: Silvia Corgiolu's Master Thesis)

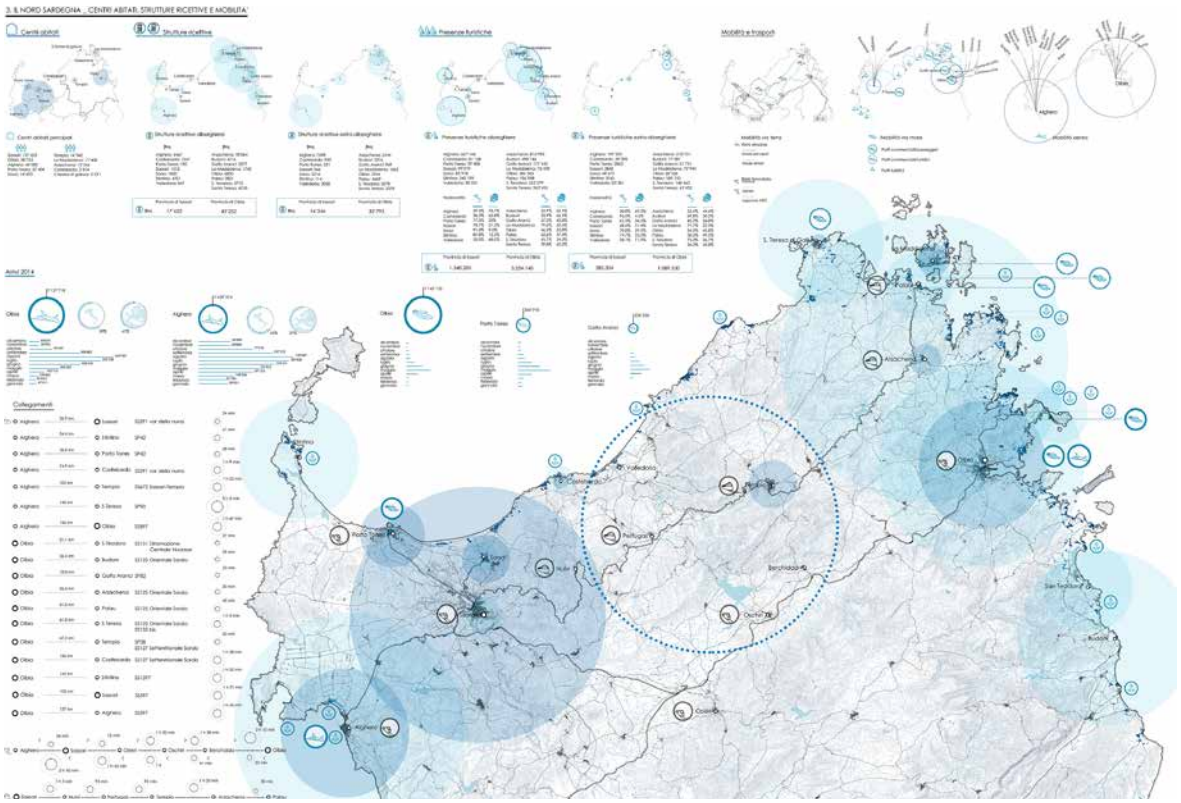
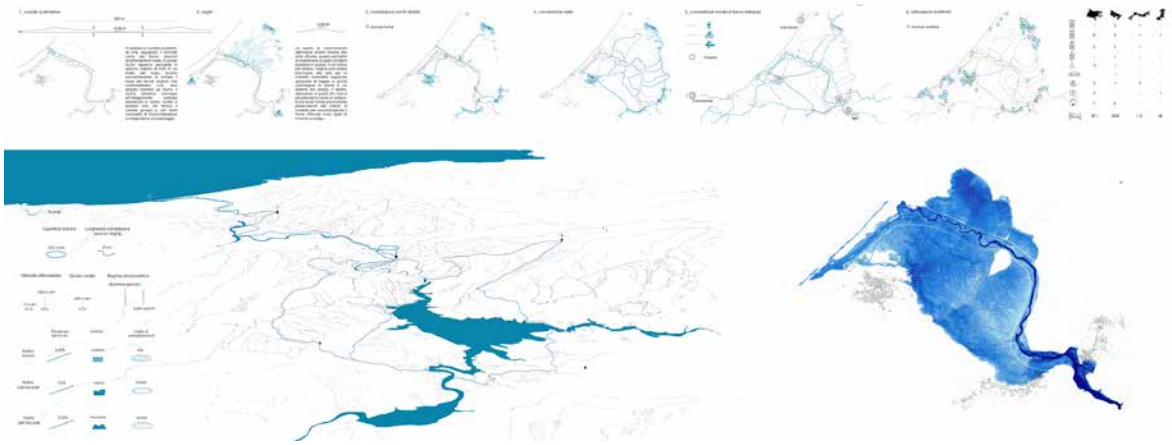


Figure 2.9: The project's alternative strategy to address the flood risk management on the valley. (Source: Silvia Corgiolu's Master Thesis)

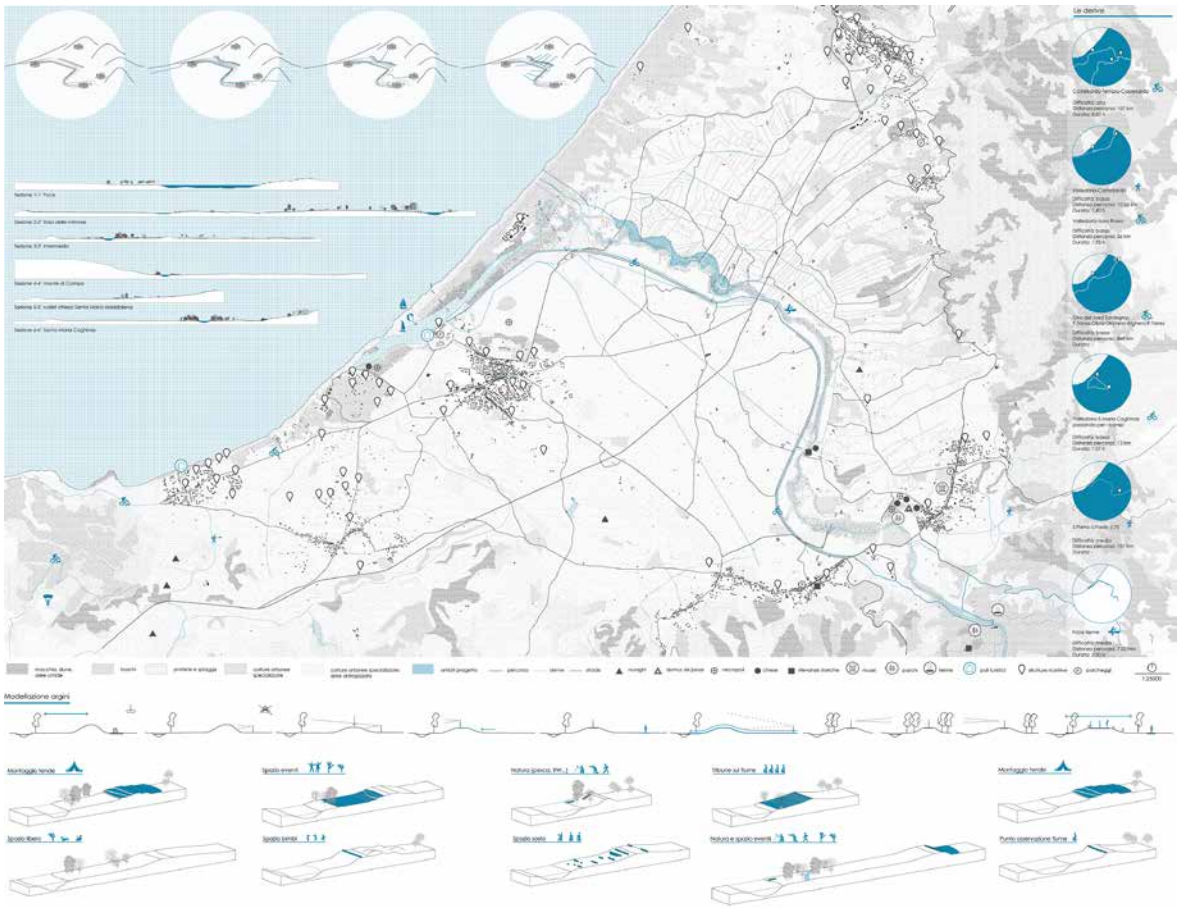


packers or trekkers) on this island's section require to uncover and make operational those territorial devices such as rivers, for instance, which would support a more dynamic and immersive experience of the landscape.

Under this perspective, the Coghinas's river basin represents a potentially strategic asset (*Figure 2.8*): its geographic location straddling the two most attractive parts of northern Sardinia assures a large pool of tourist catchment and a good accessibility level; its variety of anthropic landscapes and ecosystems allows to envision a diverse range of fruition opportunities to be explored. As the Coghinas's path stretches along about 123 Km, passing through two hydroelectric reservoirs (the Coghinas and the Casteldoria lakes) before reaching the alluvial valley and flowing into the Asinara's Gulf (*Figure 2.7*), the project strategy focuses on developing a set of works aimed at fostering the territorial itinerant enjoyment by resolving two orders of issues.

The first one concerns the accommodation topic: it is addressed by a network of shelters that recall the traditional temporary housing types of the rural Sardinia. They are designed to host groups of travellers (maximum eight people) along the route next to - or just above - the waterway and the lakes; they are arranged to set the trip stages according to well-defined, time-based evaluations. The shelters' typology changes depending on the context morphology, especially where the local hydrometric level variations are higher and require to put in place floating platforms or stilt house technologies. Beside such light infrastructural system, that mostly concerns the two lakes' borders, the proposal faces the challenge of transforming the current riverbanks' configuration on the valley, in order to provide the territory with a new relational space voted in recreational activities, sports and events.

Figure 2.10: The 'performative landscape' variations along the new Coghinas river banks. (Source: Silvia Corgiolu's Master Thesis)



In order to reach this goal, the project (*Figure 2.9*) revises the adopted Flood Risk Management Plan (i.e. 'Piano di Stralcio delle Fasce Fluviali' plus 'Piano Generale Rischio Alluvioni') whose expected defensive works may radically affect the continuity between the valley and the river raising (2,5 m) and strengthening the existing left bank while demolishing the right one. The proposed alternative solution reshapes the dune landscape around the river mouth, so as to create an artificial flood plain (i.e. flood bypass) designed to convey the waters excess in extreme conditions, corresponding to a 50-years recurrence interval. This intervention could consequently enable to keep the current height for the left riverbank - which is intended to accommodate cycling routes and trails - allowing to invest in the right one redesign, free from flood risk constraints. Here, a series of public spaces, equipments, facilities and functional areas (for events, sports, camping, etc.) compose a 'performative landscape' that puts the river at the centre of a new touristic scenario (*Figure 2.10*). Thus transformed, the entire fluvial system would be a unique attraction capable to improve and diversify the local touristic offer balancing safeguard necessities, economic expectations and development perspectives.

2.1.2 Reuse Dimensions

This section presents two applicative case-studies whose main topic is the reuse of man-made hydrographic systems born to satisfy huge water demands by emerging industrial sectors. Both territories, although very distant and different, share the same issue concerning what to do with these infrastructures once they become outdated for technical or economic reasons. By dealing with the reuse of the Conca River's artificial lake, placed next to the Italian northern Adriatic Riviera, the first proposal aims at inverting such tourism-related infrastructure functional role: from being a drinking water reservoir for the huge summer demand to becoming a recreational and environmental hotspot. The second project investigates a future potential reuse for the water distribution network connecting the many desalination plants built along the coast of Chile, in the Atacama Desert, to the copper mines on the Andes. Here, the fact that the infrastructure network life cycle is significantly longer than the mines' one gives the opportunity to plan for them an alternative to decommissioning that would be able to exploit such huge artificial hydrography for other purposes.

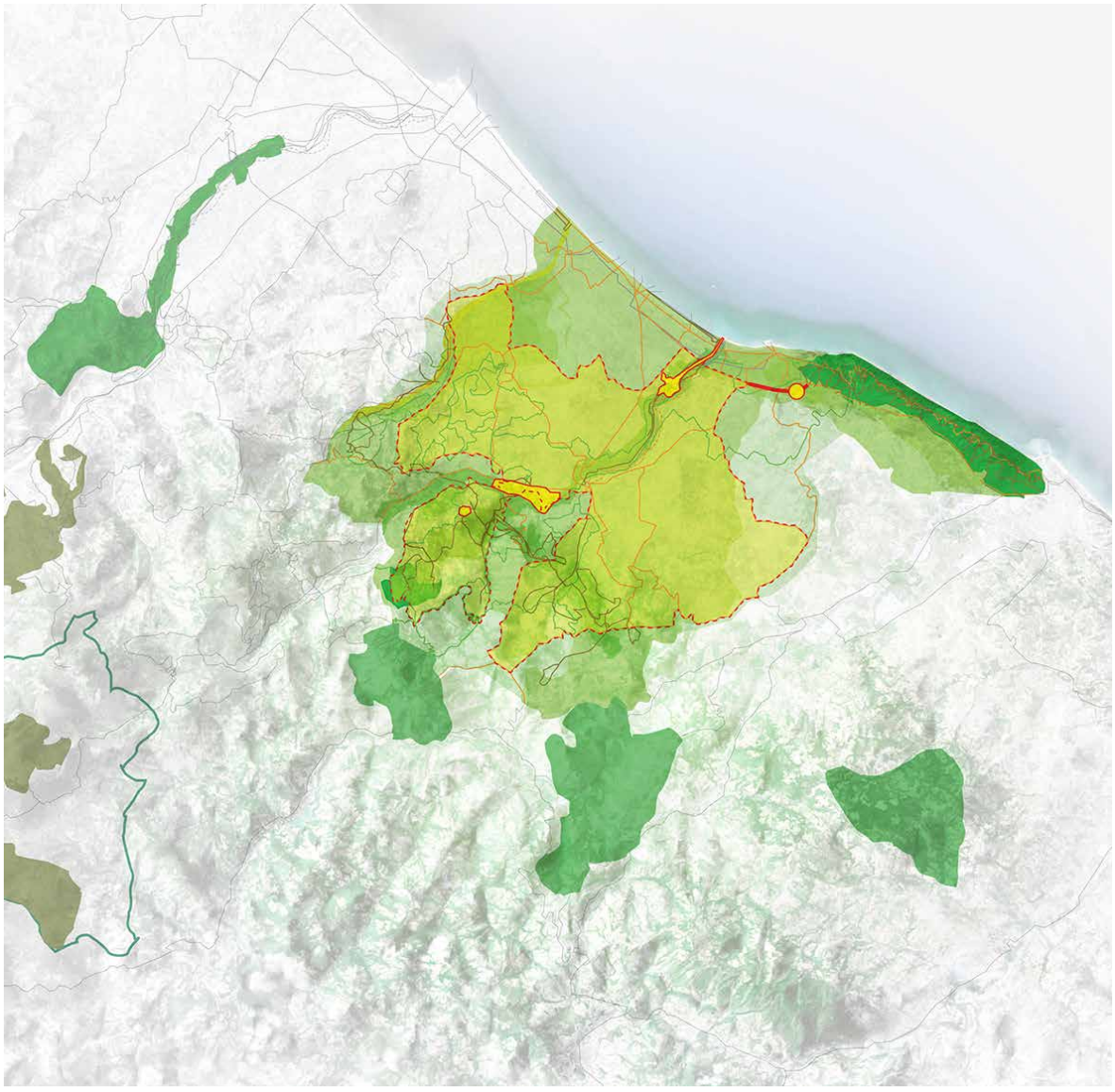
Inverting the hydrography mission: the Conca Reservoir proposal

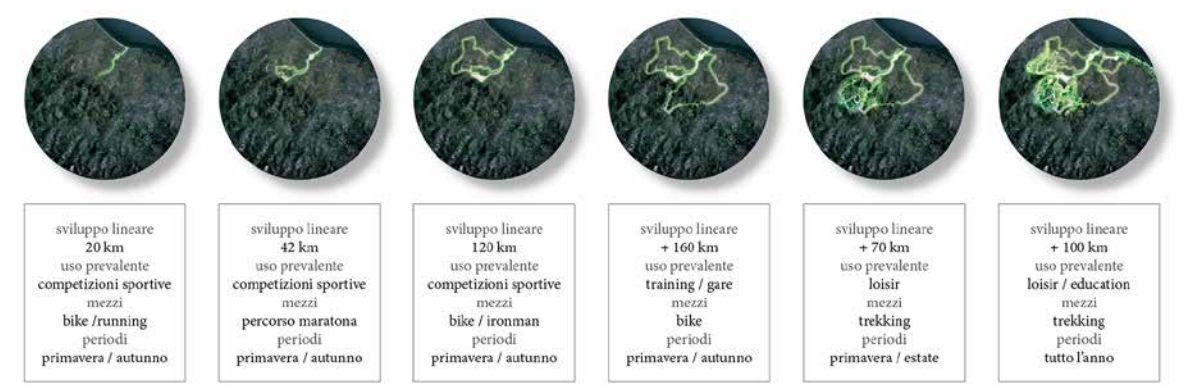
In Italy, at the turn of the '60s and' 70s, many infrastructures have been realized under the mass-tourism direct or indirect pressure. Most of these works are now obsolete, unused or over-sized; they are a sort of 'Boom's residue' and, in order to be somehow recycled, they ask for a mindset change that reverses their purely instrumental and operational function towards tourism, into a more complex one: as new public spaces and attractors, capable of mediate the relationships between temporary communities and residents.

The Conca Reservoir is an artificial lake placed at the altitude of only 20 meters above the sea level, very close to the coastline (just 2 km), between the municipalities of Cattolica, Misano Adriatico and San Giovanni in Marignano. Its dam construction began in 1971, but the whole system started operating only in 1983 with the main function of recharging the aquifers and though suppling the near touristic destinations with potable water especially during the peaks of summer demand. The water network improvements realized in the subsequent years, in parallel with the pond's progressive silting, have largely replaced the reservoir's original task which needs now to be rethought giving its

Figure 2.11: Territorial framework of the 'Wellness Habitat' research.

Figure 2.12: The 'Hiper-itinerary' usage scenarios and programming.





environmental value and its strategic position.

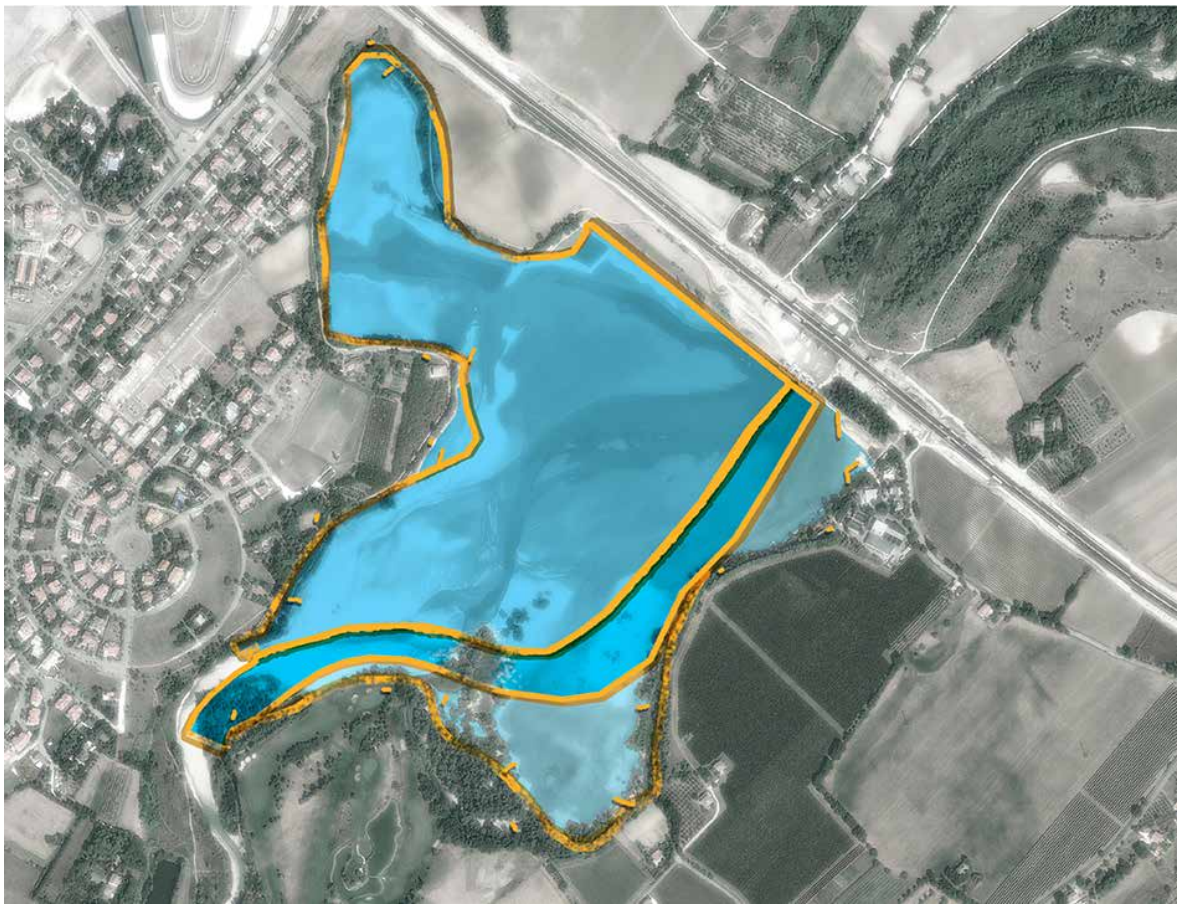
The reservoir's reference territory is a part of the so called 'Adriatic linear city': a metropolitan area that spans along the Emilia-Romagna coast representing one of the main mass-tourism destinations in the Mediterranean. During the summer, the spread between resident population and tourists is so high that infrastructural systems of any kind (such as mobility, energy, water supply, waste management, etc.) have been planned and realized according to a 'limit state' logic which actually produced an excess in some network capacity, especially taking into consideration their all-year operation. Resulting in a partial infrastructures' over-dimensioning, such issue suggests the existence of a certain unexploited potential in some of them. By connecting this topic to the progressive dropping of public spaces in favour of tourism-related facilities and settlements, new opportunities come to light concerning the multi-functional role of infrastructures in ultra-touristic territories. They may represent a last field of actions in which landscape planning can effectively operate in such almost totally densified and over-built contexts.

The working proposal for the Conca Reservoir has been carried on under these assumption with the aim of matching the hydric system retrofitting with additional functions related to recreational and cultural activities. Such purpose has required the parallel development of a wider program promoting alternative types of tourism based on the enhancement of cultural, environmental and landscape resources: the 'Wellness Habitat' program. Joined by 13 municipalities, it has focused on boosting a large scale touristic offer by equipping a vast territory with a network of outdoor sport facilities able to support events and attract new visitors.

In such framework our task was to organize and plan the physical 'matrix' that was due to arrange the various activities among the most significant spots of the entire area (*Figure 2.11*). The overall strategy has developed the concept of an 'hyper-itinerary' connecting different hubs and interesting, but isolated, paths. The main aim was to provide a first full-equipped and recognisable network capable of being set up according to different sporting events and exhibitions related to running, cycling, tracking, etc. (*Figure 2.12*). The system is mostly superimposed to the Conca River stream in order to integrate proper and indispensable hydraulic works into the itinerary implementation.

Specifically, the solution adopted for the Conca's artificial basin aims at exploiting the touristic potential of the site by shaping a new environmental balance increasing the reservoir hydraulic efficiency. The lake, whose area reaches 50 hectares and a maximum capacity of 1.4 million cubic meters,

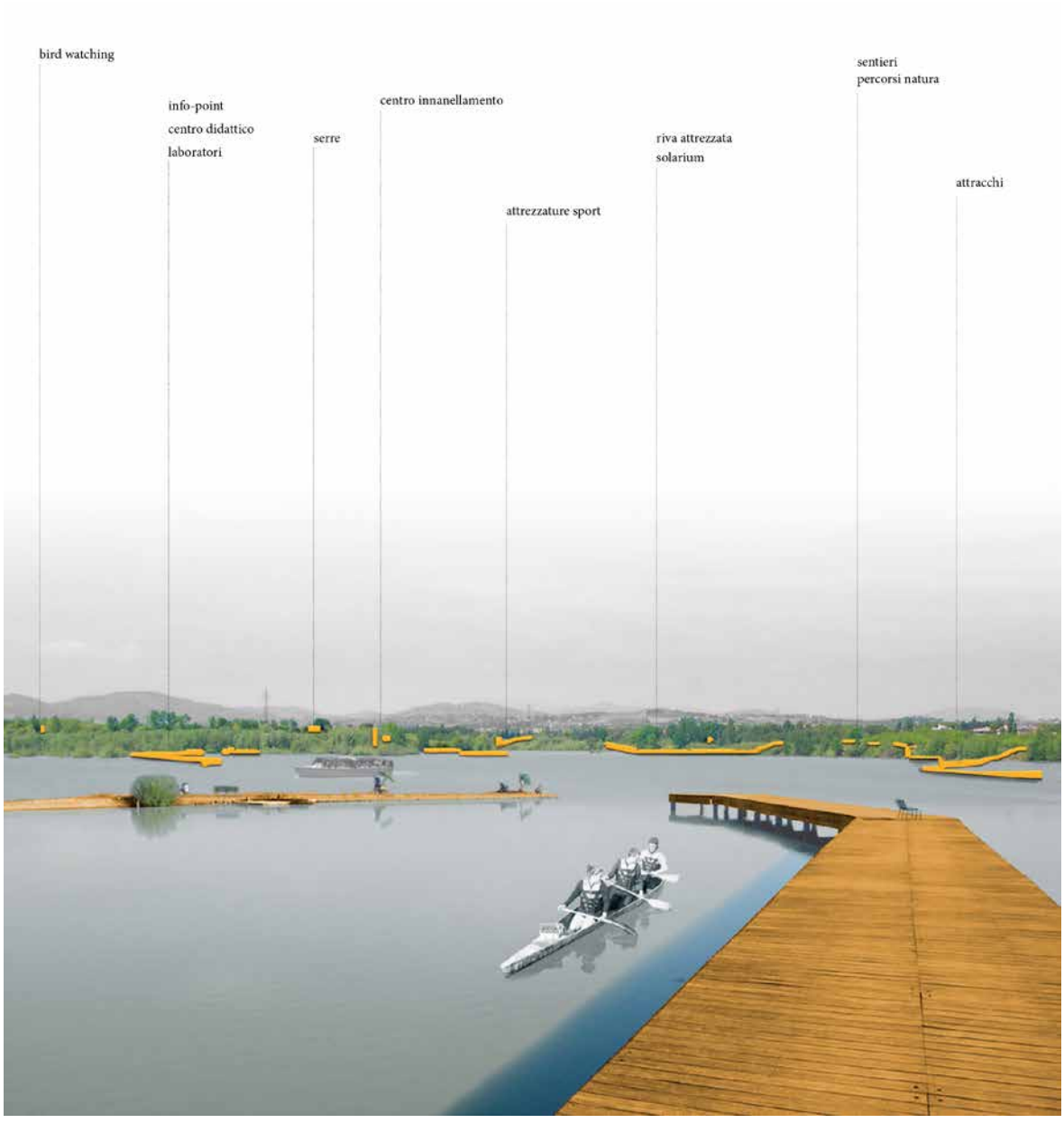
Figure 2.13: Reuse planning of the Conca River Reservoir.



is estimated to have a muddy deposit material for about 150-200,000 cubic meters. This situation compromises in large part its efficiency and has negative impacts on the water quality as well as on the site hydrographic security. Over time, alongside these problems, the reservoir has become an important biodiversity oasis thanks to its climatic location and its dissimilarity to the surrounding landscape. Furthermore, the proximity to the highway, to the coastline and to a whole range of international appealing facilities (such as the Riviera Golf & Horses and the St. Monica's Circuit) have contributed to make the reservoir a sort of geographic fulcrum for the area.

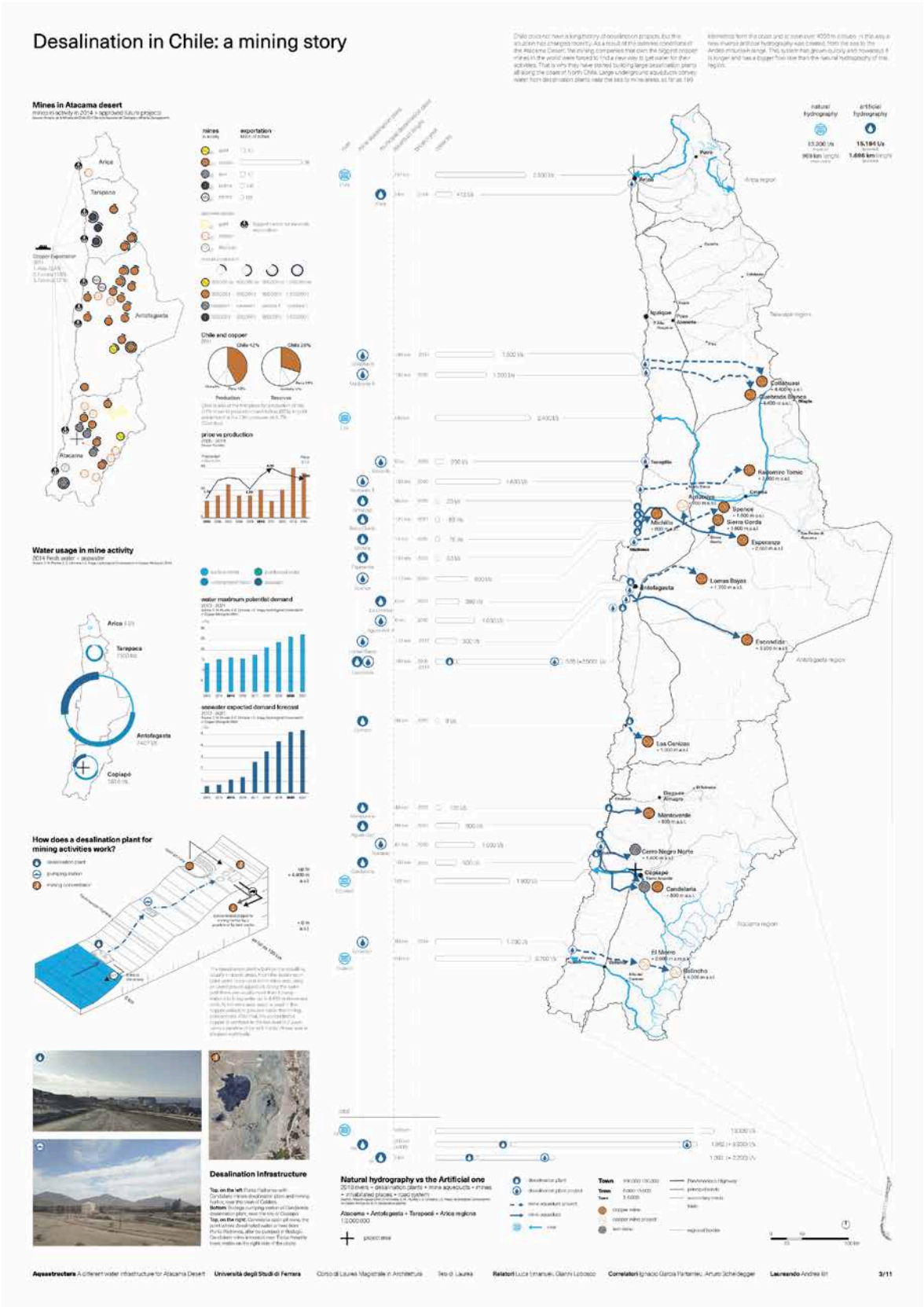
Starting from these analysis, the project investigates a landscape and usage scenario associated with one of the various technical alternatives proposed for the reservoir hydric retrofitting in order to understand the related advantages and opportunities. The solution permitting to enjoy the larger part of the reservoir all the year long has been taken into account: it consists in channelling the river towards a succession of mechanic weirs separating the basin into three different areas corresponding to as much water-flow regimes. From this scheme, the functional program for the reservoir has

Figure 2.14: Punctual interventions, new equipments and leisure services along the artificial basin's shores.



been planned arranging different services along a walkable circuit that overlaps the hydraulic works and emphasizes the lake shores (*Figure 2.13*). The aforementioned three areas have been treated according to their level stability and implemented with proper functions and recreational activities in tune with their different hydric behaviours and considering the water turbidity (*Figure 2.14*). In this scenario the Conca Reservoir becomes an important hotspot for nature hikes, birdwatching and water-sports adding to its former mission further usage dimensions related to the tourism in a different and more direct way.

Figure 2.15: The impact of mining system on the Atacama Desert hydrography in Chile. (Source: Andrea Bit's Master Thesis)



Diverting the hydrography purpose: the Copiapó Valley proposal

By analysing the impact of desalination process in the Atacama Desert, in northern Chile, the proposal considers what will happen to the associated water network once the mines for which it was built will be closed. The project aims at exploiting such existing and extensive system in the fight against drought and water shortage for drinking and agricultural purposes, as it has been already done in Israel or Australia starting from different conditions (Talbot, 2015a; Talbot, 2015b; Ehrenman, 2004). In order to demonstrate the idea feasibility, the last large farming area in northern Chile has been chosen: the Copiapó River Valley. Here, in the last few years, drought and water use by mines endangered agriculture. A reuse of desalination plants could solve at least part of the water problems of this area, providing potable water for inhabitants and ensuring irrigation. Grounded on this hypothesis, in a first instance, the work has had to deepen the desalination impact on the whole hydrographic system as well as on the landscape in order to figure out a prospective reuse scenario.

During 2014, the Chilean mining industry has used 12.7 m^3/s of fresh water. The forecasts about the future water demand in 2021 estimate more than 25 m^3/s (Prunés, Dintrans & Araya, 2015). To address this situation, mining companies have begun to invest in seawater, desalinated and not. In recent years the desalinated seawater has begun to be a viable alternative source than the traditional ones, given the fact that its production cost is decreasing thanks to a vast range of factors tied for example to the energy supply. Nowadays, in the Atacama region, almost the 27% of the whole used water comes from the desalination plats and the growth rate is 88% per annum. This trend would be further boosted by the introduction of a legal requirement that the Chilean Parliament is discussing since 2014 which will force mines needing more than 150 l/s of water to adopt a desalination plant.

Especially in the Atacama Desert, the water desalination infrastructure is creating a new artificial hydrography (*Figure 2.15*). Large underground aqueducts convey water from desalination plants near to the sea to mine areas, as far as 190 kilometres from the coast and at even over 4000 meters altitude. This system develops in the opposite direction (from the sea to the Andes) than natural hydrography. Its size, in terms of capacity and length, will soon exceed the rivers' one, also due to the progressive reduction in their flow rate recorded in the last few years (MOP, 2016). By calculating the capacity of the 10 built and the 12 planned desalination plants, the whole artificial water system, once fully operational, is estimated to attend an average flow rate of 15,534 l/s, against the 13,300 l/s featuring the all Atacama Desert rivers. Even the total length of the new artificial network, 1696 km, is almost

Figure 2.16: The current Copiapò River Valley mixed hydrography composed by natural and artificial systems. (Source: Andrea Bit's Master Thesis)

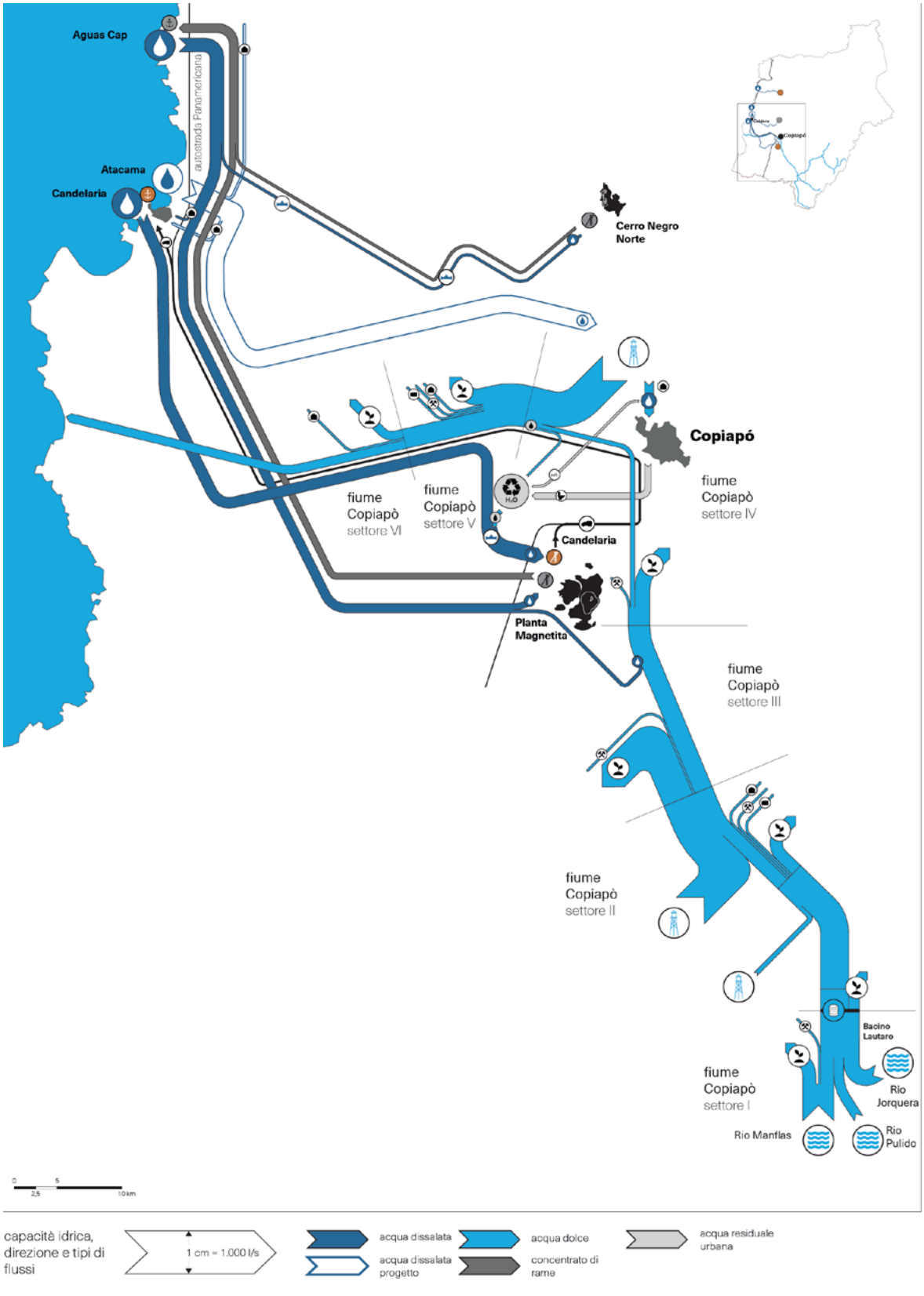
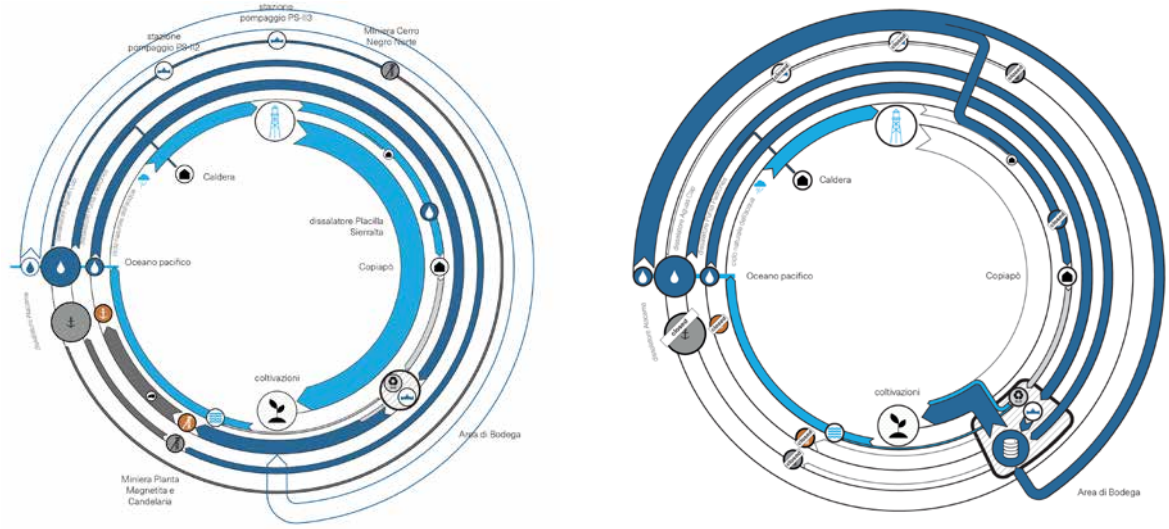


Figure 2.17: On the left, the current water system in the Valley; on the right, the scheme outlines the strategy for the simultaneous use of the desalination process and the water purification one, once the mining sites will be exhausted. (Source: Andrea Bit's Master Thesis)

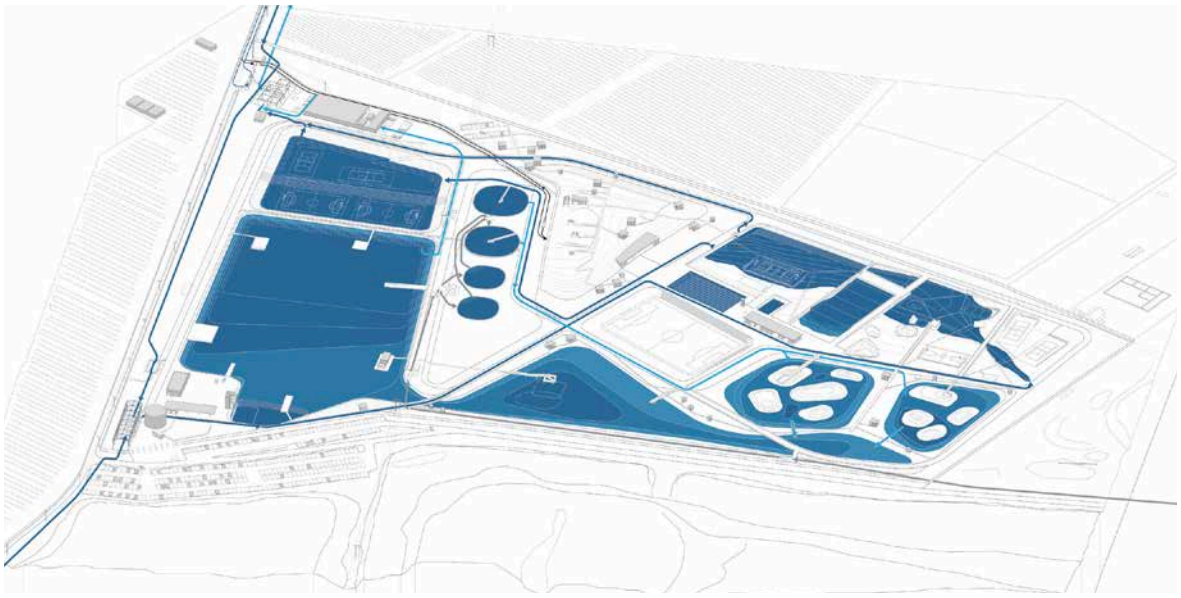


double the natural one amounting at 969 km.

These new water infrastructures have a major impact on the landscape as Roman aqueducts do, but in a different way: while Roman aqueducts affect the landscape with their architectural presence, mining aqueducts, invisible because underground, modify the landscape bringing water to an environment where there is a shortage of this resource. Unlike Roman aqueducts, mines infrastructures go out of use in a very short time as they serve copper mining and a mine usually lasts no more than 20 years. When a mine close all its infrastructures are left, creating a new landscape of gigantic industrial relicts in the desert.

Against this outlook, focusing on the Copiapó Valley area (*Figure 2.16*), the proposal develops a strategy for the simultaneous use of the desalination process and the water purification one, once the mining sites will be exhausted (*Figure 2.17*). Here, by referring to the official documentation presented for the mining projects (Cleanairtech Sudamérica S.A., 2010) the proposal has taken into account a 20 years time horizon for the desalination plants abandon: in 2036. By that time, if water consumption remain at current levels, we would witness to the gradual depletion water resources in the area. In this regard, by calculating different future scenarios about the aquifer's water consumption (MOP, 2011), we found that underground wells' level will continue to fall, until a decrease in water demand by 50% will be reached. Achieve this reduction is very difficult just focusing on water saving policies and on the improving of the network efficiency. The target would be easier achieved

Figure 2.18: The planned water storage infrastructure in Bodega, composed by two sub-systems: the purified and the desalinated water networks. (Source: Andrea Bit's Master Thesis)



by diverting the production of desalination plants from the mining industry to the aquifer: in fact they currently provide water for 1.100 l/s corresponding to the 36% of water demand.

In this hypothesis, the water redistribution would be firstly allocated to urban centres. Referring to the current data, the demand for drinking water is about 548 l/s. Consequently, 1382 l/s out of the 2100 l/s of desalinated water would remain at the agriculture disposal. To this last amount, additional 200 l/s coming from the Copiapó sewage treatment plant will be added because of their lower quality than the desalinated water. In such scenario, the main issue consists in how to manage the agriculture demand since it is, unlike the mining industry's one, extremely variable during the year with a minimum peak in winter and a maximum in summer months, in particular in January. For this reason, a new desalinated water reservoir needs to be built in order to better regulate the supplying. It will only work as a device facing temporary overflows due to variations in demand.

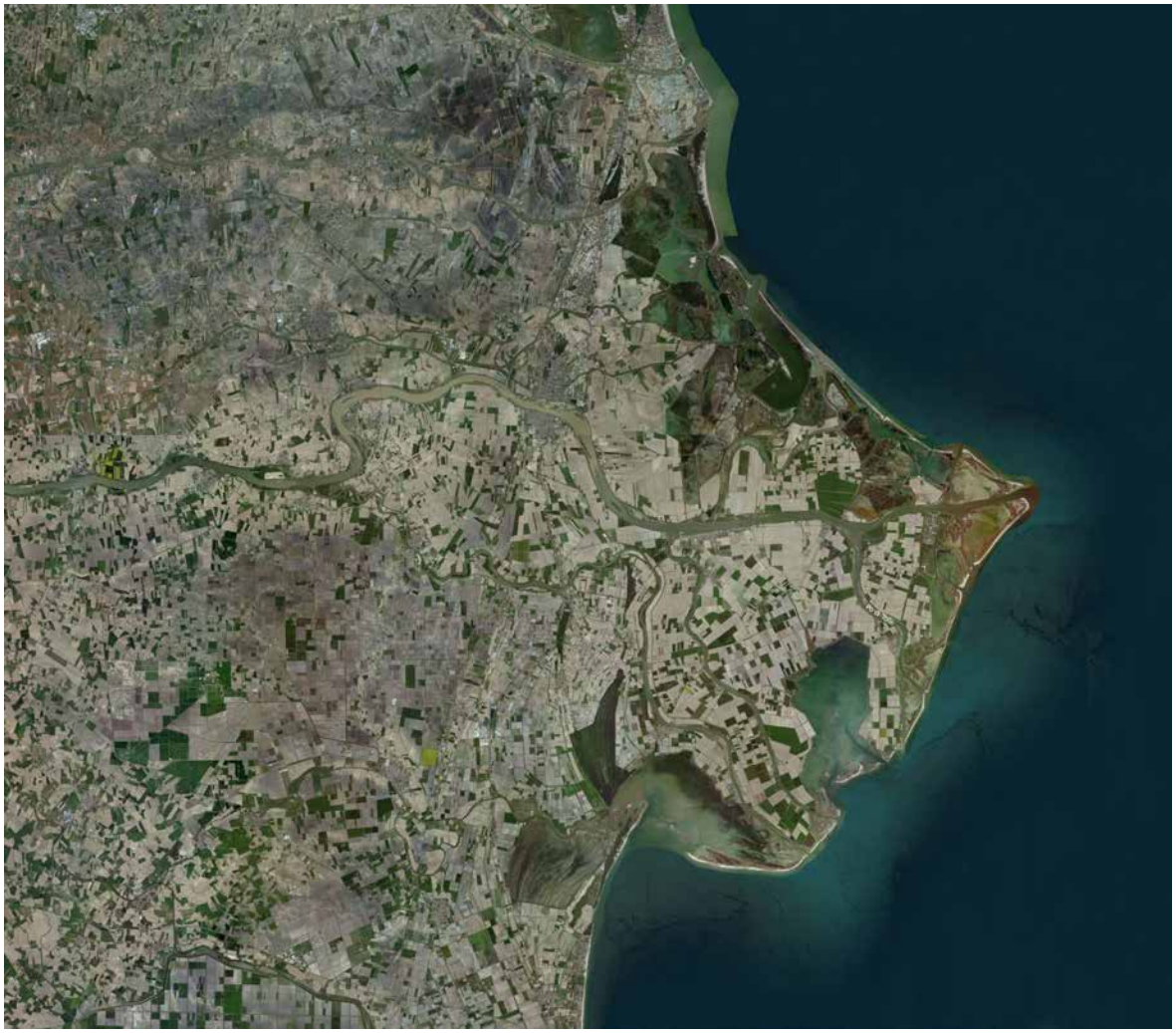
This water storage basin, being the core of a renewed mixed hydrography, has been planned at the intersection of the two sub-systems composing it (*Figure 2.18*): the purified and the desalinated water networks. In Bodega, among the sewage treatment plant area that currently hosts the pumping station, the new reservoir is be placed and integrated to the existing infrastructure up to shaping a new landscape where the water functional presence is exposed and used to create a wetland park in the desert, following the example of the 'Tres Rios Wetland' in Phoenix, Arizona. As in the latter, in Bodega, the aim is to develop a multi-functional program that, spanning over 22 ha, puts in a same

Figure 2.19: The plan of the water reservoir in Bodega integrating recreative and sports functions. (Source: Andrea Bit's Master Thesis)

system three different water basins: the desalinated water basin, the phytodepuration basin, and the purified water storage basin. A wide range of facilities related to outdoor and sport are arranged in a layout which is the consequence of an intentional and controlled superimposition of operational and recreational waterscapes (*Figure 2.19*).

In this park, the water presence allows to develop and preserve an unconventional habitat for its location at the edge of the town, in the desert. Here, visitors will be able to watch animal and plants species that inhabit the Copiapó river, but are currently threatened by its low water level. Finally, the park, working as a sort of biodiversity showcase of the desert habitat, can be read as a designed microcosm where the joint action of opposite subsystems contributes to the whole one operation and survival (McHale, 1970).

Figure 2.20: Satellite view of the present day Po Delta configuration. (Source: Lucia Ferrarini's Master Thesis)



2.1.3 Retreat Dimensions

Although in the previous applicative case-studies we have focused on the hydrographic system reuse, this section aims at showing an opposite approach to the riverscape topic concerning the increasing hydro-morphological and environmental degradation of lagoon systems. Such issue, shared by many Mediterranean contexts, should be tackled in specific areas by more radical solutions as the 'Selective Retreat Strategy' which has been proposed for the Po Delta system in northern Italy where the infrastructural efforts to freeze the landscape evolution are no longer maintainable and increasingly less efficient, given the site dimension and complexity.

Encouraged by specific boundary conditions like the low productivity of farming areas and the land ownership arrangements based on few big proprieties, the project envisages a progressive site reorganization according to its historical character of evolving landscape shaped, over the centuries, by the alternation of natural phenomena and human interventions. Through this applicative case-study, we try to understand which are the many landscape and technical dimensions to be managed in planning an abandon process.

Emerging conflicts in Delta Systems

Delta regions have always been attractive sites for human settlements, due to their fertility, abundant water supply, proximity to fluvial and maritime waterways, etc. Deltas are among the most densely populated areas on the planet. According to the International Geosphere-Biosphere Program (Bondre, 2014), they count more than 500 million inhabitants, almost the 7 % of the world population. Until the last century, life on deltas was largely subject to natural uncertainty and large floods were ordinary phenomena to deal with. Through the last two centuries the fluvial dynamics was however largely altered by human intervention, such as land reclamation and river embankment, in the majority of the deltas.

A raising conflict is taking place in many delta areas: human's will to exploit natural resources within a stable framework clashes against the dynamic processes constantly reshaping the delta environment. In the last decades, in the Mediterranean region, deltas have undergone an increasing environmental degradation. A rigid and unchangeable framework created by massif human intervention was

superimposed onto natural environments with a very large mobility (*Figure 2.21*). The sharp reduction in the sediment input, the large fresh water consumption, the man accelerated subsidence, the delta water salinization, the water eutrophication, the global climate change and eustatic rise combine to make the environmental management of delta area increasing difficult. Basic morphological elements such as coastal sand spits tend to wear out, failing in their task to soften the wave impact. Drastic reductions in flora and fauna population have also often been witnessed. Without human intervention, many delta areas would be rapidly submerged by fast marine transgression (Overeem & Syvitski, 2009).

The Po Delta System and its management strategy

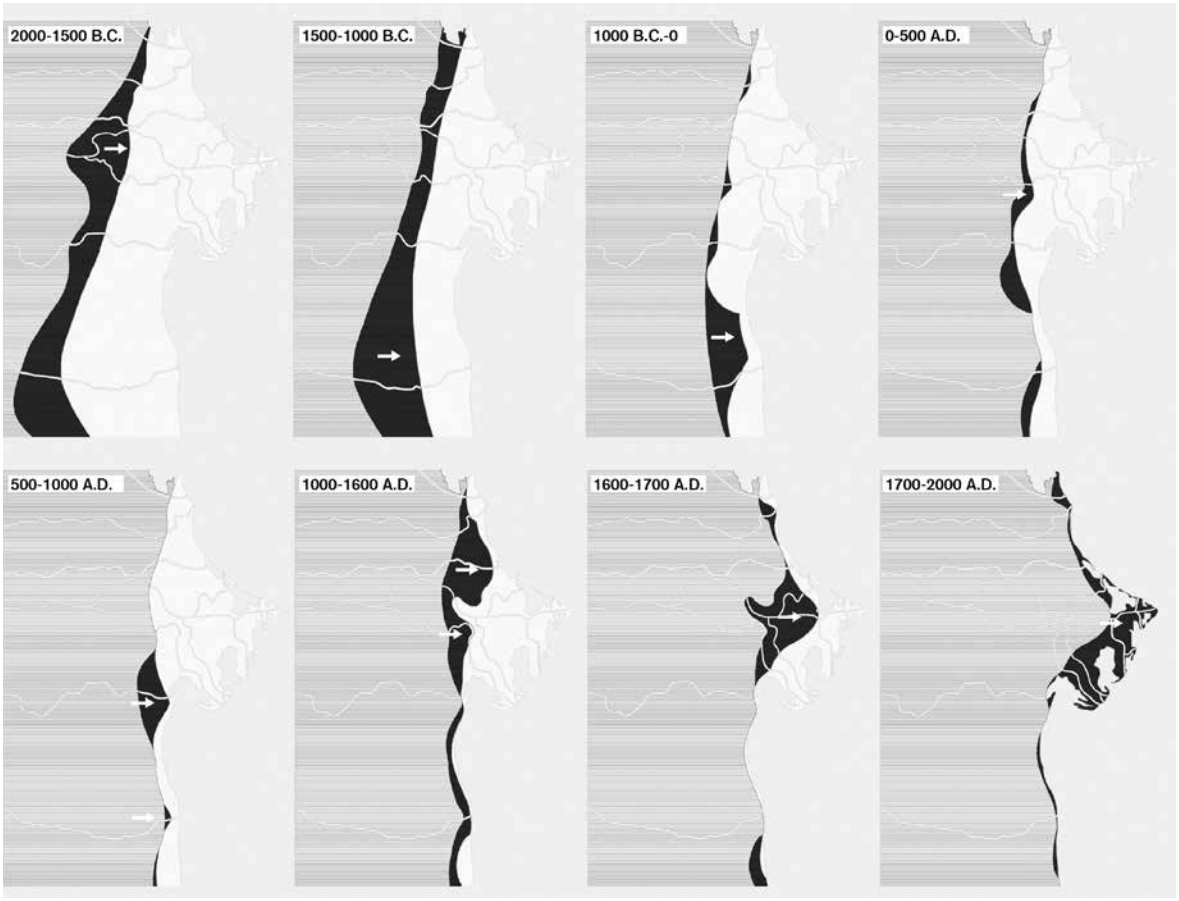
The current layout of the Po Delta of Northern Italy is the result of continuous anthropic actions started in 1604 with the so-called 'Porto Viro cut' which enabled the main distributary channel to flow southward, in order to protect the Venetian Lagoon from silting. During the centuries, similar works have been constantly carried out, in the double effort to defend settlements and reclaiming large areas from the sea. Nowadays, the Po Delta covers an area of 18.000 hectares, 8.150 of which are occupied by lagoons, 8.600 by fishing diked lagoons, over 1.250 by wetlands.

The present Delta morphology (*Figure 2.20*) is an over-engineered system in which any kind of interaction is hardened and strictly mediated and controlled. Against this logic, the Retreat Strategy aims to provide a different approach to environmental management and a long-term vision driven by pragmatic evaluations.

Through the last few years, a certain ambiguity in the landscape planning in coastal and delta contexts has grown. Scientific studies and planning procedures on deltas have mainly focused on environmental remediation, ecological restoration and the so-called 're-naturalisation' processes. According to this approach, the landscape should be brought back somehow to a previous 'natural' state, whose characteristics however actually belong to a very specific evolutionary phase. Fast evolving contexts such as deltas have often been considered and managed as if their dynamic attitudes were something to be fixed or eliminated rather than being included into planning policies.

The European and National regulatory framework itself, following the same logic, identifies protected areas and high environmental interest zones, known as 'Natura 2000' sites (under the 92/43/CEE 'Habitat' Directive), as permanent in time and space. This is in sharp contrast with the high natural

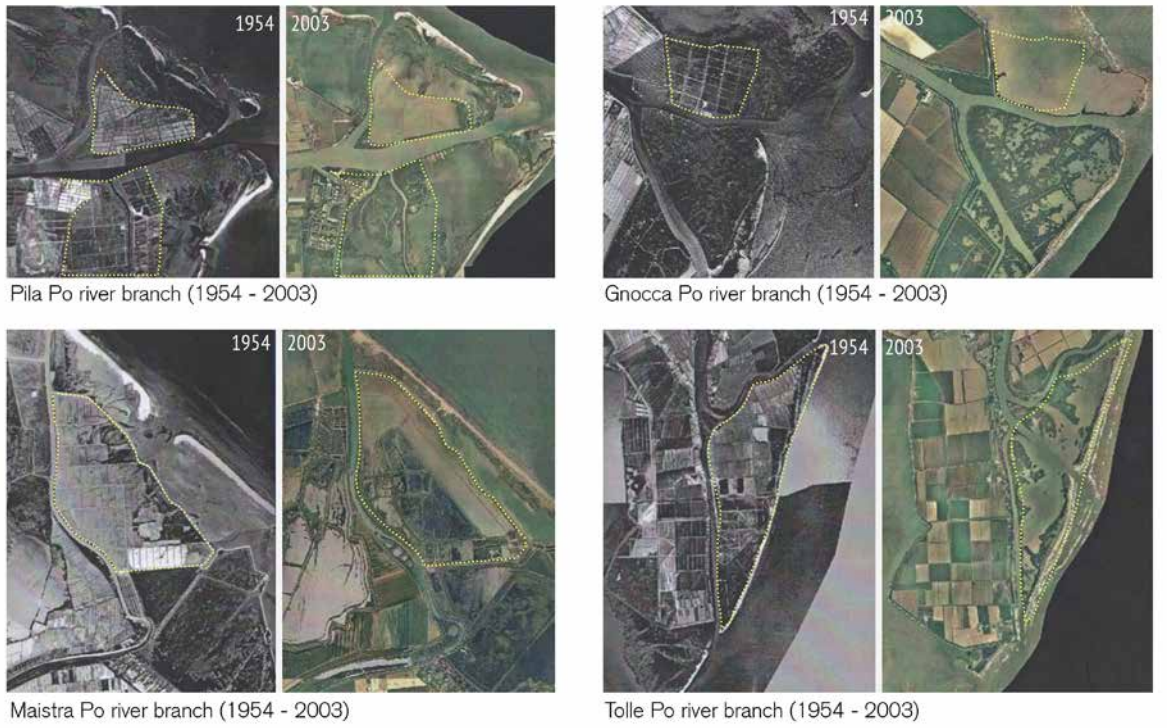
Figure 2.21: Age of deposition of the different sediment belts now forming the Po Delta coastal plain, between the Venice Lagoon and Ravenna. (Source: Lucia Ferrarini's Master Thesis)



mobility of the deltaic systems. Littoral zones, dune systems and wetlands need to be identified and protected through more flexible instruments assuming their mobility and also the chance to be relocated elsewhere. In a near future, the delta planning authorities will not be any more able to manage environmental changes without being allowed to take more radical and fast decisions. Environmental protection instruments, as the ones mentioned before, need therefore to be updated and adapted to highly mobile context framework.

The comparison of different generations of aerial photos, taken since 1950, shows the ongoing process of the sea retaking its space on the Delta top plain, re-flooding broader and broader areas and affecting human activities, settlements and their safety. At the same time, territorial policies are still mostly tied to the assumption that an ideal Delta environment exists and must be kept 'frozen' at any costs. Several environmental emergencies have however been threatening the Po Delta fragile balance.

Figure 2.22: Examples of the widespread erosive retreat affecting the delta coastline. (Source: Lucia Ferrarini's Master Thesis)

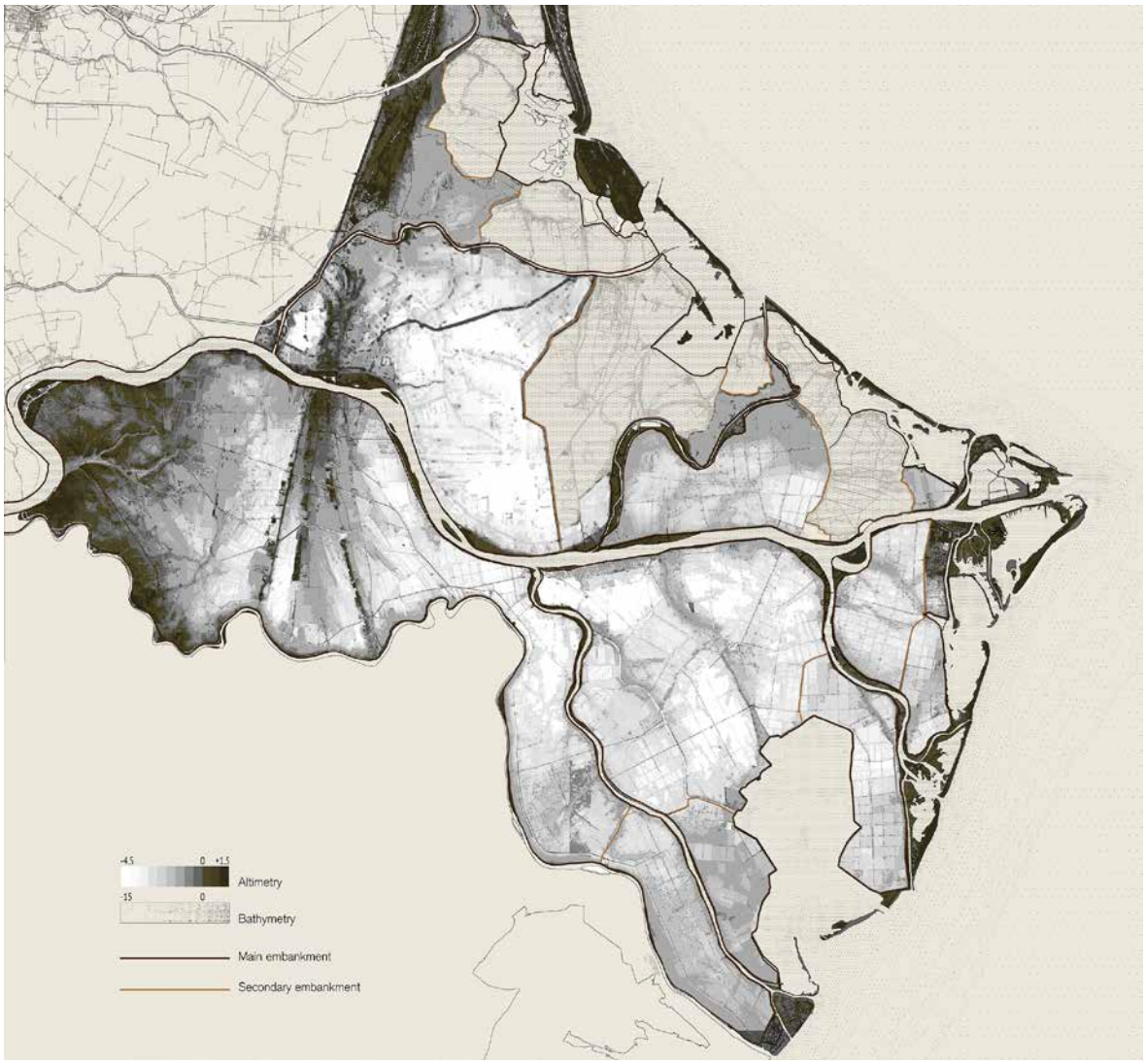


The relative sea level rise (subsidence plus eustatic rise) by boosting the saltwater intrusion already negatively affects most of the cultivations. A critical factor is the constant reduction of fluvial sediment supplies to the sea, mainly due to the extraction of raw materials all along the river course (*Figure 2.22*).

From 1958 to 1981, the loss of sediments contributed to the Delta system has been estimated at 90-95 million of cubic meters (Simeoni et al., 2007). Dramatic subsidence acceleration, started in the '50s in the Po Delta, due to an intense methane baring water extraction. Between 1950 and 1980, the coastal Polesine area experienced a sensational subsidence (Tosini & Colombo, 2009) of up to 40 and 60 mm per year! Extraction was totally forbidden in the 70s, but only during early '90s the subsidence value started to go back to more natural values of approximately 2-4 mm/y (Bondesan et al., 1995).

More than four-fifths of the area is already well under the average sea-level, even bellow - 4, 5 meters. The altimetry condition is worsened by external factors, such as the global eustatic sea-level rise predictions that are to be about 1-1, 5 m by 2100, according to the Intergovernmental Panel on Climate Change.

Figure 2.23: Po Delta plain elevation model; note that the vast majority of the area is presently well bellow sea-level and is artificially kept dry by large land reclamation works. (Source: Lucia Ferrarini's Master Thesis)



Examples of selective Retreat

The combination of fast subsidence, eustatic rise, climate change, and sediment input starvation, water pollution, deterioration of the infrastructures will soon make maintaining the current Delta configuration very difficult. Even more rigid protection works will be required, causing a further stiffening of the entire hydro-morphological lagoon system. Persisting on this course of action implies building in the future even higher embankments to protect sunken and unprofitable areas.

The futile attempt to crystallize and fully control such a changeable system is a losing approach, as events have already shown. In the long-term, such efforts will not be sustainable, neither environmentally nor economically. Innovative strategies grounded on the intrinsic dynamism of the Po Delta system are therefore strongly needed. It is clear that the present rigid environmental framework will

soon become untenable and a retreat of human activity from the artificially reclaimed areas well below sea level will become unavoidable (*Figure 2.23*). A project of 'Selective Retreat Strategy' implies policies aiming at abandoning to the marine transgression selected delta areas and at re-organizing the whole delta dynamic landscape.

Different desertion plans have been already carried out in different region the world, but as an answer to different issues, needs, and objectives. These examples are mostly the result of powerful economic interests. Entire villages and communities have been moved, to allow the construction of highways and dams. This is the case of, a southern Australian town that has been moved for about 8 km in the '50s to make way for the expansion of the massive Lake Hume Dam; more recently, in 2008, the Hubei Province of China witnessed the relocation of 1.24 million Sandouping residents, due to the construction of the 'Three Gorges Dam', a major infrastructure crosscutting the Yangtze River. In others cases, a crisis resulting from aggressive mining close to the towns forced the relocations. For instance, in the late 1910s, the Minnesota town of Hibbing was moved two miles southward because of unstable ground caused by the town burgeoning iron mine. A similar destiny is now affecting the northernmost town in Sweden, Kiruna, which is currently caving in of the over-mining in the large Precambrian iron deposit. Officials are now tasked with moving the town 2.5 miles eastward, in order to enlarge the mining site, keep the inhabitants safe, and develop an improved modern version of the city.

The proposed 'Selective Desertion Strategy' for the Po delta aims at integrating such external forces into a long-term sustainable scenario of growth for the deltaic territories. 'Leaving the Delta' plan a retreat scenario, selecting areas to selectively flood or further protect, in order to develop new landscapes and new socio-economic opportunities. Such aims can be achieved only by taking radical choices rather than continuous technical compromises. A deeper awareness of Po Delta dynamics and more flexible planning rules are however needed. Nowadays, the whole Delta territory is still highly fragmented in terms of planning and management authorities and this is a notable weakness not only for the proposed strategy implementation, but for any kind of policy that will be applied in the future.

A closer cooperation between public and private stakeholders, investors, enterprises and the inhabitants is also needed.

Selective Retreat Strategy: leaving the Po Delta

The proposal of a 'Selective Retreat Strategy' is rooted in an ongoing investigation aimed at the definition of new strategies to landscape, infrastructural and environmental evolution planning of coastal regions. The investigation is framed within a research programme on 'Hyper Natural Environments' developed by the Sealine Research Centre of the Architecture Department, University of Ferrara. This multidisciplinary investigation involves academics, professionals, and university students alike into a shared research effort. The study started by analysing potential risk scenarios forecast for the next decades. Extreme events such as sea storm surges, very high tides, and river floods were taken into account to highlight the large vulnerabilities and weakness spots of the Po delta area. The Po delta plain was subdivided into areas showing different levels of vulnerability, according to their propensity to river and sea flooding. An increasing 'porosity degree' level has been assigned to these areas to subdivide the whole of the Delta territory into areas with homogeneous 'prospective retreat levels'. On this basis, the retreat strategy has been planned, aiming at both protecting and boosting the anthropic system developed in this fragile coastal area.

The analysis takes into account several key parameters.

/ *Areas below the sea-level and coastal morphology vulnerability:* given the severe subsidence affecting the Delta and the lack of sediment input, it is highly important to safeguard areas still l above sea level. It is also important to describe the areas more susceptible to coastal erosion.

/ *Ecological habitats quality:* it is possible to pinpoint the most valuable biotopes and foreseen their preservation, on the base of several ecological studies (Pagnoni et al., 2009) measuring the biodiversity level in the Delta.

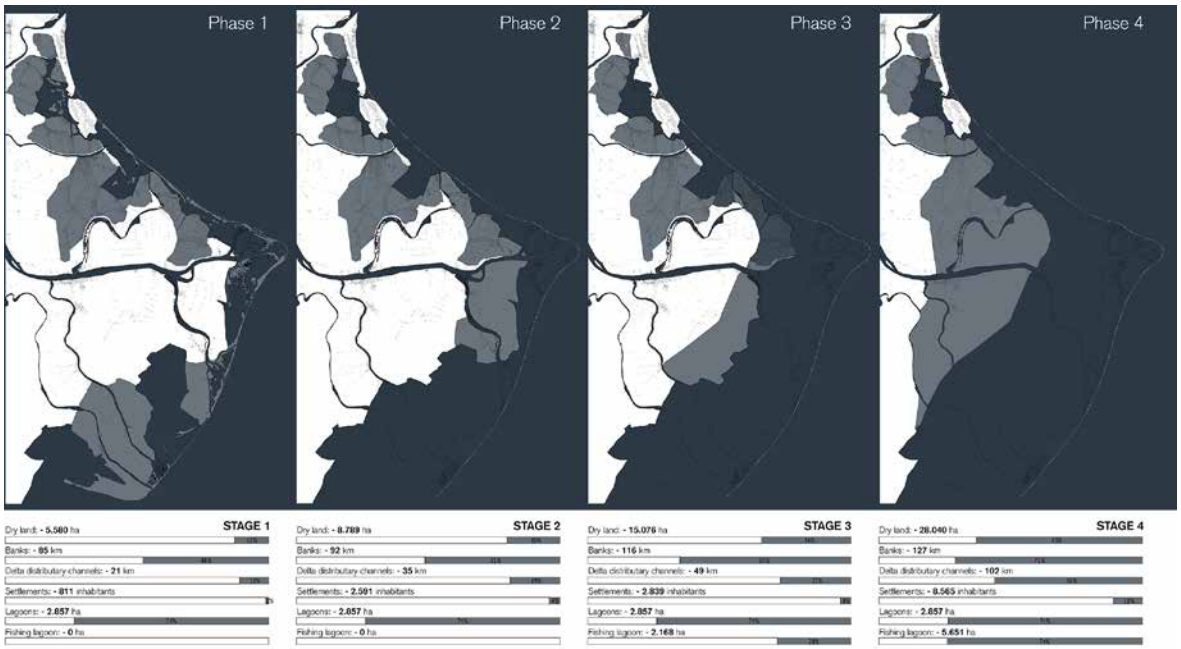
/ *Settlements importance:* the Po delta, unlike other deltaic areas in the world, has a low and further decreasing population density (93 inhabitants / km2; Tosi, 2013), nevertheless some villages have to be preserved due to their consistency and socio-economic value; due to the extremely recent geological origin and anthropic colonization, no historic centres are developed in the area.

/ *Existing economic assets:* the most profitability areas, such as fishing lagoons, have to be preserved. Some sites industrial archaeology sites, related to XIX and XX century reclamation projects.

/ *Future development assets:* some dismissed or underused areas could play, in the future, a central role for the development of tourism, transports and environmental functions.

On the base of these analytical inputs, four successive retreat boundaries (i.e. desertion lines) have

Figure 2.24: Planned stages of the anthropic retreat from the delta plain. (Source: Lucia Ferrarini's Master Thesis)



been planned. These main steps will be leading to increasingly safer configurations of the Delta system. The planning has been traced to reach a progressive economic balance in the Delta hydro-morphologic management.

/ Emerging lands are planned to decrease of 13%. in the first step, and 63%, in the last one.

/ The embankments length will decrease of 48%, in the first step, and 71%, in the last one. The associated maintenance cost-saving will be effective from the beginning of the process.

/ The delta distributary channels will shorten of 11% and 56% in the first and last phase. The channel shortening will increase the extremely low gradients, supporting an improved water flux.

/ Lagoon area is expected to decrease by 74% in the first step, to then increase through the flooding of new areas through the following project steps.

/ The spontaneous wave erosion of the newly flooded coastal area will mobilize millions of cubic meters of sediment, now stored beneath reclaimed area, already bellow sea-level. The sediment will be involved in the reshaping of the coastline, through the sea wave action, locally matched with artificial nourishment of sandy beaches.

/ The inhabitants displacement would involve the 2% of the delta region population at the first stage, up to the 11% during the eventual phase, involving a maximum of about 8.600 people. The ongoing population decrease and the incomplete demographic turnover of the elder component will likely

further reduce the number.

In many cases, persisting in the protection of anthropic habitats would be economically unfavourable if compared to balancing their loss with the re-design of similar new sites elsewhere; in other cases, flooding an area would not be economically convenient. For instance, the huge dismissed thermoelectric plant in Porto Tolle, if flooded, should have to be completely remediated: an expense far greater than the investment required for keeping it dry and re-functionalizing it on a touristic perspective. At every stage of the retreat process some sites are planned to be preserved from flooding (*Figure 2.24*), to form an artificial archipelago in front of the Delta where several services and infrastructural facilities will be developed. Existing embankments or harbour works could be saved becoming marinas or off-shore cruise docks, with the aim of boosting the maritime accessibility to the area. Small isolated villages, such as Santa Giulia, San Rocco and Gorino and other sites below sea-level, could be networked and converted into diving parks. The whole archipelago system, besides its value as a focal element within the landscape, would probably act as a catalyst for the development of the Delta tourism.

The project is now focusing on two main operative layers: the mobility infrastructure network and the wetlands system.

The infrastructural system needs to be reset before the starting of the regulated flooding process. Both existing and new infrastructures have to be connected to manage the population and economic activity resettlement. Several interventions are planned for resetting the territory according to the new scenarios which would imply, for example, the population increase in some areas and functions losses in others. Roads will be designed following short and long term previsions on rising relative sea-level and catastrophic events. Roads already are well under sea-level and exposed to a high flooding risk will be abandoned. The new mobility network is planned through two types of roads corresponding to an increasing resiliency level.

The first level consists in seasonal connections, conceived to be flooded under extreme overflow conditions, being just over the average sea level. They will shape the wetland landscape when the most advanced protections are dismantled. The second one is designed to be a long-lasting infrastructural level. This road system is patterned after existing main roads and embankments, set up to a safety elevation, and will ensure durable connections between dry lands. Road infrastructure will become the supporting framework to the retreat process, catalysing new functions and re-shaping the Po Delta's

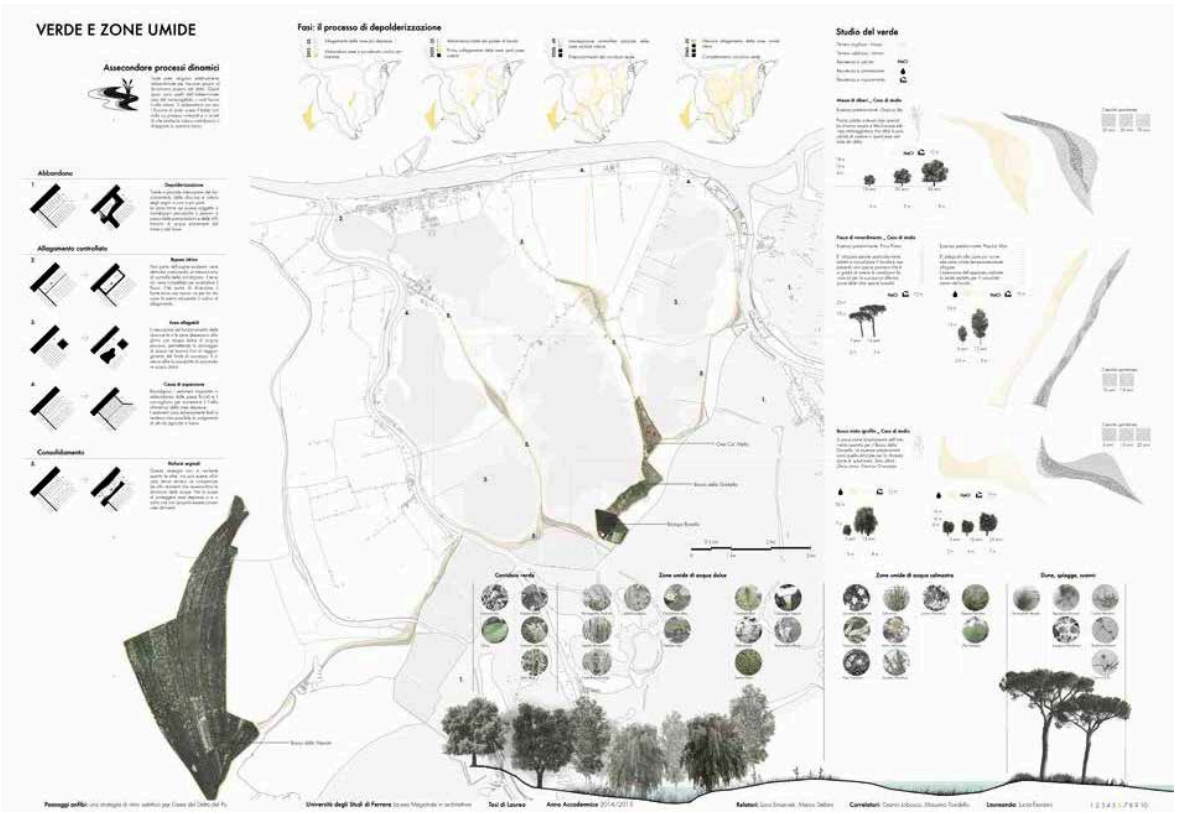
identity. Unlike today, the future Po Delta landscape will lay on a 'branched' fruition system, rather than on the monotonous zoning of single-purpose areas (*Figure 2.25*).

The present territorial layout, as developed from the 1951 Land Reform planning (Milan, Perini, Tognon, 2004), appears to be a large and uniform carpet, where rectangular fields and scattered houses monotonously recur. A few peculiar sites standing out from this uniform, flattered context struggle to become perceivable and attractive. The new mobility network is planned as a recognizable element within the landscape. Through the retreat process, the road infrastructure is designed to become a touristic element in itself, offering a unique way to visit the Delta and its 'water landscapes'.

To control these environmental dynamics, the project strategy relies on the coastal defence and buffering potential of wetlands. The areas will limit coastal erosion by dissipating the marine wave energy and by providing sediment generated by the erosion of the freshly submerged areas. Wetlands also behave as expansion basins for river floods. Wetlands importance is also associated with biodiversity conservation. All qualities should be measured in the long term and according to an overall management of the different Delta's habitats. Along the coastline, after removing a few portions of embankments, the sea will quickly retake large areas. In inner lands, artificial basins will keep fresh waters in order to prevent the salt water wedge intrusion from reach the inner delta plain and to improve the productivity of the remaining fields. In some cases, the flooding process will be achieved just by shutting down a few water pumps, so that the rain water could fill the lower lands. It is almost impossible to exactly predict the final configuration of the coastline and the way the sandbars will migrate over the years. The persistence of a lagoon belt and inter-distributary bays between the coastal sand spits and the new delta borders is certainly the most likely scenario.

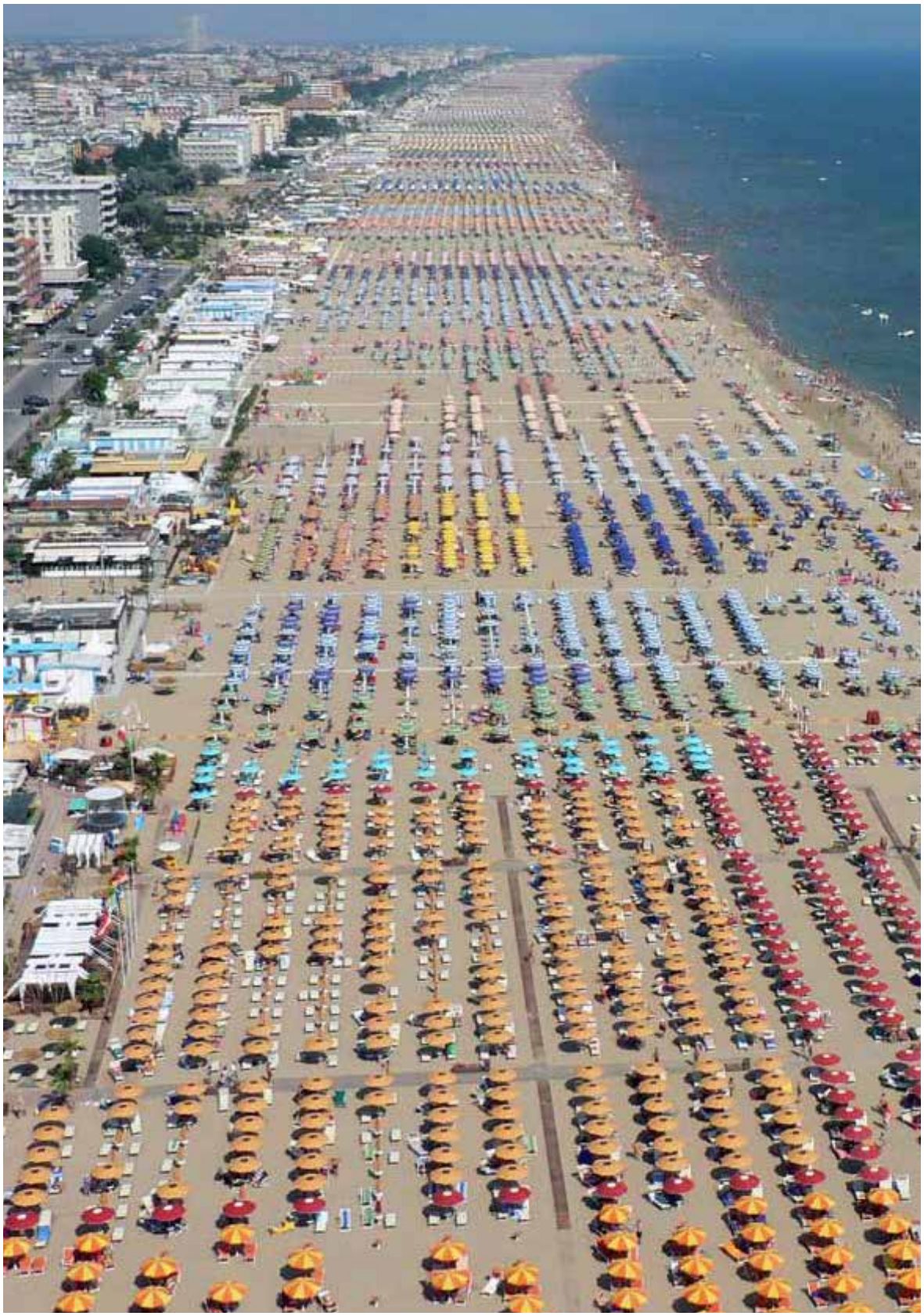
Within the lagoon belt 'buffer zone', many activities will be rearranged and enhanced such as the mussel culture, taking advantage from the increase of the shallow seabed areas. The controlled marine transgression process will also make available a large sediment stockpile that will be used for beach nourishments. A similar approach could be carried out by tapping inland fluvial sediment by river regulated floods into expansion basins. In this perspective, one of the most challenging zones is Porto Tolle, a 10.000 inhabitant's settlement near the Po channel that would greatly benefit from the development of sediment trapping overflow basin protecting its eastern boundary. By lowering and strengthening the river south bank in a few points, overflow waters, which are the only ones rich in sediment, can be collected into the basin raising bottom. The silt up basin will eventually produce a

Figure 2.25: Some interventions concerning floods protection by wetlands and vegetation planting to improve the resilience of the mobility network. (Source: Lucia Ferrarini's Master Thesis)



valuable hydraulic protection against flooding and generate new farm-land. All these interventions consider the limit between land and water as a deep and dynamic space with soft transition borders and consistent resiliency sectors, devoted to mitigate extreme sea and river events. Since the effort to 'freeze' the environmental evolution is no longer sustainable, dynamic scenarios should be planned to manage a soft and resilient transition to future arrangements (Nicolin, 2014). The recent declaration by the UNESCO of the Po delta as one of the 651 Biosphere Reserves of the world ratifies the importance of this region and presents a new challenge. According to the MAB Program (the 'Man and the Biosphere Programme' launched in 1971, by the UNESCO), the proclamation purpose is to recognise and promote a balanced relationship between human communities and ecosystems. In this framework, even though by an extreme position, the 'Selective Retreat Strategy' proposal is aimed at supporting a sustainable Delta development, by exploiting its intrinsic changeability and by supporting an effective adaption to climate change, eustatic sea level rise, fast subsidence, reduced fluvial sediment input and socio-economic expectations. Far from being a rigid and definite design, the proposal aims to give alternative standpoints, from which to start rethinking the Po Delta future.

Figure 2.26: The Emilia-Romagna Riviera in the northern part of the Adriatic, Italy. A summer image of Rimini's full-equipped beaches.



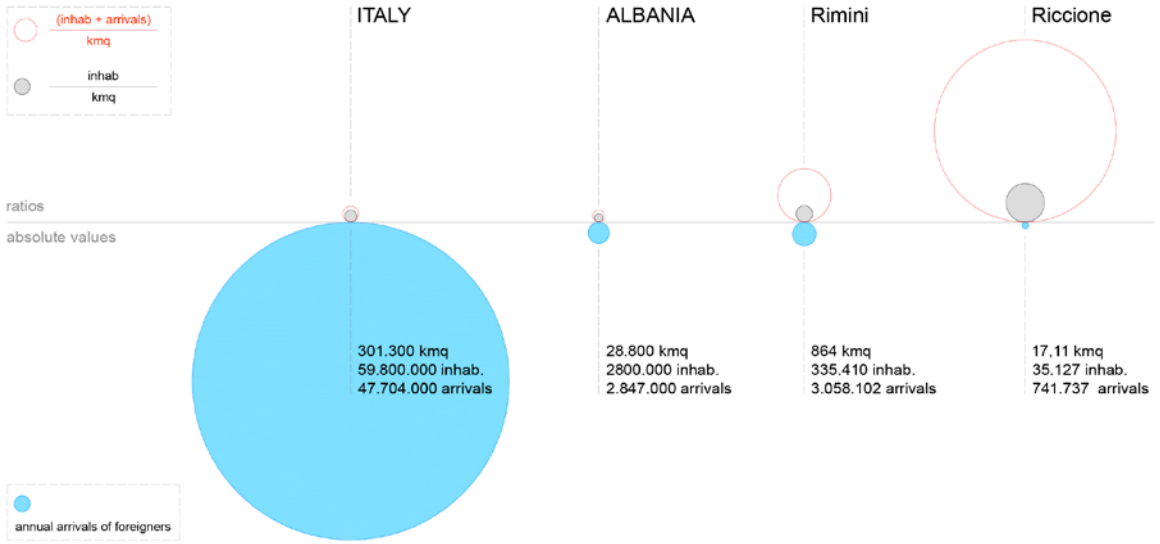
2.2 Learning from Tourism: Reactive Rivieras - Case-studies

Since 1990, when Albania shifted from a centralized economy to a liberal one, tourism has significantly increased. According to the Albanian Institute of Statistics (INSTAT), since 2009 arrivals of foreign citizens have almost doubled (from 1.855.634 to 3.672.591) overtaking national tourism in terms of hotel overnights (260.000 versus 199.000). In this framework the pressure for touristic construction has constantly grown, boosted by public policies based on economic forecasts on their potentials in creating direct and indirect employment (Albania Ministry of Public Works, Transport and Telecommunication, 2007). Especially along the coast this 'boom' has caused a growth in private investments on hospitality and facilities, carried on following both formal and informal development processes. Beside these phenomena, especially during the last few years public authorities are pursuing a proper policy to contain construction violations and preserve the historical, cultural and landscape heritage of the coastline (AKTP, 2014).

As Minca (1996) underlines, such attitude to open up to investments and simultaneously fencing in, trying to preserve the local heritage, is symptomatic in emerging touristic destinations. In fact, entering in a worldwide competitive market where thousands of other regions have solid positions, these territories attempt to resemble their own stereotyped image although, at the same time, they have to change in order to construct all the basic structures which will contribute to a successful and effective hospitality model (accommodation system, commercial activities, infrastructural networks, etc.). In this way, such emerging touristic destinations drift away to a kind of 'schizophrenic dualism' (Minca & Oakes, 2006) causing chaotic urban growth. But, as a 'late entry' on the Mediterranean touristic market, Albania has today the chance to learn from other countries' mistakes and avoid them, driving tourism development rather than suffering from it.

The term 'Reactive Rivieras' comes from the need to merge the most significant design experiences that have been developed in the last few years by Sealine between Italy and Albania with aim to show how the comparison between design experiences -in both established and emerging tourism destinations- might contribute to finding more effective and sustainable strategies for addressing touristic evolution in a supra-regional perspective. In fact, as tourism flows and demands are increasingly tied to economic and geopolitical factors, local planning must comply with unstable global dynamics,

Figure 2.27: Touristic data comparison between Italy, Albania and the touristic district of Emilia-Romagna (referred in particular to the whole territory of the Rimini Province and to the Municipality of Riccione).

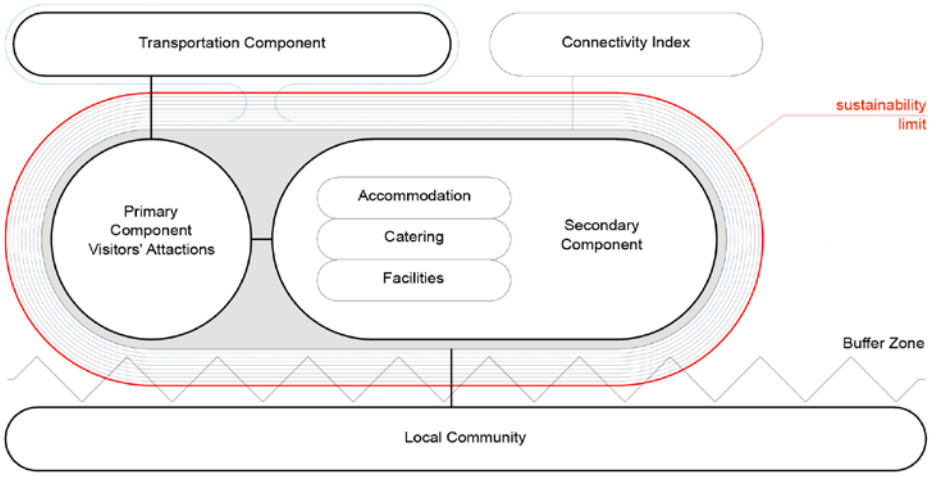


shaping more adaptable landscapes and urban systems.

'Reactive' is the adjective we used to describe the reaction of the Italian area know as Riviera Romagnola to the economic crisis in 2008, following the very same attitude it had previously developed in similar experiences, like the mucilage proliferation during 1989 which destroyed the 'seaside reputation' asking for a change in the touristic model. In the Albanian case, the same adjective has been used to give a sense of reaction to the challenge represented by the current tourism pressure on the southern coast: the so called Albanian Riviera, indeed. Such approach has been useful to consistently make a comparison between areas at different stages of their tourism development and, moreover, to demonstrate how - working on some invariants as services, accessibility and sustainability thresholds of visitor flow - is possible to outline a range of actions and solutions which can be effective both in a context where the hospitality model has reached a deadlock, and in a context where the future conditions are extremely uncertain and dynamic.

In pursuing this goal, the paramount issue is 'sizing the context' by analysing the key-indicators which can be functional to define an appropriate intervention scale and foreseen the project impacts. Working on the Albanian coast, some overall dimensions had to be constantly taken into account and compared with the other reference territory, the Emilia-Romagna coast. The *Figure 2.27* shows only a few data of the main ones that have been considered (data updated in 2014, come from: the Albanian - INSTAT - and the Italian Institute of Statistics- ISTAT): in particular the territorial extension, the

Figure 2.28: The reviewed version by Sealine of E. Law's diagram on Tourism Design Model.



number of inhabitants and the number of touristic arrivals from abroad - listed in terms of absolute value and related through a graphic representation of their ratio. If the comparison between Italy and Albania points out a similar impact index of foreign tourism on the overall country (in relative terms), the analysis of specific Italian areas - such as the Rimini province or the city of Riccione - clearly highlights how mass-tourism can stress and totally 'shock', at least for a period, an entire territory. It is useful, for example, to remark the fact that the Rimini Province on its own (864 km2) has the same foreign arrivals (3.058.102) than the whole Albania (2.847.000) and Riccione on its own (17,11 km2) a quarter (741.737). Such destinations owe their 'performances' to a consolidate and popular touristic model, but, at the same time, they are facing the consequences of controversial choices in term of urban development and touristic flows management. The same issues are possibly the ones that will affect in a next future some spots of emerging touristic destinations such as the Albania.

In this regard, the sociologist Eric Laws' scheme (1991) about the Tourism Design Model is a useful instrument to represent and understand how tourism 'works' and affects a territory. In *Figure 2.28*, we propose a new version of it, adapted to our aims and research field. Such diagram helps to analyse the components by which the tourism organizes and 'shapes', in some way, a place. The Primary Component can be described as the set of the attractions that the visitor is encouraged to seek over a city or a region: it is the trigger for the trip. The Secondary Component includes all the rage of touristic services gathering facilities, accommodation and catering. Such two components can sometimes

Figure 2.29: Bunkers on the beach, Albanian Riviera.

merge into each others to become one: a set of high-standard, diversified and unique services can contribute to the attractiveness as the appeal of a destination is also given by the offer richness and its complexity. The Transportation Component deals with the accessibility to a sight and it is supported by the Connectivity Index of that place which refers to its ability to be recognisable on the market and 'user-friendly' in terms of trip planning.

The original version of Law's diagram shows a Buffer Zone between the the influence area of the Local Community and the tourists' one (the temporary community) where their mutual relationships take place. Inside it we introduced a 'Sustainability limit' beyond which such relationship turns into conflict affecting moreover the Primary Component itself. Many are the examples of popular destinations 'drained' by their own development: here containing the touristic flow becomes an urgency which to dealt with. Such limit has to be considered and planned as well as for those areas that are currently growing. Defining a tourism development strategy means to set targets and limits at the same time: the accommodation capacity, for instance, should be planned according to the existing supply and to a careful assessment of all its repercussions on the environmental and infrastructural networks (for water, energy, waste management, etc).

Working on the Albanian Riviera, this has been the basic point to focus on: how to deal with a territory that is going to host in the next few years an increasing number of visitors while, probably, its best and more charming features by now are related with 'loneliness' and isolation?

Figure 2.30: Riccione's beach resorts in the Emilia-Romagna Riviera.

Such kind of topics need to be explored by a deep analysis of the Primary Component, both in a present and in a future perspective. A site-specific interpretation can be supported by a set of key-words allowing to read into a place, better draft its development and strength its potentials. They describe the consequences that the tourism generates on a territory, once it starts to change, in term of behaviours, trends, processes. Some of those, derived from the Riccione case-study, have been for us:

/ *accumulation over selection:* the act of accumulation doesn't select, but collects together very different things in a rapid and intense way;

/ *frenetic update:* the attitude to be always updated, opened to the change and new trends, is pursued through small and fast interventions;

/ *diffuse repetition:* new trends are captured and displayed by few, then they are replicated diffusely by many;

/ *multiplicity without inhibitions:* anomalies and irregularities foster the ability to multiply experiences without inhibit the various expressions;

/ *interferences and overlapping:* different activities overlap and interfere to go beyond the seasonal tourism switching from a cyclical temporariness to a simultaneity of temporariness;

/ *reassuring instability:* the instability of the territory, instead of generating uncertainty, reassures through the change; the result is not an enclose framework, but the chance to imagine adaptable scenarios.

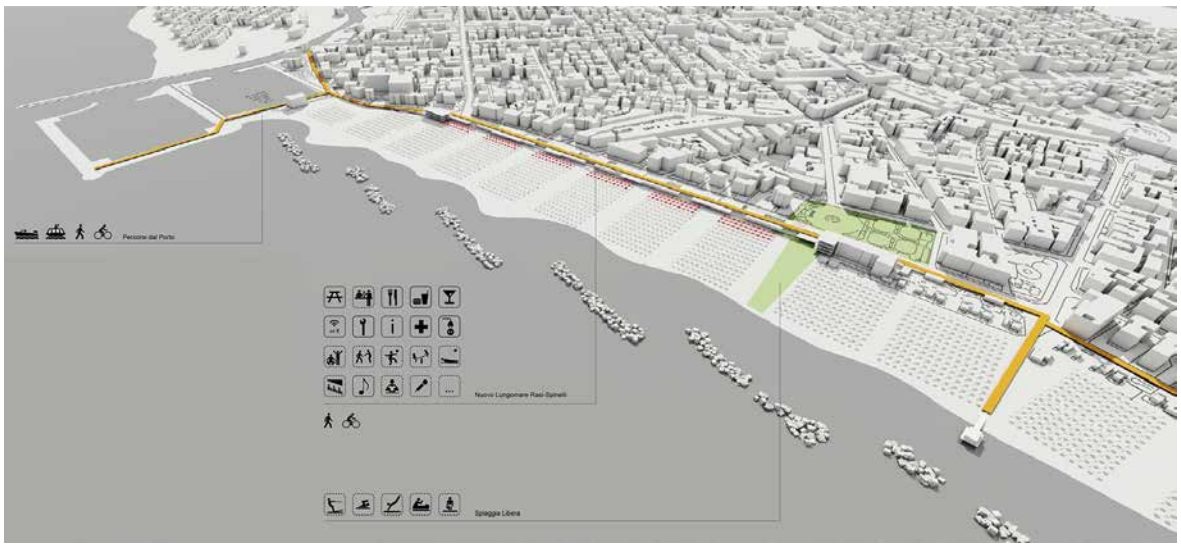
In the following paragraphs, by presenting some different applicative case-studies that have been implemented under these guidelines, the thesis attempts to demonstrate how the 'landscape dimension' is fundamental to approach the topic of tourism (Goula, Spanou & Perez Rumpler 2012), especially if the landscape is interpreted with disenchantment: as a change-driver and not as 'victim' of it. If the comparison between emerging and established destinations is therefore useful to understand some strategic choices implications and learn from them, at the same time, it highlights, regardless of the context, a basic consideration: every touristic territory is ultimately an in-transition area. We believe that this awareness should drive local development proposals characterised by wide margins of freedom: design strategies must be adaptable but still able to clearly define urban, landscape and environmental frameworks within which changes will take place.

In order to manage such complex dynamics, the above-mentioned diagram was adopted to evaluate the consequences of our design choices. In every project, we decided to focus on a specific component, that seemed to be overriding, to affect the other ones. The next paragraph reports how the topic of urban seafronts has been faced outlining in which way they can act as service aggregators in different urban situations, generating a new kind of public space able to organize, at the same time, the beach's functions and uses. Describing the projects for Cattolica (Italy) and Vlora (Albania), the importance of integrating tourism facilities in the urban environment transformation, in order to avoid any detachment between them and the rest of the city, is stressed.

In the second case we analyse the accessibility issue as a key factor for addressing a regional touristic model and balance tourists flows among different areas. We start illustrating the proposal for the 'Mississippi' pier reuse in Gabicce (Italy) and the strategic process that brought to the idea of a seaway network that succeed in exploiting the touristic potential of several similar spots along the Italian Adriatic littoral. Then we show how this concept has been used for the southern Albanian Riviera planning proposal with the aim, this time, to quickly provide a less organized territory with a proper mobility infrastructure affecting the beaches' use and accessibility. Considerations about timing, costs, reversibility and environmental impact have been assessed to design an alternative and more sustainable way to equip the coast with a light and adaptable system, in a region where the touristic process is a its early stages and whose attractiveness lays mainly in the landscape wild look. The creation of local networks managing and distributing touristic flows along the coast can be inscribed in a wider European framework according to which the creation of transnational touristic

routes has to be increasingly pursued by regional authorities (Richards, 2011). In such perspective, strengthening territorial systems is crucial to maximize their impact, and leverage the macro-regional scale to boost local attractiveness. In this perspective the third paragraph deals with a strategic proposal developed at the Adriatic-Ionian scale capable of improving Marine Protected Areas and their touristic attractiveness, while boosting the positive environmental impact on the ecosystems. It focuses on achieving around each existing or forthcoming SPAMI (i.e. Specially Protected Areas of Mediterranean Importance) a new touristic cluster made by different satellites and, afterwards, on implementing several macro-regional networks among these clusters, to enable specific physical and thematic itineraries.

Figure 2.31: View of the proposal developed for the Rasi-Spinelli Waterfront in Cattolica.



2.2.1 Services Component

The proposals for Cattolica and Vlora both deal with the topic of waterfronts facing the instances related to the integration of the beach in the urban public space. In both cases, the waterfront has been considered as an organising device, a services aggregator, aimed at designing new relationships upon the threshold between the sea and the city (Emanueli & Di Giulio, 2010). The two experiences' common goals were:

/ enhancing the waterfront promenade by setting up accessibility, routes and building volumes in order to emphasize the visual relationship with the sea;

/ streamlining the beach services and bathing equipment in accordance with a layout aimed at diversifying functions and fruition opportunities as well as creating a hierarchy within a system which is, by its nature, linear;

/ making the waterfront a driving force for upgrading the hospitality system, a space where developing urban services capable of extending use of the beach by tourists and residents all over the year.

Both projects ground on the will to provide public and private stakeholders with an adaptable infrastructure allowing to face major swings in tourism demand by concentrating strategic actions in a single urban element rather than in a multitude of places disconnected from each other.

Shared Services' Aggregator: a new waterfront in Cattolica

In Cattolica, such objectives have been pursued by designing an articulate urban element aimed at containing different functional programs and management models (*Figure 2.31*). The present waterfront configuration is characterized by a variable difference in altitude between the seaside and the promenade. This has been used and emphasized in order to create, on two levels, a sort of double slipping: of the public space towards the beach and of the seaside services towards the city. A cycling and walking path runs along the almost 500 metres of the waterfront at the altitude of 1.3 meters above the road level: a 20 meters wide promenade allowing the horizon free view and from which to access to the underlying services passing through the patios dotting the route. At he lower level, all the old and new equipments can be so rearranged and optimised in order to earn more space for the seaside and for the beach resorts (*Figure 2.32*).

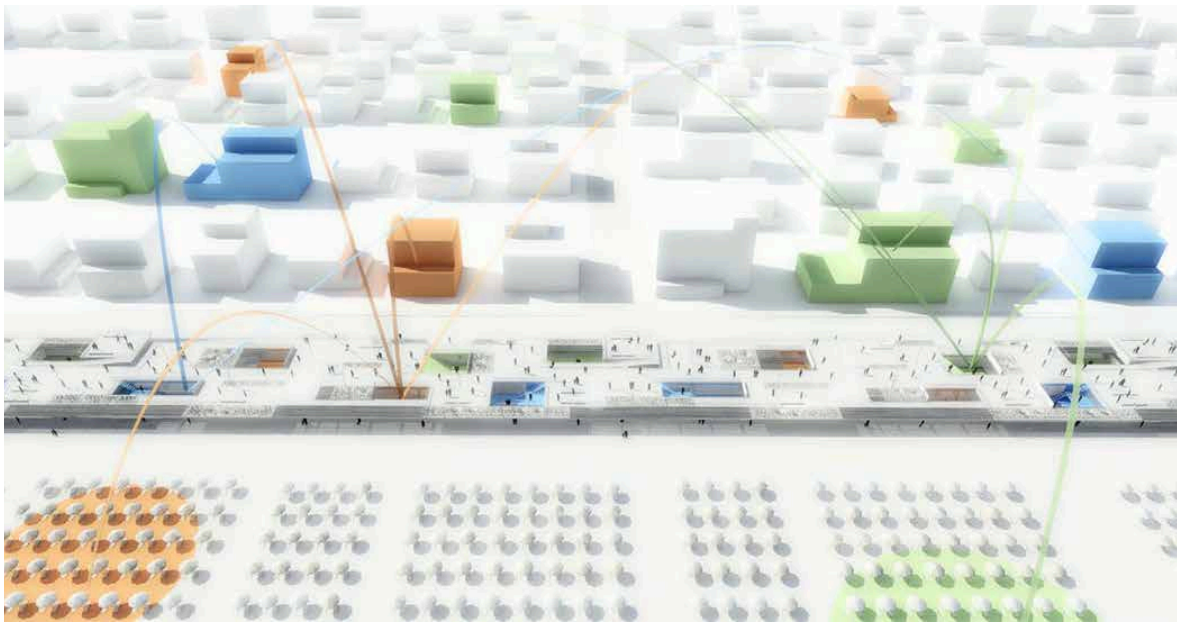
Figure 2.32: On the right, a section of the project; up on the left, the current seaside organization, while, below, the seaside re-organization envisaged by the proposal.

The new system provides a series of different spaces for potential usage and for the relationship they have with the outside. In this sense the patios play a crucial role in determining the adaptability degree of the project to various functional programs. Their location, size and mutual distance are calibrated so as to support different planimetric configurations, always guaranteeing lighting, ventilation and visibility from the promenade. Additionally, their generous dimensions provide the services with an additional outdoor space which can be used during the different seasons thanks to the protection from the wind and the sand. Therefore, the project puts forward a range of measures to create below the walk an as much as possible fluid space to be configured according to different needs.

Another key aspect of the proposal lies in the attempt to conceive a mediation device between urban and the tourism identity with the aim of organizing unitarily the transition space between the beach and the town. In such kind of destinations, the beach, and in particular the activities related to it, are often perceived as exclusive, just dedicated to the tourists, and so shaped to satisfy transient, seasonal, short experiences. The redevelopment hypothesis for the Rasi-Spinelli Waterfront goes in the opposite direction trying to accentuate the citizens' sense of belonging to the site: an example of how the beach and its facilities might become an added value, in terms of services too, for the town life (*Figure 2.33*).

The beaches' urban characterization is a touchy topic for the Riviera Romagnola destinations which belong to this dense and almost completely man-made territory, Italian paradigm of the mass tour-

Figure 2.33: A diagram showing the potential relationships between existing touristic facilities of the city and the new services' aggregator on the waterfront.



ism, where the same logics that led to the building stock development have been applied to the beach: continuity, repetition, fragmentation, extreme homogenisation and pragmatic use of every available square meter for the hospitality. A sophisticated and successful model based on the sequence of the beach umbrellas, bathing facilities, cabins, restaurants, hotels, etc. A model which, for its complexity, required, before than elsewhere, an early legal and regulatory framework to manage the thousand overlapping concessions, jurisdictions, superstructures. Nevertheless, a sort of planning vacuum remained: in the sense that it has alway been hard to update or questioning the model just because of its over-regulated nature (Lobosco, 2010).

In the face of epochal changes in types and forms of tourism, the Riviera's touristic district has often reply with partial and precarious solutions. Just taking the beaches' example, it's easy to show such attitude remarking how each operator tackles new investments independently, with a reduced spending power and hence reaching low or medium quality standards. This results in the widespread replication of temporary and soon obsolete solutions contributing to shape a 'perpetual insecurity landscape' which is renewed, fixed and manipulated every year. Against this trend, the proposed scenario for the Rasi-Spinelli Waterfront tries to aggregate, optimize and merge some services into a single urban system that makes them improve in size, quality and appeal.

Planning the Vlora beachscape

The same basic concept has guided the drafted plan for the beaches and the maritime space in the bay of Vlora: a town of about 140,000 inhabitants in southern Albania which has experienced after 1990 (the year of the Hoxha's communist regime fall) a fast as well as chaotic urban development also tied to a significant growth in the tourism sector (Guri, 2016). Vlora is the capital of a large regional district, the gateway to the southern Albania Riviera, an area attracting the most interior and foreign tourism. Such strategic importance has pushed the Albanian Ministry of Urban and Touristic Development at implementing a regeneration plan (Nepravishta et al., 2014) starting from the waterfront promenade arrangement whose design was committed to the Xaveer De Geyter Architects (XDGA) after an intentional competition. The competition objective was to create a public space able to increase the tourism potential by boosting small and medium the private investments on specific services.

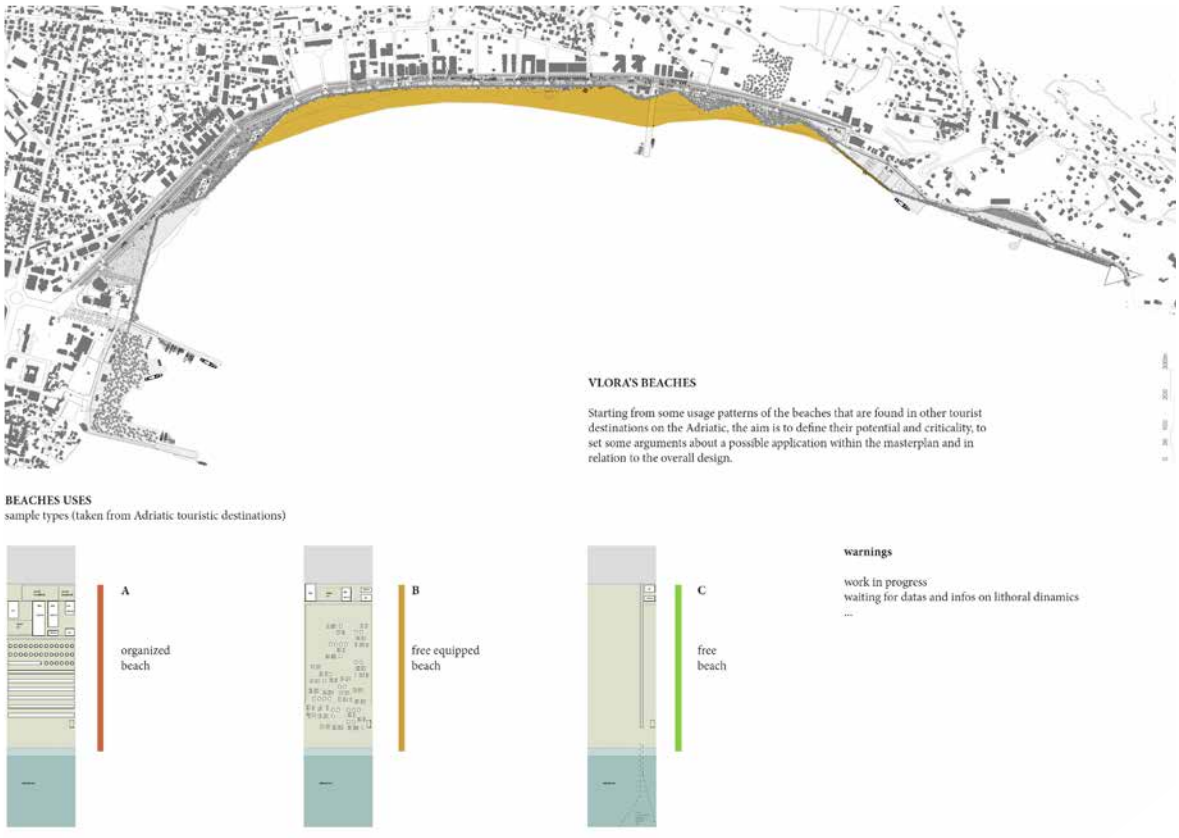
Our consulting to the masterplan focused on the beach planning which has been carried on with the aim of assuring an effective conformity between the promenade project idea, in terms of views and relationship with the landscape, and the actual development of bathing services and equipments (Emanueli e Lobosco, 2016). The main task was to provide the Municipality with guidelines addressing different scenarios due to several uncertain factors dealing mostly with land proprieties and vehicular accessibility. Such uncertainty has required to develop an instrument capable of managing alternative 'beach crowding' forecasts by combining 5 different beach typologies according to a variable aggregation sequence sufficiently responsive to masterplan's reviews.

Starting from the well codified beach typologies already studied in the Italian Riviera (Emanueli, 2010), we have firstly analysed their strengths and weaknesses referring in particular to visual impacts, management models and economic outcomes (*Figure 2.34*):

/ the *'organized beach'* is a complex system, a stretch of coast characterized by the presence of permanent and temporary structures; given to the total entrepreneurial management of one or more dealers which, supplying - under payment - bathing and other complementary services, could also inhibit the access to certain beach areas;

/ the *'free-equipped beach'*, characterized by a free and open access, is licensed to a private entity providing services not necessarily related to bathing activities, such as catering, in exchange for the seaside cleaning, surveillance, rescue service and toilets supplying;

Figure 2.34: The Vlora beachscape highlighted in yellow and the three basic typologies of beaches analysed.

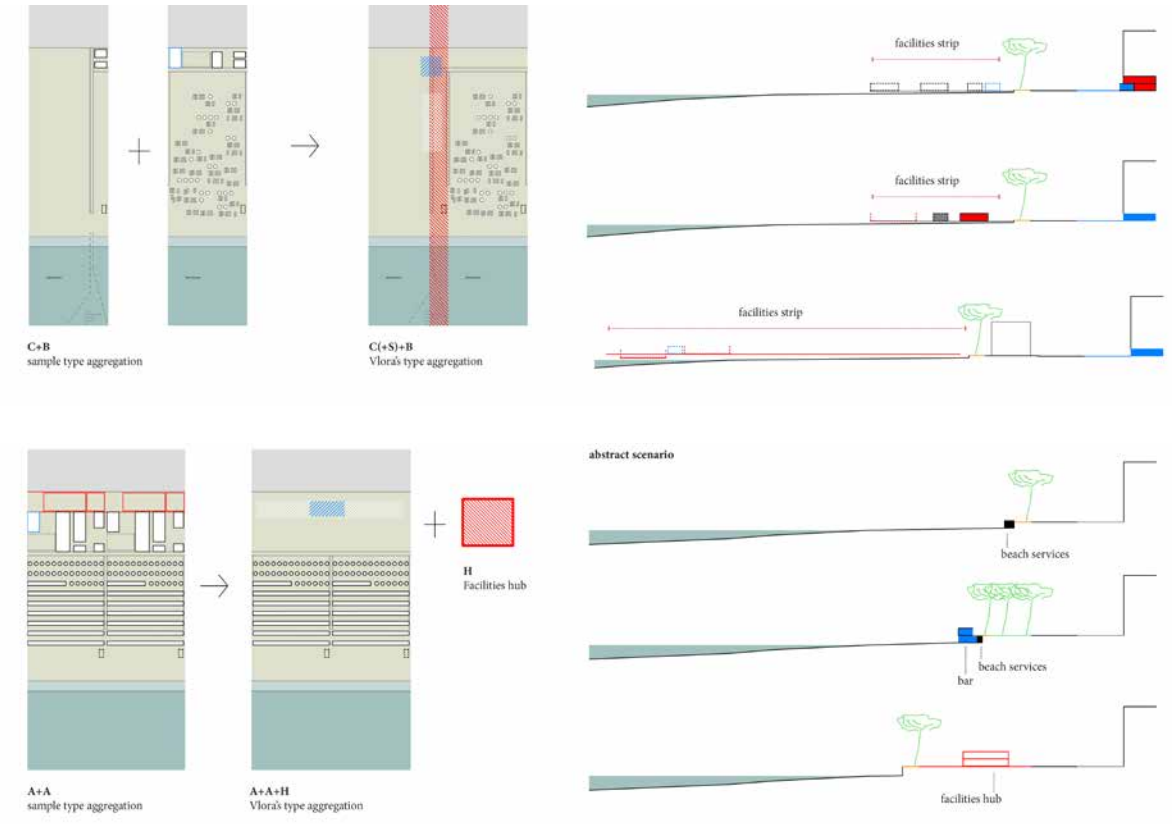


/ the *'free beach'* is devoted to public use and does not imply licenses nor land occupation for commercial purposes; minimum services, cleaning and surveillance depend by a public body which is totally in charge of its management.

The simple transposition of these models to the Vlora context would not meet two of the strategic conditions underlying the masterplan idea: maximizing the sea view from the promenade; and placing along the waterfront a series of hotspots working as services' aggregators usable by the seaside as well as by the town. So we worked on these typologies by eliminating volumes and functions that seemed incongruous with the main project objectives (*Figure 2.35*). Such operation has led to define the two further devices - or beach typologies - that would have acted as shared services' aggregators: the so called 'Facilities Strips' and the 'Facilities Hubs'.

The first ones, corresponding to a kind of hyper-equipped area perpendicular to the coast, have a minimum width of 8 meters and can host small fixed or temporary structures (deposits, cabins, bathrooms, showers, bars, etc.) as well as sport playgrounds. If extended to the shoreline, they could also work as light and noninvasive piers giving the fact that the bay is very sheltered from sea currents and

Figure 2.35: The two processes that have bring to develop the'Facilities Strips' and the 'Facilities Hubs'; their relationships with the waterfront promenade is analysed by the typological sections.

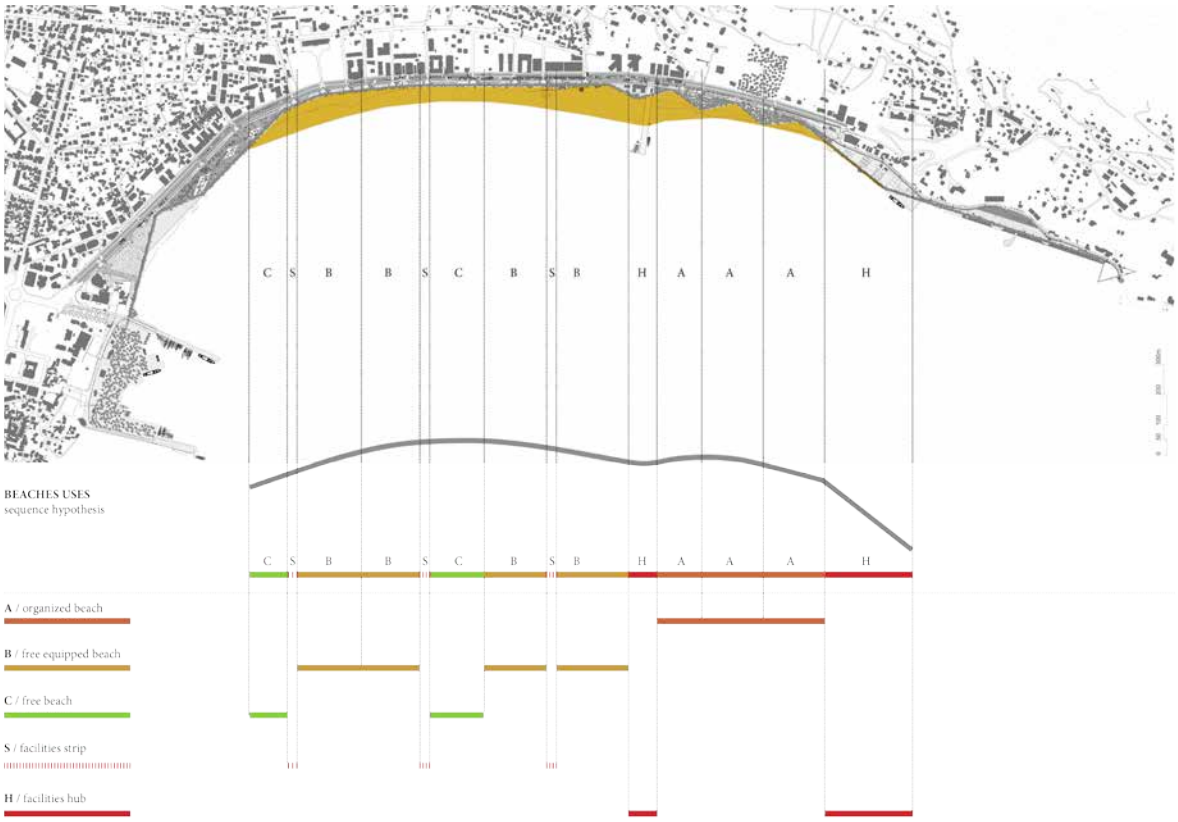


tides are minimal. The 'Facilities Hubs' are, instead, intended to accommodate more complex and sophisticated services which can complete the beach resorts' and the hotels' offer: such as restaurants, spas, clubs as well as cultural and institutional functions operating for much of the year.

Along the 2 km coastline affected by the project, the resulting possible combinations of these five elements (i.e. 'organized beach', 'free-equipped beach', 'free beach', 'facilities strips' and 'facilities hubs') have been determined by cross-checking the masterplan guidelines with those derived from the maritime spatial planning of the bay (*Figure 2.36*). In this perspective, the aim was to connect, both visually and functionally, the functional areas on the coastline with the ones on the water (such as transit and mooring areas, diving, swimming, recreational zones, etc.) avoiding any interference; for this reason the exit points for sport activities have been placed among the 'Facilities Strips', while the water-bus stops among the 'Facilities Hubs'. This has further reduced the range of possible combinations between the five types of beach, but without a doubt it has increased the potential for the services' development enriching the waterfront functional program.

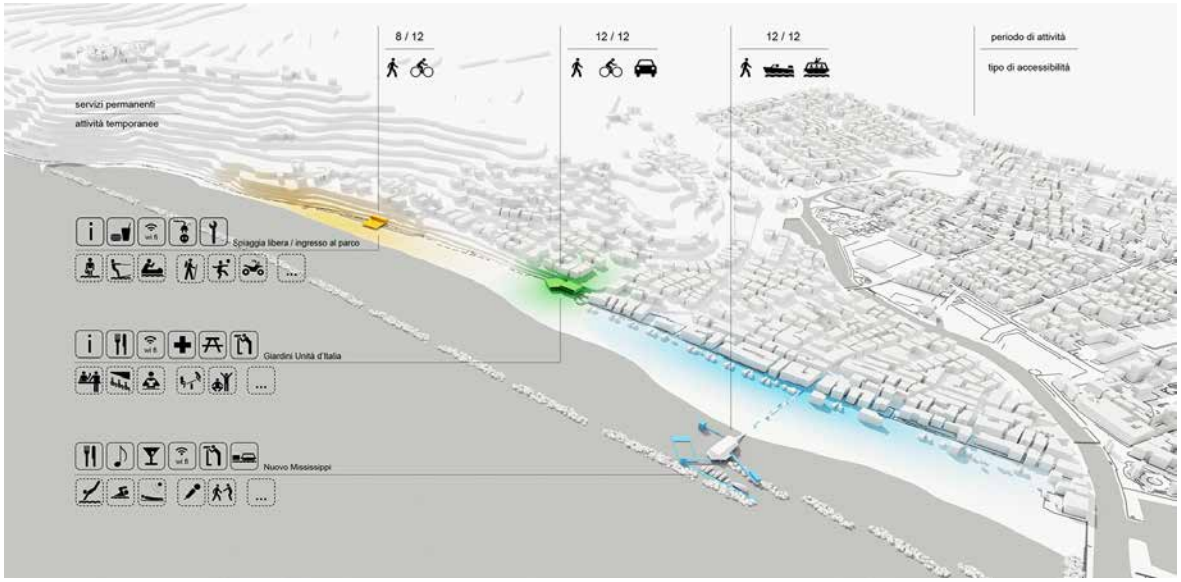
The Vlora proposal adopts from Cattolica the idea that the waterfront planning in these type of con-

Figure 2.36: One of the potential combinations between the various beach typologies.



texts represents the chance to unify the touristic experience with the urban one by the creation of high quality services organized in a comprehensive vision for the city. In the attempt of reaching this goal, economic motivations and management issues are fundamental. An indication in this sense comes from the, so-called, well-established experience of the 'Product Clubs' (Menegatti, 2004) in Italy. They are business trusts engaged in activities aimed at creating and promoting a specific touristic product intended for a niche, but extremely rewarding, market. Every Club brings together different types of enterprises from the bigger to the smaller ones which, by this means, have access to communication and business channels otherwise precluded. In our intents, the physical transposition of this concept are the services' aggregators that have been developed in the projects for Cattolica and Vlora according to different frameworks, but comparable needs facing the tourist attractiveness challenge.

Figure 2.37: View of the proposal developed for the Waterfront of Gabicce.



2.2.2 Accessibility Component

By presenting the proposals for Gabicce and the southern Albanian Riviera gradually we shift the focus from the services component to the accessibility one, in order to highlight how together can contribute to drive touristic potentials. The Mississippi Pier functional reconversion, in Gabicce, has been a first chance for reasoning about the role of mobility networks connecting services along the coast at a wide scale. A concept further analysed and implemented within the strategic proposal for the Albanian Riviera where a maritime mobility network has been planned for prioritizing the visitors' flows to the beaches and managing the increasing tourism pressure in order to avoid environmental and landscape degradation.

Urban and territorial getaways: the Mississippi reuse proposal and its implications

The Mississippi Pier, built in the late 50es, was originally a Restaurant Bar Night Club which for some decades have been at the top of the glamorous night-life in the Adriatic Riviera. After a crisis period, its ownership is passed to the Municipality that asked us to define some possible scenarios for it reuse in relation to urban waterfront redevelopment.

The structure has an almost central position with respect to the city's waterfront and it marks somehow an anomaly in the repetitive scenery and in the flat topography of this Adriatic coast's northern branch. A little further on, in fact, the Gabicce Monte promontory, characterized by a high rocky coast, emerges causing the beach constriction between the sea and the coastal paleo-cliff. Here everything is compressed: hotels, roads, promenades and beach resorts. The Mississippi seems an attempt to get out from this condition gaining space and a privileged point of view on the coast. As a strong element in the landscape, it still keeps an aura suggesting, regardless of functional programs, new relationships with the context.

The present Gabicce waterfront configuration is too dense and too fragmented in a multiplicity of proprieties to be redesigned by continuous elements. It was therefore decided to approach it by punctual interventions aimed at creating a network between recognisable spots along the coast (*Figure 2.37*) which should be able to host permanent and temporary functions as well as to work as connexions between areas now disconnected from each other by acting as polarity of a multi-modal system

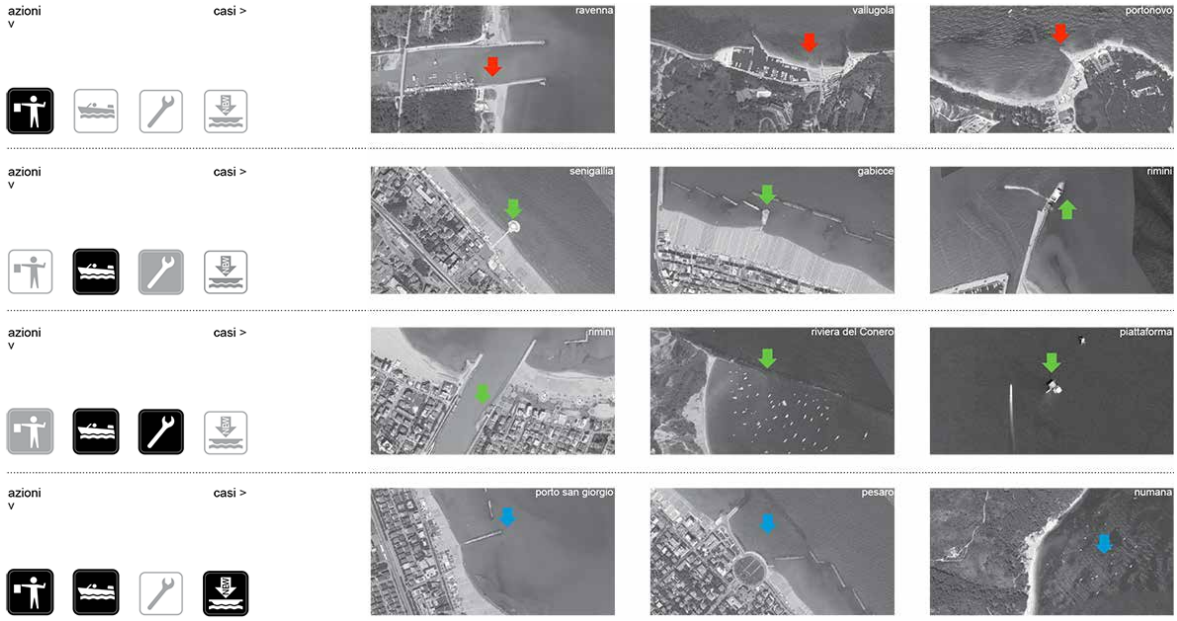
Figure 2.38: The Mississippi reuse proposal and its impact on the new urban system of intermodal connections.

of walking, cycling and maritime trails. A kind of infrastructure and service mix whose purpose is to unify the urban experience by marking the existing routes, parallel to the coast, and by permitting new cross connections from the sea and from the river promenade to the city centre.

The first spot, among the eastern public beach, provides new equipments for the seaside and works as the new entrance to the Monte San Bartolo Natural Park. The second spot, among the 'Unità d'Italia' Gardens, is a multipurpose building aimed at solving the altitude gap between the beach and the town most scenic area by an internal pathway along which cultural facilities and performative spaces are arranged. The third spot is the Mississippi (*Figure 2.38*), whose main purpose is acting as a new gateway to the city from the sea. In order to encourage its functional reuse, the building is thought as a plug-in system on which developing additional temporary and permanent structures: platforms, equipments, piers and small floating building targeted at boosting the pier's usability throughout the year by partitioning its spaces and so its management. This aims at providing a constant use without engaging necessarily all the whole structure.

The floating pier near the existing reef, providing a secure landing for shallow-draft vessels, makes the Mississippi accessible even by shared transport systems such as water-buses, and taxis. A new access to the city by the sea that becomes even more interesting thanks to chance of bypassing the car traffic by enhancing satellite parkings along the Tavollo River. An opportunity to increase pedestrian areas during the most crowded periods and recover some city marginal districts. In this

Figure 2.39: Strategic guidelines aimed at triggering a new regional mobility network by the sea by the reuse of existing spots and the construction of additional landings.



perspective, the project elaborates a strategy that refers to the territorial scale on which the feasibility of a wider mobility network between other remarkable spots on the Romagna and Marche littoral has been assessed. \In fact, along this territory a rich range of interesting landings for private boats and tourist transport already exists; beside them there are other spots where the mooring is possible, but no services have been developed, so they are not attractive. Many of these are frequented by locals for their unique location, but little known elsewhere. Still, other points on the coast are currently unreachable by the sea, but potentially they could be easily equipped with moorings and so included in the network (*Figure 2.39*).

In this scenario, the coastline looks like a single container of chances. Our hypothesis is based on the idea that the landings network can be activated according to various complexity degrees and responding to different themes: visibility, accessibility, enhancement or creation of services and facilities. Such devices would broaden the tourist offer in the already popular destinations while, for others less known, would represent an innovative way to test their tourism potential by joining a vast regional system. The planned actions should range from existing structures' simple recovery to new structures development in strategic locations. A site-specific approach based on guidelines and criteria (to be provided to local administrations, public and private entities) is though immediately required in order to asses the intervention consistency in terms of landscape impacts and considering the spots arrangement balance on the territory as well as the technical and economic feasibility.

Figure 2.40: The Albanian Riviera coast landscape descending the Llogara pass.

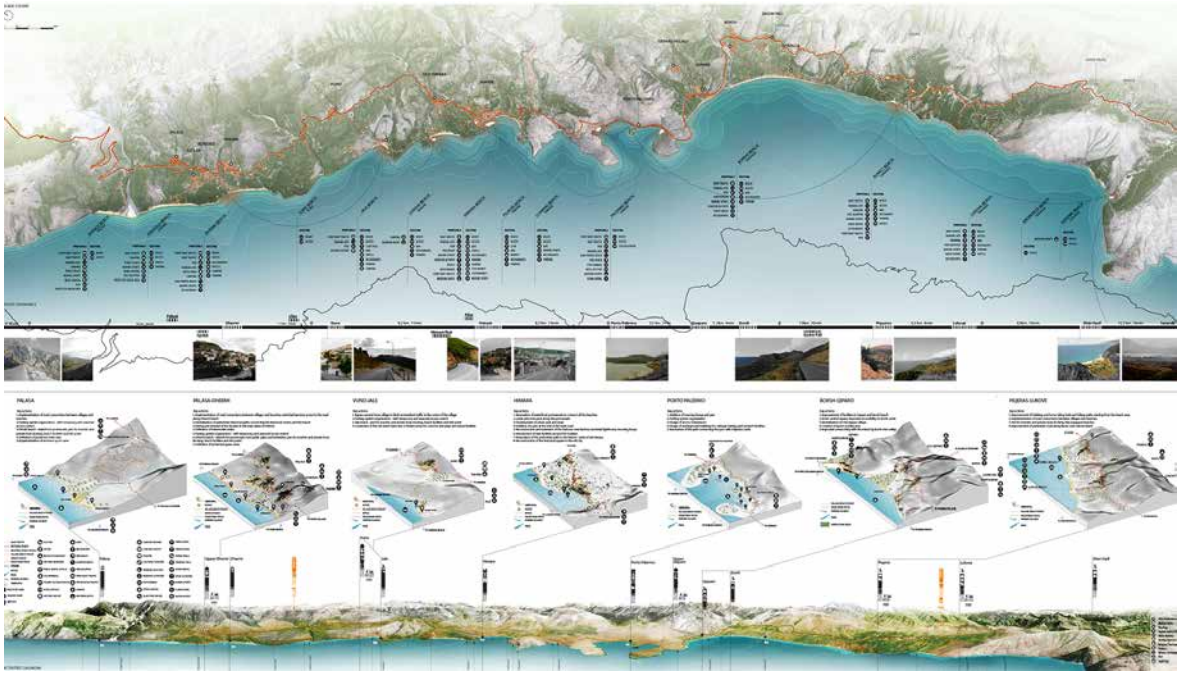
A seaway mobility Network for the Albanian Riviera

This methodology was subsequently used and refined within the proposal addressing the tourist development of the Albania's southern coastline between Vlora and Saranda, better known as Albanian Riviera (*Figure 2.40*). As already mentioned, this territory has seen in the last few years an exponential growth of domestic and foreign tourism having to deal with the recurrent consequences of a fast and uncontrolled building development on the coast and in major towns. On the other side, this phenomenon has been balanced by the area low infrastructure level which, in pair with its morphological configuration, has preserved the pristine natural appearance and landscape value of the beaches. In the Mediterranean, the Albania Riviera is undoubtedly one of the emerging destinations and, potentially, the most interesting in terms of foreign arrivals prospective growth. On this basis, the Albanian Government has promoted a series of initiatives aimed at planning more sustainable development models balancing economic and environmental repercussions.

Our work started by the comparison with other territories having undergone a similar evolution: rural areas dotted with small and picturesque villages transformed into extreme busy and crowded destinations. We decide to focus our attention on the mobility infrastructure topic as the basic and more effective component for managing the territory tourist transition towards a balanced poly-centric system, in our opinion, more responsive to the tourism trends' changes and more appropriate for this context. In fact, by analysing critical issues, ambitions and economic potential of the site, the need of an immediately operational strategy facing the tourist flows distribution appeared to be the priority (Lang e Lobosco, 2016).

The proposal plans to improve the accessibility by implementing a widespread sea-based network capable of integrating the only panoramic road that currently connects all the villages on the coast (*Figure 2.41*). A deeper analysis of how visitors move along the Southern Riviera shows that, informally,

Figure 2.41: The planning proposal concerning the sea-based mobility network along the coast and all the infrastructural interventions on the most important beaches.



some transfers already take place through maritime transportation. In fact, some private boats offer by-call services, using existing docks or directly landing on the beach. Although not yet developed, this system suggests a different way to approach mobility from the sea. Our proposal aims at setting informal tourism practices into an organised framework on which to develop a singular offer opening up the Riviera to new touristic procedures: more sustainable, diverse and adaptable to a fluctuating international demand.

The proposed seaway system aims at integrating and matching in some points the panoramic road in order to possibly build, across the Southern Albanian Riviera, a multimodal infrastructure which should be able to offer, in peak-periods, an alternative to inland-based mobility through more sustainable collective sea-based transportation. Such system would increase the permeability of coastal areas, allowing the discovery of normally unreachable landscapes (rural coastal zones, wild environments, protected natural areas, etc.). By identifying intermodal nodes through which users can be sorted to different paths and itineraries, it could also balance out over-crowded areas with under-frequented ones, activating an infrastructure at territorial scale in a shorter time compared to inland-based ones which have higher impact, are more complicated and need longer execution times. The network development could furthermore act as a 'recycling' device for empty, dismissed or over-dimensioned existing structures such as piers, harbours and military zones.

Figure 2.42: The idea of a 'light infrastructure' enabling different uses of the proposed mobility network.

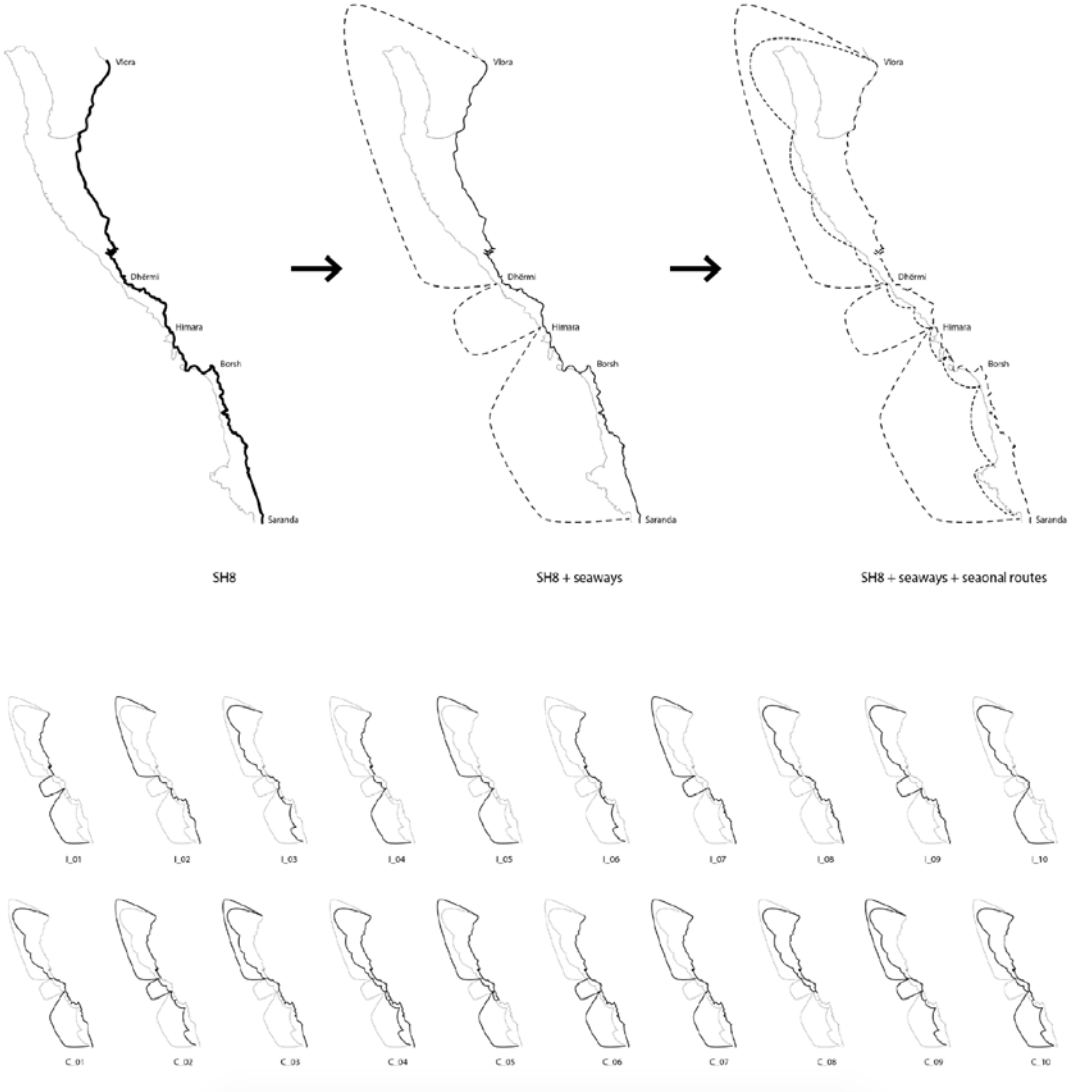


Figure 2.43: The SH8 road running along the sea in Porto Palermo bay. (Source: image courtesy by T. Lang)

The system is composed by three connection layers, each one reflecting a way of visiting the coast and each one associated to different facilities (*Figure 2.42*). The first and most important connection layer takes place between the major coastal towns where the popular urban beaches are placed and the current equipment of parkings and other facilities is not suitable for managing the several daily arrivals. Here, new waterfront services are designed along with additional intermodal infrastructures, such as parking lots next to the docks, in order to give to the visitor the chance to move daily from there to other less-used locations. The second mobility layer deals in fact with the connection between urban area and the so called 'satellite beaches' which have been distinguished into two further categories: those in minor villages are equipped with small landings, basic facilities for bathing and commercial activities; the most isolated beaches are only accessible by the sea and any possibility of car access is precluded. The link service will be provided seasonally by private boats. The third and last mobility layer is addressed to private pleasure boats and yachts. It will be progressively composed by the implementation of a light and reversible typology, thought as a sort of 'detached port'. Potentially, the southern Albanian coast can be highly attractive for marinas development, but currently the few harbours host a limited number of moorings. Instead of creating high-impact civil infrastructures, a light and reversible system based on mooring fields could be implemented: a kind of 'smart' harbour system, sustainable for its detachment from the coast, for being temporary and built low-budget in a short time span. Mooring sites are composed of buoy fields and other reversible structures such as floating jetties and breakwaters that must be arranged in selected areas avoiding extreme wave exposition to guarantee safety and comfort conditions. Partially depending on

Figure 2.45: An example of the spotted interventions to be developed along the coast; in this case, the wellness park connecting Borsh's to Qiparo's beaches.

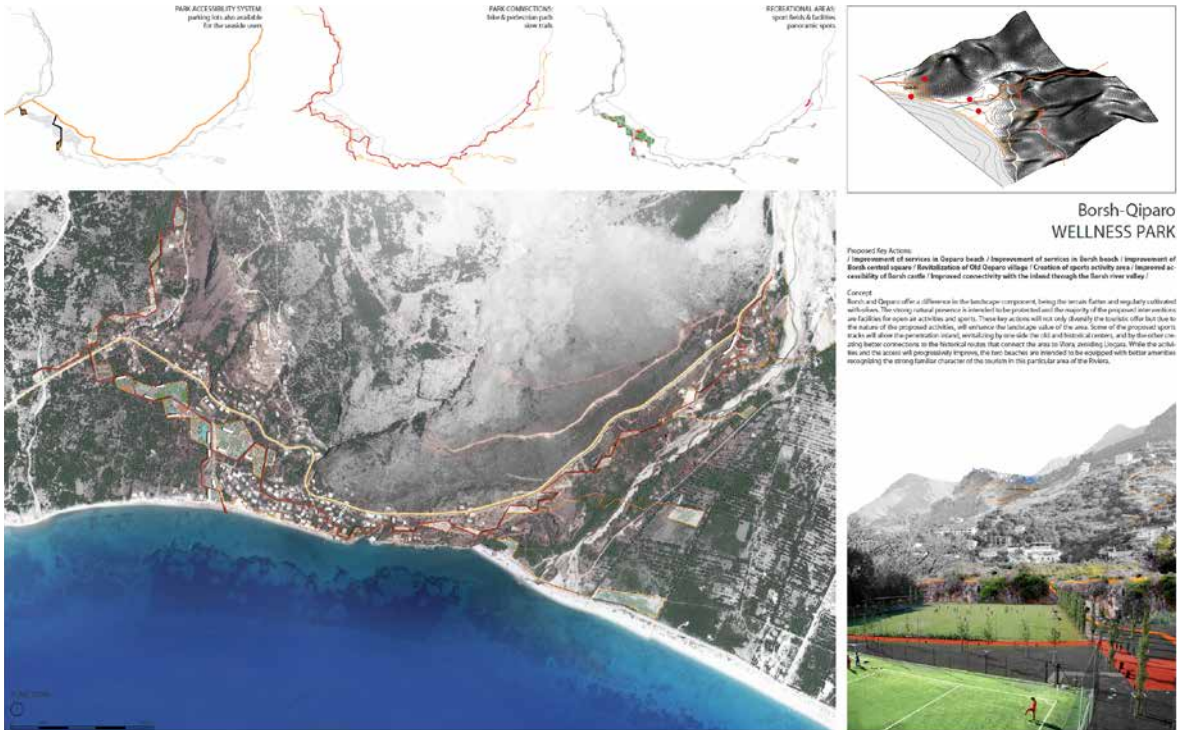


Figure 2.44: An example of alternative accommodation and recreational services along the coast integrating parking lots and equipments to be used as intermodal mobility hubs.

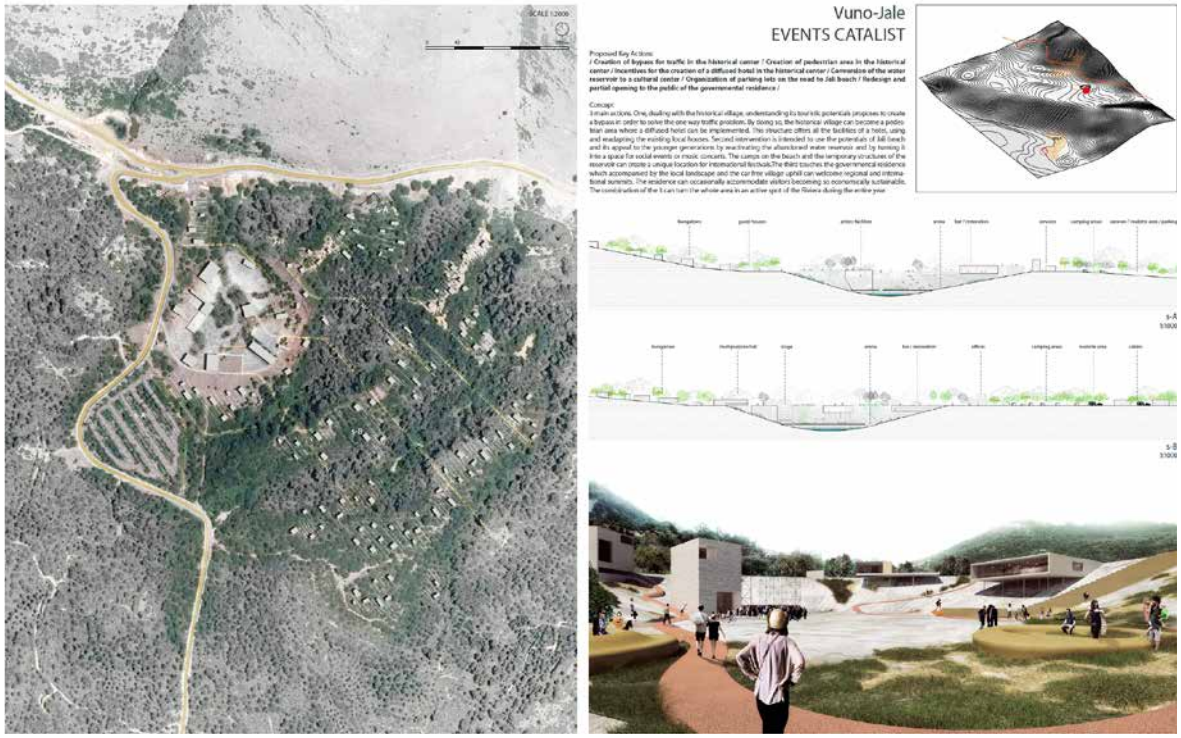
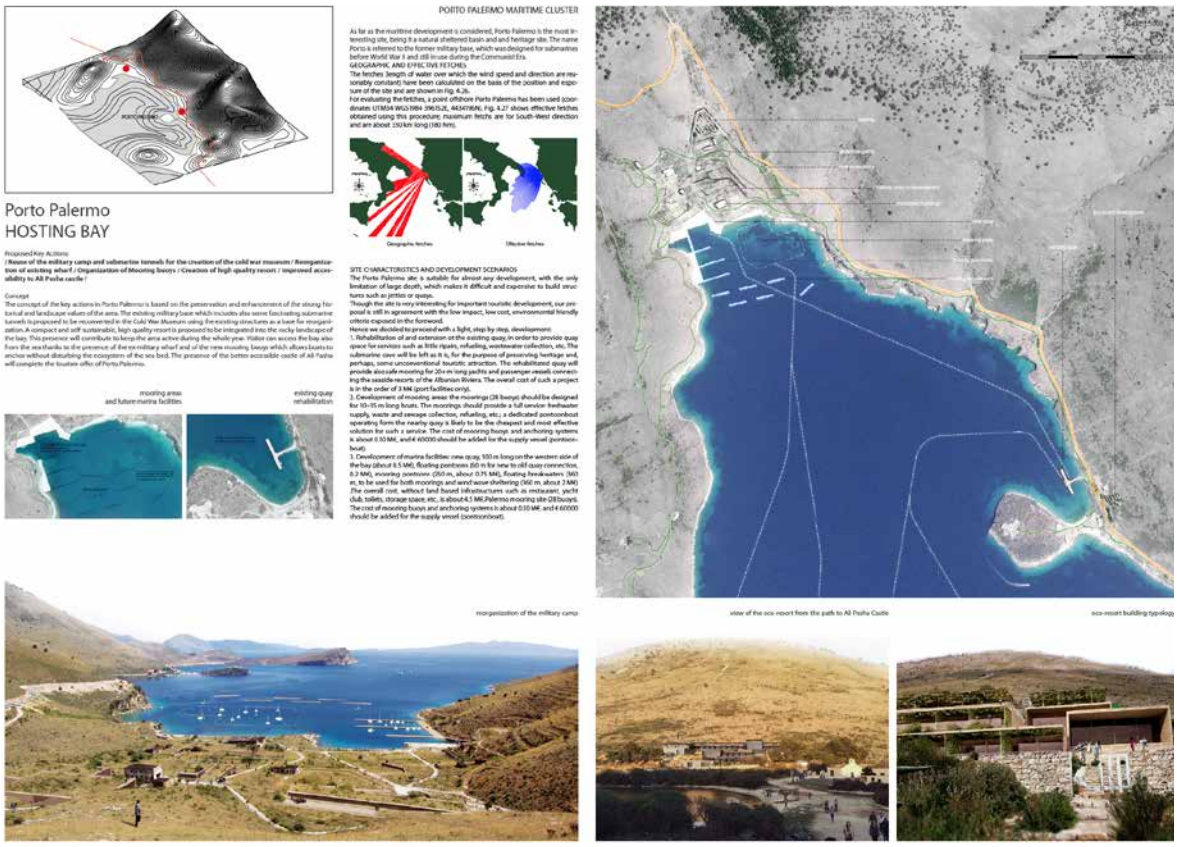


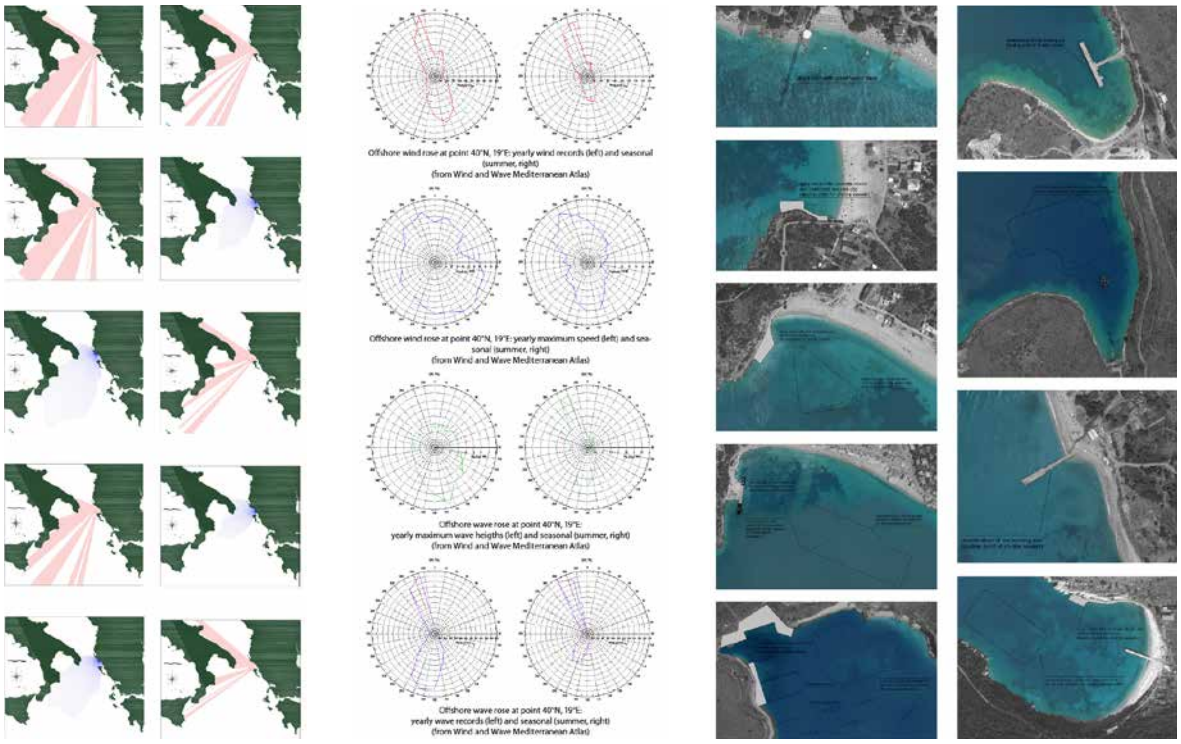
Figure 2.46: The image shows the proposed 'detached port' in the Porto Palermo bay which is developed starting from existing buildings and infrastructures.



amenities and facilities in existing harbours, they have a very low environmental impact and allow programming nautical development in a more flexible manner and with lower investments. Operating these light infrastructures may also affect a wider scenario at macro-regional level, where some existing and very structured marinas could have spin-off satellites in other coastal areas (even across the Adriatic sea) using local suppliers for services such as water, food, fuel and waste.

These ports represent a more flexible model both from an economical and a management point of view. Different market formats can be planned: as mobile harbours, their location could change every five to six years; otherwise they could be clustered offering costumers seasonal alternative locations. Thanks to their 'lightness' they represent an effective development tool for unknown and under-equipped touristic areas, boosting their competitiveness in such a gainful market as the yachting one. In the Albanian Riviera specific case, their location choice has to be carried out following contextual criteria: first of all a preliminary analysis of specific sites conditions based on fetch dimensions, offshore winds and wave climate (*Figure 2.47*); then, careful assessments about environmental impact minimization and initial investments, the preservation of landscape qualities and the touristic

Figure 2.47: Preliminary analysis of fetch dimensions, offshore winds and wave climate addressing mooring areas and peers development.



offer diversification.

In general, the presented proposal aims finally at defining a land use strategy based on the accessibility component and the smart development of mobility networks. Their planning requires to face several issues concerning their immediate effect on dynamic economic sectors especially in emerging countries as Albania. Tourism, due to its rapidly changing character as a socio-economic phenomenon, needs to be approached by flexible strategies in particular since it is done in a country at the very beginning of its touristic development. The infrastructure topic, as sustained in these paragraphs, is a fundamental component of this process and therefore it has to be arranged in time. The present contribution has explored just a portion of the matter, dealing with accessibility and mobility, but other issues need to be tackled as well -such as energy and water supply, waste management, hydro-geological risk (Eftimi, 2003), etc.- looking for adaptable and more sustainable devices.

In general, working on a 'light strategy' means to start facing these issues regardless of bigger and long-lasting decisions that will be effective later on. It means also to operate a more pragmatic and time-based vision through incremental steps, even making mistakes, then fix errors and improve the system as long as bigger choices turn to be operational. That is even more true considering infrastructure whose time of accomplishment is normally very extended.

In the Albanian Riviera context, the discussed proposal of a multimodal mobility system is an application of this concept. Its attitude at being progressively upgraded by low cost and quick interventions could really steer the development and further enhance the potential of the coast in a short time: creating a market, offering new perspectives to engage private assets and initiatives, influencing forthcoming political and economical choices. The strategic goal is to provide the Riviera with a feasible instrument to tackle contemporary challenges in the framework of a high-competitive and global tourism market. In these perspectives such mobility and accessibility light infrastructure have to be seen as a proactive tool whose basic value relies on its tight involvement with time:
in terms of period: given its ability in accommodating different seasonal usages and incoming flow rates;
/ in terms of *duration*: thanks to the ease with which the network can be 'scaled' (enlarged or reduced) according to tourism growth (or decline) scenarios;
/ in terms of *rhythm*: as far as it can act as a catalyst of diverse travel experiences fulfilling a vast range of tourists' expectations;
/ finally, in terms of *timing*: enabling fast decisions and accelerating the implementation process.
In this perspective, the general role of infrastructures' development should be re-considered (Emanueli & Lobosco, 2015): conceiving such interventions no more as definitive answers to incoming (or increasing) needs, but as a kind of landscapes 'producers'; in other words, adaptable devices aimed at steering, in space and time, territorial alterations related to large-scale phenomena, such as tourism.

Figure 2.49: Buoys field in New Bullards Bar Reservoir, Yuba County. (Source: www.downwardscausation.com)

2.2.3 Attractiveness Component

Disclosing Maritime Landscapes (i.e. D-mLand) is an on-going research project developed by Sealine in the main framework of the EU Strategy for the Adriatic and Ionian Region (i.e. EUSAIR). In particular, the work investigates a possible effective strategy capable of improving the Marine Protected Areas (i.e. MPAs) and their touristic attractiveness, while boosting the positive environmental impact on the Adriatic and Ionian basin ecosystems.

The project grounds on the main reference-tool of the SPAMI protocol, which aims at promoting and enforcing the Specially Protected Areas of Mediterranean Importance. Shaped and inspired by these guidelines, the D-mLand strategy focuses on achieving around each existing or forthcoming SPAMI a new touristic cluster made by different satellites and, afterwards, on implementing several macro-regional networks among these clusters, to enable specific physical and thematic itineraries.

In fact, as the touristic demand is changing and specific types of tourism are growing stronger and stronger - associated for example with recreational scuba-diving (van Treeck & Schuhmacher, 1999) -, proper systems able to arrange, control and manage new and increasing flows become necessary. The carrying capacity of each singular MPA is far from fulfil such requirements, and therefore needs to be somehow enhanced in a landscape perspective, in order to develop - without threatening the already fragile balances - more integrated and coordinated approaches to support both conservation and tourism agendas.

Disclosing strategy

In this perspective, D-mLand identifies a set of ignored or unconventional sites which do not present yet all the features to become MPA themselves, but have the potential if clustered with the already existing SPAMI to act as satellites and positively influence from the outside the general exploitation of these areas. Following the framework of the Protected Destination System (i.e. PDS) elaborated by Miller et al. (2016), the research investigates an operative way to plan and design the relationships between its two, spatial and conceptual, components: the Protected Area and the Gateway Region.

According to this vision, the existing or potential new SPAMI area is expected to act as the core of a cluster made by numerous satellites. These satellites may have different features (such as geo-

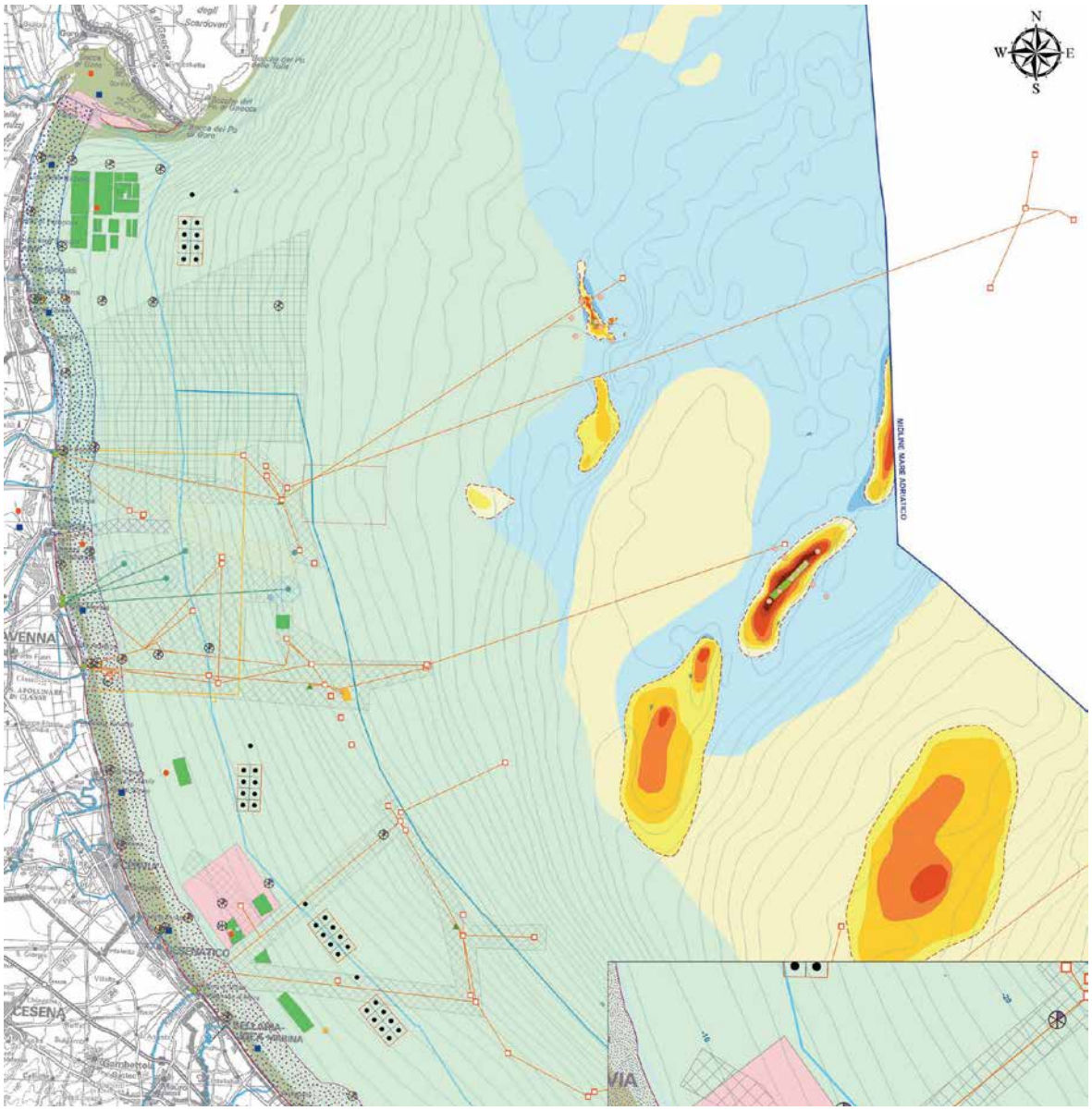
Figure 2.50: Plan of dredging furrows found in 'Piazza Municipio' in Naples representing the city's old harbours development trails. (Source: Carsana et al., 2017: 15)

sites; cultural, archaeological and industrial spots; offshore platforms; industrial heritage; etc.) and locations (coastal, deltaic and offshore areas, sub-tidal and intertidal sites, etc.), but might contribute in fostering the touristic attractiveness by hosting those facilities and activities that would not be settled in a MPA, although they are essential for the whole area accessibility, usability and competitiveness. For this reason every cluster should be planned according some basic requirements: being recognizable, reachable, inviting and well-dimensioned in terms of services according to site-specific environmental assessments.

In order to face such objectives, the research has been organized in 2 different steps designed to tackle the main issues that commonly arise from debating with stakeholders. The first one concerns the creation of a Maritime Landscapes Atlas: an instrument to build a network at Macro-regional level addressing the sustainable development and preservation of maritime natural and cultural heritage, through the showcase of new landscapes made by protected areas and their satellites. The second step focuses on formulating possible Strategies for Cluster-Districts' Touristic Upgrade. A range of parameters, guide-lines and analysis will be taken into account for implementation in order to give a preliminary feedback to local stakeholders (public agencies, economic operators, etc.) about the utility and convenience for a territory to apply for the SPAMI label, according to the cluster scheme. Such maritime protected areas, if gathered and managed in a more comprehensive network, could be able to better influence the whole Adriatic-Ionian ecosystem, not only in terms of environmental benefits (protection of maritime and coastal biomasses) and blue growth (restrictions for fisheries, monitoring of marine species, etc.), but also in terms of economic development (for instance through the development of sustainable tourism).

Such hypothesis grounds on a main desirable shift in the way the EU and its State Members' policies consider the Maritime Spatial Planning (i.e. MPS) purposes in relation to the established definitions given by the European Landscape Convention (2000). As stated in its first Article at point a): *"'Landscape' means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"*. Such 'double genesis' of Landscape gets further reiterated and highlighted in the same Article by defining the concepts of Landscape protection, management and planning. In particular, as *"'Landscape planning' means strong forward-looking action to enhance, restore or create landscapes" (Article 1, f)* we believe that the principles guiding the MSP should take into account and even work towards such Landscape 'creation'.

Figure 2.51: Simplified version of the "Sea uses' Chart of the Adriatic sea in front of the Emilia-Romagna Region coastline". (Source: ARPA Emilia-Romagna)



In this direction, there are at least two crucial consecutive actions that have been the subtle subjects of the present research:

/ to disclose marginal and hidden landscapes, affecting what can be 'perceived by people' in order to go beyond the zoning-oriented approach that is commonly used to describe the maritime space, while providing a more holistic and dynamic interpretation of the relationships among its components;

/ to conceive operative strategies intended to combine sustainable development and protection, promoting the view of future landscapes as the result of the action and interaction of natural and/or human factors.

Figure 2.52: Composed chart of Riccione (Italy) showing the items which characterise the sea as an urbanised landscape.

Maritime Landscapes Atlas

Wrecks, pipelines, cable-ducts, extractive offshore platforms, LNG terminals, energy plants, docks, piers, artificial reefs against costal erosion and/or in favour of the ichthyic repopulation; sampling, measuring and monitoring networks as marker buoys of oceanographic instrumentation; breeding areas of mussels, oysters and clams; suitable areas for shellfish farming, discharge areas for rivers' dredging material, reported waterways and bathing areas; mooring sites for yachting, offshore sand mining sites, as well as archaeological and industrial heritage spots.

This is only a partial list collecting infrastructures and functional areas insisting on the maritime space. A more exhaustive representation of how such items deeply characterise the sea has been, for example, developed by ARPA Emilia-Romagna agency, looking at a limited span of the Adriatic basin (Preti et al., 2009). The map reported in *Figure 2.51*, giving an outstanding depiction of complexity, aims at providing both an overall and detailed view of the uses and the monitoring activities happening in the sea area in front of the Emilia-Romagna coast. Furthermore, it suggests the chance to question a certain picturesque and idyllic sight of the Sea as some sort of untouched natural realm. In fact, the vast range of human artefacts, uses and regulations that here overlap suggests an intrinsic continuity of the sea with its hinterland built environment (*Figure 2.52*) and, as a consequence, allows to consider such environment under a Landscape perspective, beyond the inventory. This means disclosing the existing as well as planning the future interactions between Protected and Marginal ecosystems, their possible synergy towards new fruition scenarios, even changing their appearance. The aforementioned neglected and marginal sites actually create a widespread maritime landscape

crossing the sea and affecting its habitats' evolution, as some scientific literature has already demonstrated (ISPRA, 2012), often contributing in their biological differentiation and richness. Especially in the AI basin, they represent an underestimated biodiversity reserve which could be exploited to reach the main targets that EU policies on MPAs have fixed for the next years.

It should be noted that many diverse definitions of MPAs exist, and every country has its own regulation in this field. In general, MPAs are geographically well-defined areas in which human impact is kept to a minimum level (e.g. extraction is not permitted), often established with the main purpose to strike a balance between ecological constraints and economic activity (EEA, 2015a). Both globally and across Europe, MPA designation is evolving towards the construction of more representative and ecologically coherent MPAs networks: from the protection of singular sites, presenting vulnerable and essential features (e.g. rare habitats or vulnerable species), to a more holistic assessment and design of entire MPAs networks, based on an ecosystem approach.

The Marine Strategy Framework Directive (i.e. MSFD), foreshadows that EU Member States will have to launch - possibly by the end of 2016 - programmes and specific measures that will contribute to achieve consistent and coherent MPAs networks, by firstly designating new single MPA areas and then grouping them together (EC, 2014). In fact, as Smith et al. (2009) remind us, the importance of constructing and officially recognizing MPAs networks lays in the potential environmental achievements that these could lead to by working synergistically, while covering different protection levels and targeting specific goals that -if considered singularly- MPAs couldn't achieve.

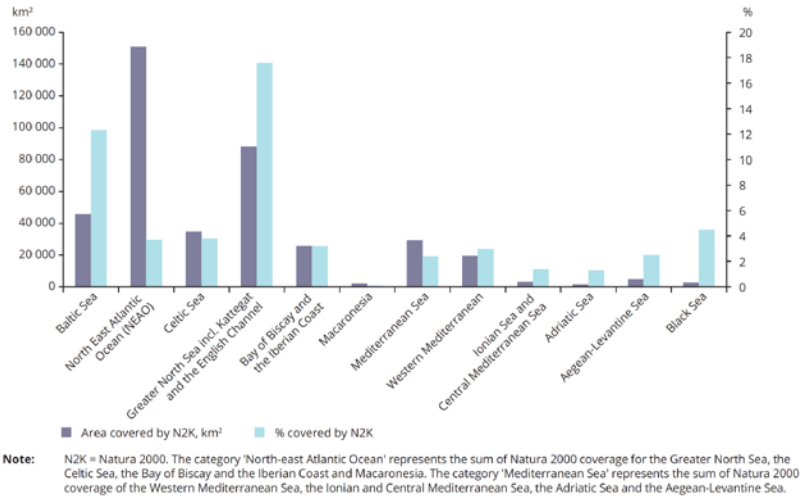
Referring to the MSFD's Article 13.4, the main future challenge in MPA design concerns the concepts of 'network coherence and representativity' and their meaning for Europe's regional seas in practical, scientific, and legal terms (EEA, 2015b). Until now, the marine Natura2000 network, for instance, has played a key role in such direction for it includes over 23 countries and has brought to the improvement of the MPA coverage in the EU's seas. On the other hand, focusing on a specific, limited number of vulnerable marine species (seabirds, turtles and marine mammals) and habitats, such network seems to be inadequate for future developments in the integrated approach of marine ecosystem management and protection. This becomes even more evident if looking at the distribution of the Natura2000 network (*Figure 2.53*) where offshore habitats, e.g. sandbanks below 20 m or soft-bottom habitats, and the associated communities of fauna and flora have struggled to find a collocation.

Figure 2.53: On the left, Portion (%) of near shore waters, coastal waters and offshore covered by Natura2000 sites; on the right , Coverage of Natura2000 network in Europe's regional seas. (Source: European Environment Agency)

MPA assessment area regions	Near shore waters	Coastal waters	Offshore waters
Baltic Sea	**30.9**	**15.3**	**3.9**
North-east Atlantic Ocean	**42.9**	**15.4**	**2.0**
Celtic Sea	31.9	7.8	2.3
Greater North Sea incl. Kattegat and English Channel	59.0	31.5	11.2
Bay of Biscay and the Iberian Coast	47.7	15.6	1.7
Macaronesia	16.3	2.4	< 0.1
Mediterranean Sea	**24.5**	**4.8**	**< 0.1**
Western Mediterranean Sea	45.7	8.5	< 0.1
Ionian Sea and Central Mediterranean Sea	27.0	2.1	0.0
Adriatic Sea	10.1	1.0	0.0
Aegean-Levantine Sea	14.1	2.3	0.0
Black Sea	**77.9**	**19.2**	**0.0**
Total	**33.3**	**11.3**	**1.7**

Note: Near shore = 0–1 NM zone, coastal waters = 1–12 NM zone (for Greece, 1–6 NM), offshore = 12 NM – END, where END = equidistance to neighbouring state or 200 NM.

Source: EEA, 2015. See EEA, 2015 for the delineation of the assessment areas (regional seas). Zones within each assessment area have been chosen to help illustrate the current distribution of the Natura 2000 network and inform future discussions on completeness.



Note: N2K = Natura 2000. The category 'North-east Atlantic Ocean' represents the sum of Natura 2000 coverage for the Greater North Sea, the Celtic Sea, the Bay of Biscay and the Iberian Coast and Macaronesia. The category 'Mediterranean Sea' represents the sum of Natura 2000 coverage of the Western Mediterranean Sea, the Ionian and Central Mediterranean Sea, the Adriatic Sea and the Aegean-Levantine Sea.

A more effective and comprehensive tool in this perspective might be represented by the Protocol Concerning Specially Protected Areas of Mediterranean Interest (RAC/SPA, 1995) set by the Barcelona Convention. In 2012, 32 SPAMIs were established in the basin: they were MPAs already organised by contracting parties according to the Protocol, following some general features whose main interest -from the present research point of view- lays in the concept of 'regional value' as an area basic requirement for being included in the SPAMI List. Under this concept, some of the criteria used in evaluating potential SPAMIs recall a more inclusive and landscape-oriented approach: among others, the criteria of 'Diversity' and 'Cultural representativeness'.

The whole Adriatic-Ionian Macro-region is characterized by specific excellence spots in terms of marine environment, but only a few of these have all the SPAMI's requested features. Furthermore the coverage of Natura2000 network in the Adriatic regional seas is not sufficiently developed if compared to other contexts (*Figure 2.53*). This gap reflects a lack of underwater heritage protection and entrenchment that even affects the areas in which strategic and national parks insist. As many studies have already highlighted - for example on the role of seagrass meadows in the mitigation of the erosive phenomena (Fonseca & Fisher, 1986) -, coastal protection can be attended effectively through the development of promotion policies for submerged areas, but they need a preliminary deep knowledge of such habitats, along with their natural and cultural maritime heritage.

The Atlas-related activities have then been structured to classify and map the potential SPAMI areas in the AI basin with the final goal to enhance the protection from natural and anthropogenic hazards. In fact, beside creating an ICT-GIS database of the AI maritime environment's assets in order to pro-

Figure 2.54: Some maritime habitats considered for the Taxonomy.

vide policy makers with the necessary tools to plan for future operations, it is important to identify risk factors and cross-border resilience strategies from which defining development priorities and guidelines for a proper distribution of SPAMIs' clusters over the sea.

One of the main tasks of the project is therefore represented by the 'SPAMIs' Satellites Taxonomy', which targets a typologic classification of maritime coastal and/or submarine habitats not yet officially recognized nor protected, but interesting for their ecologic and landscaping value. In partnership with other research centres and Universities, Sealine is spotting and studying such landscapes (*Figure 2.54*) in terms of environmental impact, analysing their actual capacity to increase biodiversity as well as to potentially affect users behaviours and fruition dynamics of the sea.

Their effect on marine habitats has been analysed on the basis of a wide literature review dealing with the concept of 'artificial reefs'. According to Baine (2001), Artificial reefs (ARs) are manmade structures deployed on sea bottoms with the primary purpose of protecting coastal habitats and/or increasing biotic resources by aggregating marine species and preventing trawling. Traditionally, in the oligotrophic waters (e.g. western Mediterranean Sea), the ARs goals were to protect Posidonia

oceanica meadows from illegal trawling, to increase habitat complexity and promote higher species diversity (Relini et al., 1994; Riggio et al., 2000; Gonzalez-Correa et al., 2005). Conversely, in the eutrophic waters (e.g. central and northern Adriatic Sea) the main purpose of ARs was to increase fishery yields (Bombace et al., 1994; Ardizzone et al., 1996; Bombace et al., 1997).

Widening the artificial reefs definition to all those structures whose main aim don't fit this purpose (such as offshore platforms and energy plants, sub-tidal and intertidal structures for coastal defence, wrecks, harbours and similar works) it is possible to describe a broader census of items across the sea that interact with the environment supporting, for example, sessile filter feeders, providing nourishment and refuges for motile species, and attracting bentho-nectonic fishes (Bohnsack and Sutherland, 1985; Baine, 2001).

In fact, fish aggregating effects of artificial reefs and similar structures are well known, and the effectiveness of different structure typologies in this respect are well documented (Santos et al., 1997); on the other hand, such interactions are not cause-effect, and happen according to complex ecological processes affected by external phenomena like seasonal larval supply, water circulation, turbidity and nutrients, depths, orientation and physical-chemical features of the substrata (Anderson and Underwood, 1994; Relini et al., 1994; Riggio et al., 2000; Turner and Todd, 1993). This explains why, besides the study of environmental conditions, structures' age and typology (i.e. the Taxonomy), it is necessary to develop a more holistic tool that enables to monitor and plan the interactions between different spots working as Fishing Aggregating Devices (FADs) by considering their mutual spatial and temporal relationship in the waterscape also in the light of fluctuation in environmental condition and variability of recruitment processes (Ponti et al., 2015).

Therefore the Atlas, by mixing spatial, topological and typological data, aims at providing such dynamic representation of the maritime landscape, in order to support effective planning choices that should consider:

/ spatial arrangement of MPA and marginal spots;

/ changes in local species composition, interactions and food webs;

/ interactions between organism and substrata (encrusting, bio-erosion, etc.);

/ alteration in exploitation of biotic resources;

/ alteration of population connectivity and genetic diversity;

/ facilitation of the spread of non-indigenous species by creating suitable habitats with reduced com-

petition with native species and migrating corridors (Sheehy and Vik, 2010).

Finally, the Atlas major expected goals concern:

/ providing the project beneficiaries, stakeholders and target groups (public authorities and private investors) with a clear overview of the current situation (a sort of SPAMI and MPA state of the art), highlighting the network potentiality and multiplicity;

/ providing proper instruments to detect and discover attractive sites around potential SPAMI areas, showing their features in terms of landscape and environmental quality;

/ creating a platform to inform target groups with a first implementable representation of the AI Maritime Landscape conceived as a network of cluster-districts (made of MPAs and their satellites) that are about to apply to the SPAMI procedure;

/ facing the issues raising from national rules contradictions in order to define a shared protocol to recognise at local and cross-border level such cluster-based system.

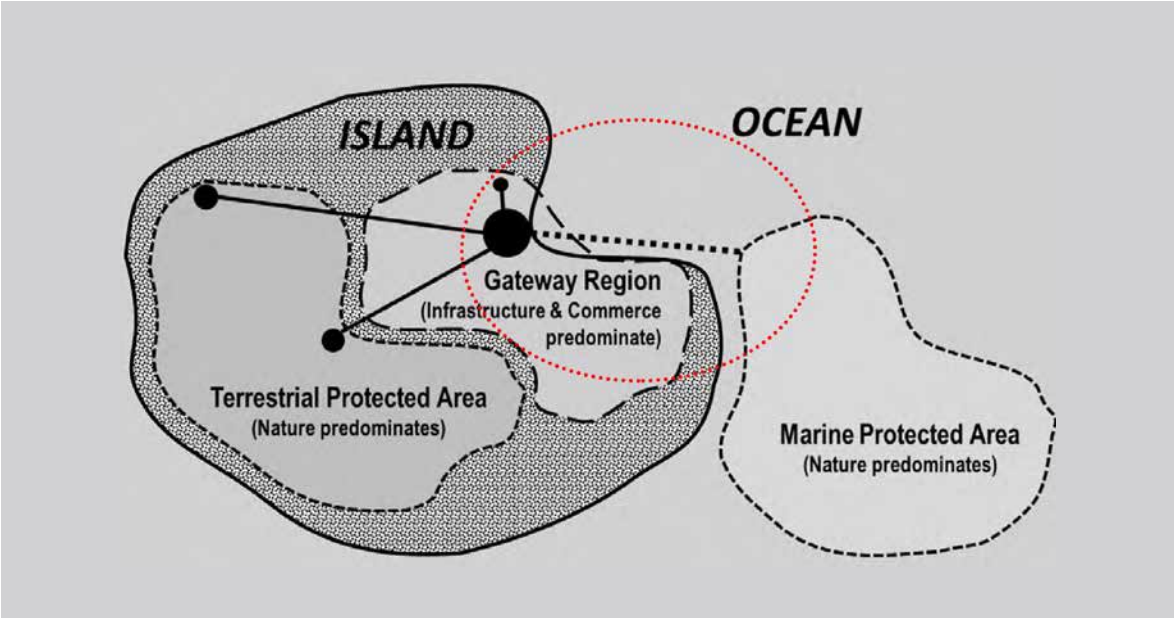
Together with the efforts at EU level for MPA enhancement, a new work should be done to define actual and future sites where biodiversity could flourish around existing and new human activities on the sea. D-mLand has been focusing on this topic by developing a set of strategies and guidelines concerning the touristic upgrade of significant 'cluster-districts' in the AI basin, in order to implement new ways of fruition designed for the purpose of job creation in the tourism sector through new creative industries dedicated to the enjoyment of maritime environments.

Strategies for Cluster-Districts' Touristic Upgrade

Following the SPAMI's Protocol's quality standards, the project general aim is to involve in such conservation and promotion process a higher possible number of territories. Developing a protection model based on cluster-districts, and able to boost the touristic flows could give additional reasons to public authorities and stakeholders to apply for the SPAMI label, making its convenience more evident.

In fact, as the Satellites do not have the SPAMIs' constraints, their ecological value might be easily combined with a touristic use of the marine environment, so that more proactive policies and planning activities could be developed both in medium and long term perspectives. Networking integrated services for the exploitation of natural and cultural maritime heritage gives, at the same time, the chance to reduce the operating costs for sustainably managing the habitats. The creation of cultural

Figure 2.55: Hypothetical protected destination system (PDS) and, in red, the operative field of the Cluster-district model. (Source: Miller et al., 2016: 10, edited by Sealine)



and creative industries, besides increasing touristic attractiveness and support the running costs of higher-level environmental protection, could also raise awareness among citizens on the value of maritime tangible and intangible heritage.

In such framework, where public and private actors are encouraged to collectively upgrade sustainable tourism products, the development of new MPAs and strong gateway communities (Eagles & McCool 2000; Howe et al. 1997) becomes an essential prerequisite to the success of the cluster-district model. Referring to the image in *Figure 2.55* proposed by Miller et al. (2016: 10), the cluster-district model can be interpreted as an operative application of the Protected Destination System (i.e. PDS), whose main aim is *"[...] highlight[s] the interdependency between tourism destinations and protected areas."* introducing a conceptual framework *"[...] for the multidisciplinary study of the human, artifactual (e.g., the built environment, laws, policies, projects) and natural domains"*. According to this model, the principal PDS components are: a Protected Area devoted, at least in part, to recreational and touristic activities; a Gateway Region accommodating the human communities (i.e. residents and occasional users) which should somehow take advantage of the characteristics of the first one.

In particular, the cluster-district model we propose around SPAMIs is meant to foster the connection, as well as the landscape and the ecologic continuity between the two PDS components. In such perspective, the SPAMI's Satellites can be inside or just at the borders of the gateway region on the

hinterland and the coastline, as well as adjacent to an offshore protected area (this is the case of the already mentioned marginal maritime landscapes). Satellites, depending on the context and according to site-specific strategies, are supposed to work in four different ways:

/ as *accessibility devices* (for example, a network of landing spots working as cluster's gates) they should enable a better management, control and regulation of visitor flows over the year, setting the cluster-district's carrying capacity on the basis of environmental assessments and touristic demands;

/ as *showcase devices* (for instance, a set of open diving areas and underwater parks) they might provide visitors with a preview of the SPAMI different habitats under controlled and safe conditions, catalysing the interest of tourists and general public on specific itineraries and future experiences;

/ as *service providers* (for example, thematic and specialised hotels) they should supply visitors with a high-quality standard availability of accommodation, with catering and other facilities designed on the basis of different types of tourism specific needs;

/ as *monitoring devices* (for example, spots integrating remote sensing technologies) they would contribute to data gathering, analysis, and communication in support of planning actions aimed at establishing proper usage thresholds for the cluster-district, in orders to avoid conflicts between biological and anthropic processes.

Clearly, the actual function of Satellites in the cluster-district model depends on the context, but also on the type of tourism it mainly addresses. Since the ecotourism definition (Hetzer, 1965), a vast literature has insisted on the respect for nature and the importance of creating and supporting protected areas (De Los Monteros, 2002). This orientation can also be found at different scales in other similar tourism forms: nature tourism, geo-tourism, wildlife tourism, green tourism, conservation tourism, environmental tourism and endangered species tourism, among the variants. But, beyond definitions, the present research focuses on the proactive role that maritime landscape may have in boosting and supporting a range of tourism forms through a strong engagement in disclosing the opportunities provided by neglected or underestimated sites; places where touristic formal and informal practices are often already performed, even though not officially recognised.

Around the Adriatic, the most valuable example is represented by the so called 'Paguro experience': an unintended example of 'rigs-to-reefs' procedure originated by the explosion and the consequent sinking -on 29 September 1965- of the AGIP drilling platform ''Paguro'', placed 12 nm offshore Ravenna (Ponti et al., 2002). The platform wreck became in a few years a major scuba-diving des-

tination due to the fast proliferation of marine flora and fauna, and thanks to the active engagement of several diving associations in promoting, protecting and maintaining the area. Such spontaneous, but well organised actions brought, since 1995, national and regional authorities to recognise the ecological value of the area, declaring its status of 'biological reserve'.

Nowadays, according to the estimation given by local diving associations and limited to summer flows, the 'Paguro's spot' is visited by 4.000 divers every year; it creates job opportunities related to move tourists and divers around (at lest seven charter boats are involved in their transportation and supporting safe diving), and to train them in several Diving Centres based on the coast. Also, it increases profits because of the logistic required by scientific research and didactic activities. Other forms of business could involve the underwater park maintenance and improvement thanks to the installation of plug-in structures for different trails.

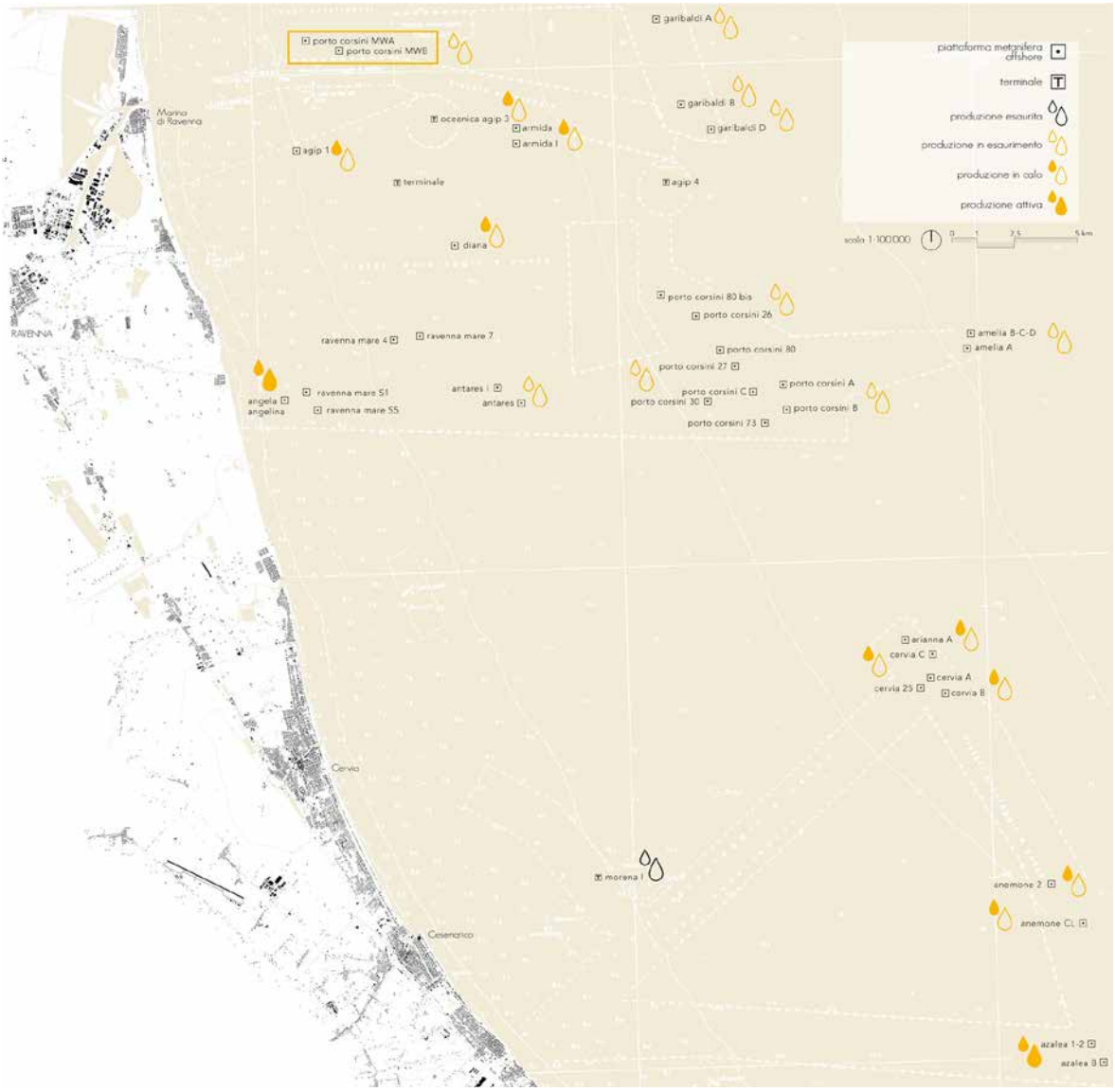
Looking at the touristic trends data, it is also important to highlight how, in only ten years, the 'Paguro's spot' has been able to reach almost 40.000 scuba diving sessions, half of which have been performed by divers coming from outside the Emilia-Romagna region, and 12% by foreign divers mainly from Austria and Germany. Another important factor to be considered is that the divers' spending capacity is usually higher than the average-tourist one as their stay in touristic destinations (Stoll & Ditton, 2002).

Alternative ways to decommissioning: an applicative case-study in the Adriatic

All these data and considerations have been taken into account for formulating a project proposal dealing with alternative ways to the so-called issue of offshore platforms 'decommissioning' in the Adriatic, concerning the chance to develop among them touristic cluster-districts related with recreational scuba-diving activities, which could apply to be recognised as SPAMIs. Such operative case-study has been supported by a multidisciplinary team of external advisors in the fields of underwater archeology, maritime engineering, marine biology, ecology and professional scuba-diving practitioners.

The project faces the issues raising from the decommissioning procedures required by law for exhausted offshore platforms in the Adriatic. At the end of their life-cycle, gas and petroleum companies are committed to remove all the extractive structures and proceed with a complete remediation of the site. In fact, while the 'rig to reef' procedure (i.e. the practice of converting offshore, gas, oil

Figure 2.56: Extraction platforms in the northern Adriatic and their actual production rate. (Source: Alessio Ghiselli and Virginia Melandri's Master Thesis)



and petroleum rigs into artificial reefs, diving spots, tourism attraction) has been already successfully adopted in the Gulf of Mexico (Scarborough Bull and Kendall, 1994) and is being considered for the North Sea (Aabel et al., 1996; 1997), the complete removal of decommissioned platforms is still the main disposal strategy adopted by the EU.

After an accurate analysis of the extraction data concerning the Adriatic platforms (*Figure 2.56*), their actual productive period has been set on an average of 30 years. Nevertheless, due to the massive costs that decommissioning implies, companies usually prefer to keep the platforms in use at a low operational level-rate, well beyond the normal end of their productive and remunerable lives. Such information, together with the risk of loosing the marine habitats that meanwhile have colo-

Figure 2.57: The PCW-B/C platforms off the coast of Ravenna. (Source: Alessio Ghiselli and Virginia Melandri's Master Thesis)

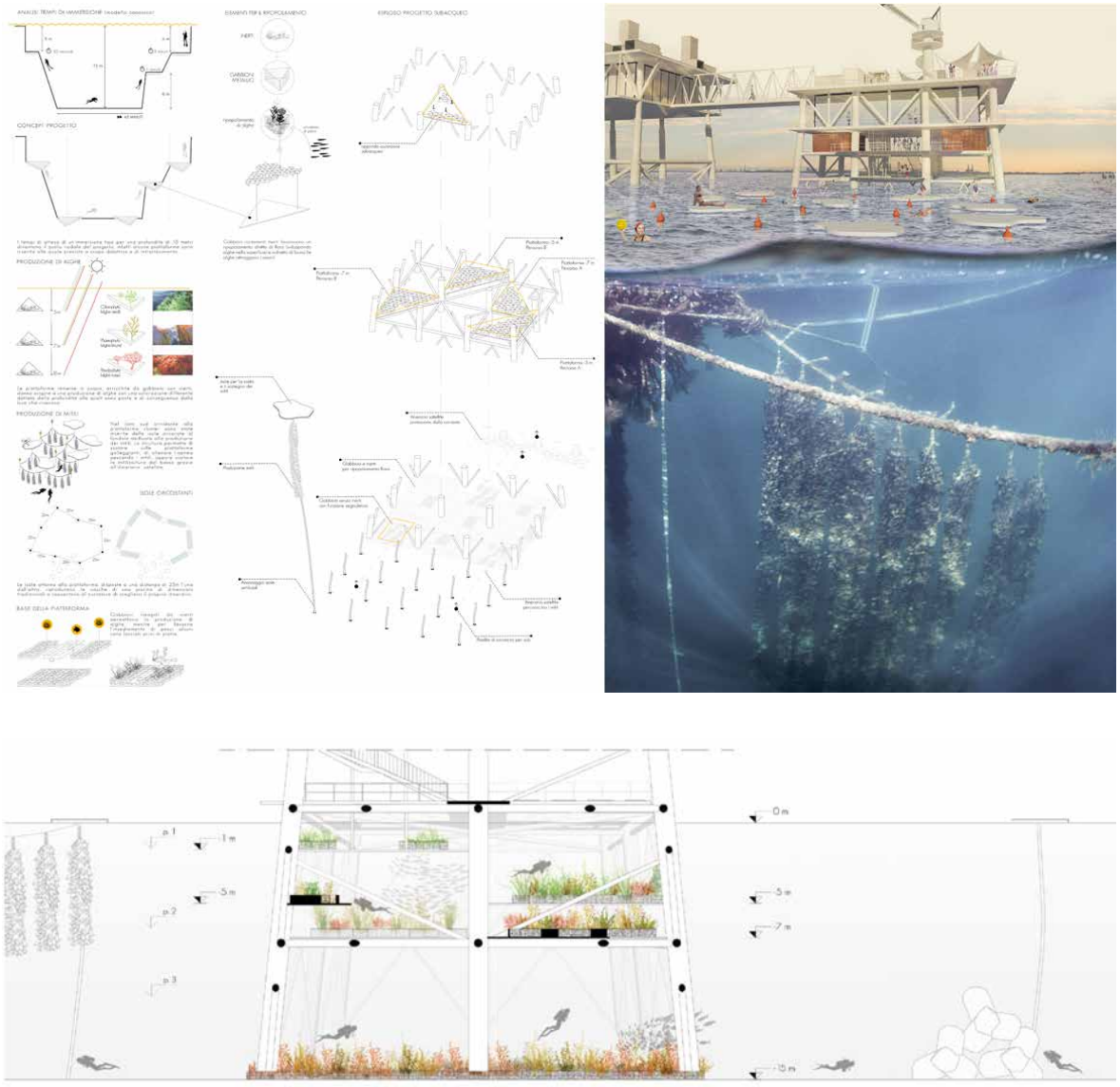
nized the underwater platform structures, led to the idea of a progressive reconversion of exhausted platforms into offshore underwater and scuba parks.

Evaluating the expected residual production period of each platform, the project establishes a step-by-step reuse scenario for the whole platforms' network, mixing different techniques and approaches to their decommissioning (as the total removal or 'rigs-to-reefs' by 'partial removal', 'topple in place' or 'tow and place',) and proposing for some of them more specific interventions aimed at hosting recreational, educational and research activities related to scuba-diving, fishing and industrial heritage discovery. Depending on the typology, the distance from the coast and the proximity to other spots, each platform has been planned to contribute to the cluster-district operation, according to the above-mentioned criteria for the SPAMIs' satellites.

In this project, the PCW-B/C platforms (*Figure 2.57*) have been strategically identified as the best spot for developing the Diving Centre facilities: only 7 Km from the Ravenna harbour, it is a two-rig composed structure connected by a 30m bridge with a footstep of 2.400m2 and an overall surface of 4.800m2.

After the capping of the gas wells and the complete removal of their pipes, the project plans to arrange on the main platform (the PCW-B) all those functions related with users accessibility (such as docks and mooring areas) and accommodation (reception, hosting and recreational rooms, relax areas, canteen, etc.), while on the second (the PCW-C) the Diving Centre facilities such as a offices, dressing and teaching rooms, workshops, tank storages, rental shop, and all the equipment and functional spaces. A good part of the proposal consists in the design of the underwater landscape (*Figure 2.58*) both at the bottom and between the steel framework of the PCW-C; the main challenge was to create an original and attractive diving experience, addressing both the beginners' needs and the

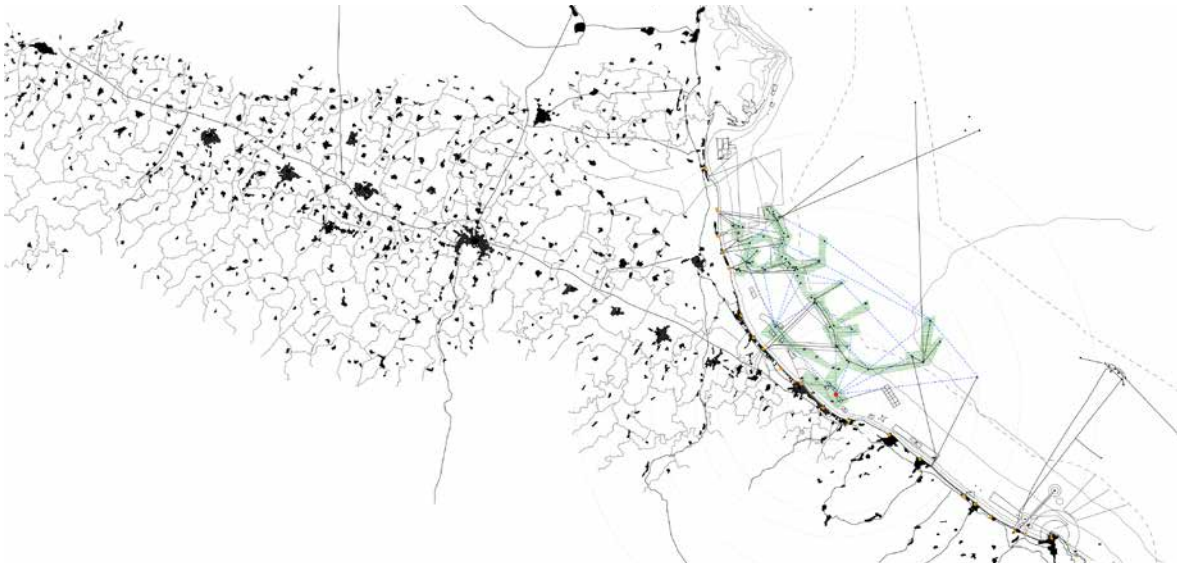
Figure 2.58: Above the landscape design concept and a rendering of the platform; on the bottom the section representing the underwater park project. (Source: Alessio Ghiselli and Virginia Melandri's Master Thesis)



professionals' expectations.

The landscape design concept (*Figure 2.58*) has been mainly inspired by three types of analysis. The first one, concerning the procedures of a standard 45-minutes scuba-diving session (with its pertinent waiting depths, periods and ascent timings), was used to define the location of several triangular wire-mesh platforms within the existing framework, specifically designed to signal the pauses to amateurs and to enrich the divers' experience with additional exploration areas. In fact, as outcome of the second analysis, the wire-mesh platforms were studied to promote the flora re-population depending on the incidence of solar radiation at different depths; these consist of modular metal cages that can be filled with inert materials, and easily fixed to the structure. Their filling density, orientation and

Figure 2.59: An hypothesis of underwater regional park in front of the Emilia-Romagna coast.



position depend on the study of solar radiation in order to create a multiplicity of micro-habitats for the proliferation of coloured seaweeds (such as chlorophyta, phaeophyta, rhodophyta), and to house as much and various aquatic fauna as possible. The third and last analysis concerning the local wave climate was essential to address the seabed landscape design outside the platform footprint, where security conditions could be critical due to sea currents coming from north. A great attention was payed to mark fixed paths for divers using guide-wires, visible metal cage patterns, and artificial reef devices to mitigate sea currents.

The PCW-B/C reuse project represents only the first step of a wider programme that could further involve up to other 50 platforms in the area in the underwater park development (*Figure 11*). According to the estimates released by the Bureau of Safety and Environmental Enforcement (BSEE), that since 2011 has been the leading U.S. federal agency charged with improving safety and ensuring environmental protection related to the offshore energy industry, a typical four-leg structure provides about one hectare of habitat for hundreds of marine species (BSEE, 2015). A simple projection of such data to our context would signify at least a 50ha offshore area to be devoted to the creation of a maritime cluster-district in front of the Emilia-Romagna Riviera, one of the most attractive, well organized and tourism-oriented territories in Europe. Such territory represents a Gateway region, whose hosting capacity, facilities and infrastructural equipment, as well as its entrepreneurial structure could effectively take advantage of a SPAMI's cluster, develop its touristic potential with new products, and properly manage the environmental impacts.

Figure 2.60: Construction works of the SNAM's gas pipeline connecting Tarvisio to Malborghetto in Italy. (Source: ILCEV, www.ilcev.it)

2.3 Relying on Instability

The previous paragraphs, by focusing on applicative case-studies carried out in different contexts and scales, have investigated the influence of forecasts, data and trends on landscapes generated by infrastructures. In particular, the reported projects and researches indirectly stress the importance of dealing with uncertainty and, in some way, they aim at including indeterminacy into the design process. Such aptitude grounds on an operative approach that can be referred to the 'Landscape Urbanism' one, whose most fascinating aspect is possibly such idea of incorporating the fluid or changing nature of any environment in its prospective planning (Corner, 2006).

In such theoretical field, over the last years, the role of infrastructure as a landscape's organizational device has seen the emergence of several different positions up to put the 'landscape infrastructure' issue at the focus of the international debate. Especially in the USA, but also in Italy (Ferlenga, 2012), a raising number of architectural events and publications have focused on infrastructure exploring the role of design in finding new solutions for complex and technical infrastructural challenges.

In many ways, 'landscape infrastructure' builds on the theoretical ground pioneered by landscape urbanism (Allen, 1999). Early theorists of landscape urbanism were interested in describing the city as a landscape, overcoming the binary between urban and rural (and urban and natural) that reigned at the time (Corner, 1997; 1999). Drawing from narratives of cultural and political geography, these writers were interested in reexamining the physical parts that make up a city, along with all the related components scattered across the horizontal urban field (blocks, buildings, parks, watersheds, food-sheds, and habitats to name just a few). They were also concerned with the social and economic drivers at play in the urban landscape (Waldheim, 2012). Whereas landscape urbanism looked to open conversations with developers, planners and policy makers in order to give landscape a role in shaping urban growth, landscape infrastructure attempts to bring civil engineers, highway departments, international shippers, and similarly massive players into the game.Despite all the newfound attention, the definition of infrastructure is still very much in flux (Bélanger, 2009) and constantly practitioners and theorists contribute to expand it analysing its component parts and proposing new kinds of infrastructure projects (Bélanger, 2010; 2013).

In such panorama, this dissertation has contributed to the topic by investigating specific contexts,

Figure 2.61: The trail of the SNAM's pipeline still visible five years after the works completion. (Source: ILCEV, www.ilcev.it)

such as touristic ones, in which the physical impacts of infrastructures on landscape are 'perturbed', amplified and stressed by unstable and overpowering phenomena. This operation's principal aim was to better understand some 'metrics' of infrastructural landscapes and their variations in order to inform the following steps of the research that will focus on building a model for developing prospective landscape scenarios.

In such perspective, we have pointed out the relevance of *'load dimensions'*, since every infrastructure is primary sized considering its structural and usage limits. These are more or less tied to the infrastructure occupation of space in the landscape, but also to some structural element recurrence or distances. A good example, in this sense, is represented for example by detention basins whose width and capacity is proportional to the statistical return-timing of exceptional storm events.

Other factors affecting the infrastructure extensions on the landscape are *'life-cycle dimensions'*. In fact, every work is planned to be operational for a specific timespan; such periods are normally prolonged through structural oversizing, by additional devices and choosing more enduring materials. But rarely, the decommissioning is planned or integrated in the infrastructure strategic vision.

A similar statement can be done regarding to the infrastructure *'provisional dimensions'* concerning in particular construction sites which actually represent, especially for huge works, a sort of temporary landscape often neglected, during and after the infrastructure completion. More attention is

Figure 2.62: The maintenance works along a drainage canal regulate the dimensions and the shape of banks in order to allow machines' movements. (Source: CBRO Consortium)

given instead to the *'discard dimensions'* of infrastructural works: soil displacements mostly due to pollution risk management often require measures that can turn into new landscapes.

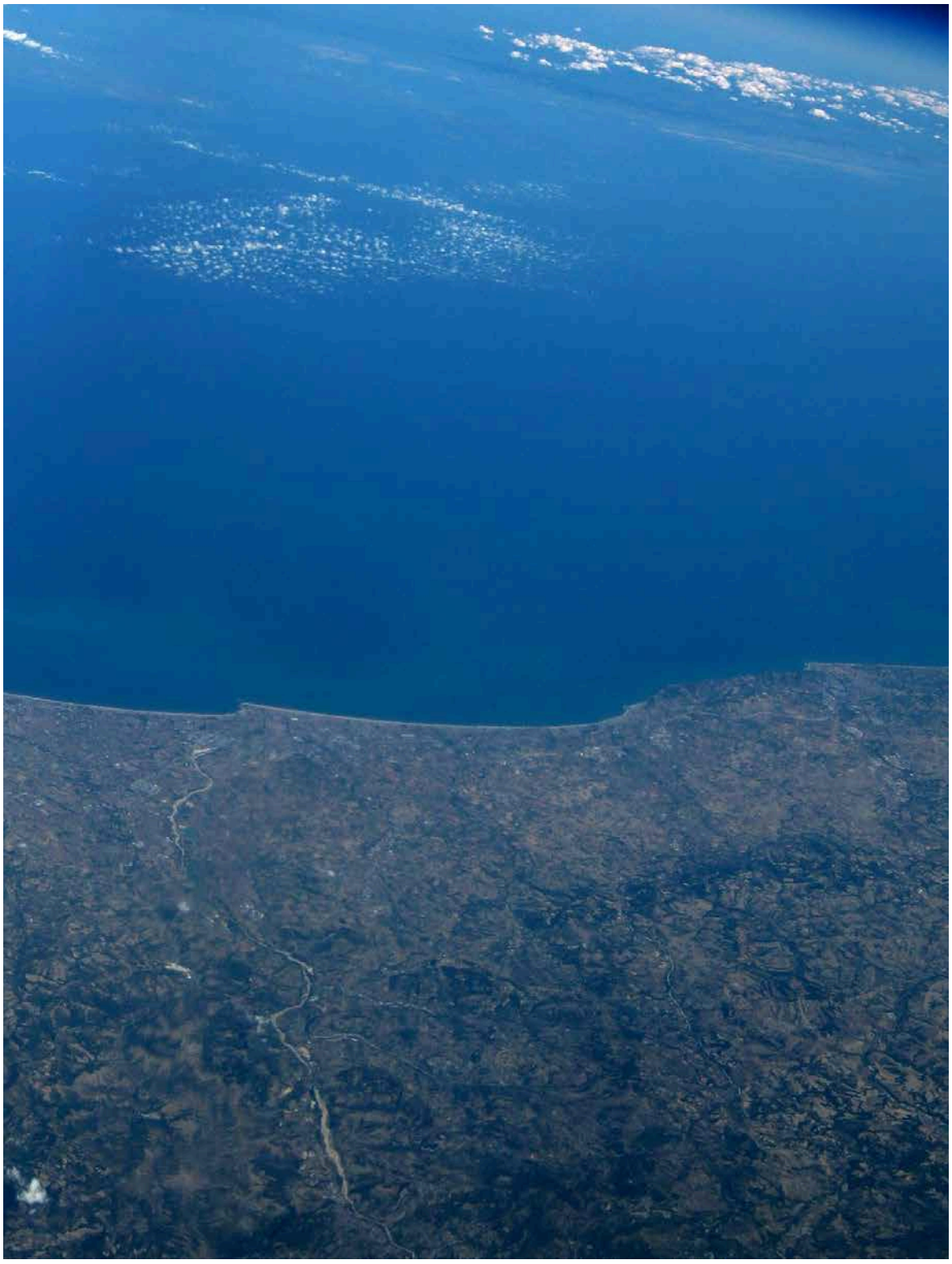
Two additional related metrics can be taken arccos infrastructural landscapes. One concerns *'normative dimensions'*,while the other is about *'maintenance dimensions'*. In a sense, they quietly affect the infrastructure field of action by providing a set rules, distances and usage prescription that generates a parallel landscape to the infrastructural one.

The instability of such dimension is obviously tied to infrastructure typology, but also depends from specific contexts and historical periods. In the aim of the present research, what is important to underline is their potential of being converted into landscape outlooks and their potential contribution in sizing future infrastructural development scenarios.

Chapter 3 / The Sizing Landscapes Model

This chapter basically focuses on the general model set up and on its preliminary implementation. The T.H.ER.E. project is here presented and reviewed, at the beginning, as a first empirical attempt of applying the scenario approach to the sizing of a complex multipurpose infrastructure. Also in response to the issues raised by that experience, and reworking other disciplines' workflows, an operative model based on the development of alternative landscape scenarios is postulated: the 'Sizing Landscapes Model'. A specific early-implementation of the model, concerning the infrastructural systems and contexts which a land reclamation authority has to manage, is then reported and analysed in order to test the instrument and its workflow, as well as its potential effects on strategic planning and the developer decision making.

Figure 3.1: A satellite view of the Emilia-Romagna coastline. (Source: StratoSpera Team Project, www.stratospera.com)



3.1 The First Approximation: T.H.ER.E. Scenarios

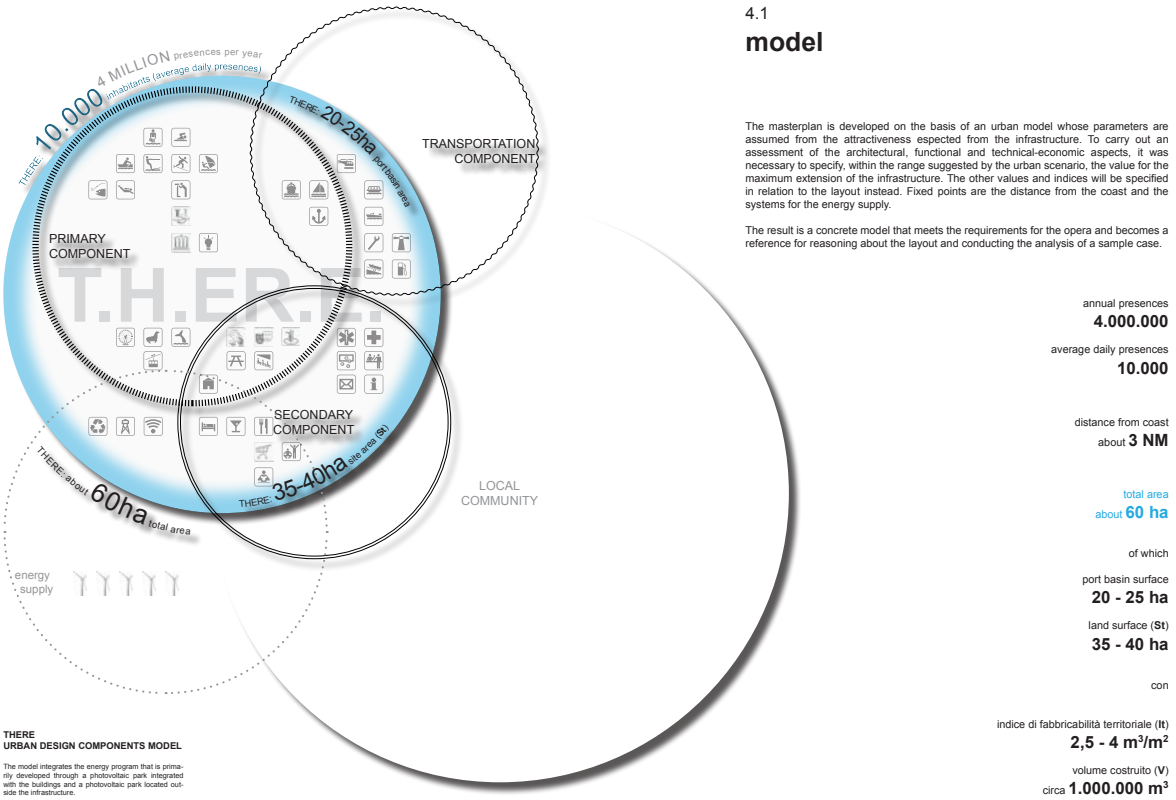
Below, the thesis reports an applied research work, carried on during the last few years, developing the idea of a maritime infrastructure in front of Riccione (on the Italian northern Adriatic Riviera), 3 nautical miles off the coast, which extends over 60 hectares and can accommodate up to 10,000 people: the 'Touristic Hub Emilia-Romagna East', namely T.H.ER.E. The project has been a sort of preparatory experience to the development of the 'Sizing Landscape Model' because of the design process employed, but mostly thanks to the outcomes tied to its procedural complexities which have clarified the need of a structured scenario-based approach.

T.H.ER.E. (i.e. Touristic Hub Emilia-Romagna East) is a project developed under an agreement between the Research Centre Sealine and SIS spa (Società Italiana Servizi). SIS spa is a company owned by 14 municipalities of the Conca Valley in the Riviera Romagnola. On behalf of these municipalities, SIS has promoted the project in order to develop a sufficiently clear and credible framework within which to involve investors and stakeholders in the successive stages of the proposal realization.

T.H.ER.E. is the response of a reactive territory to the state of crisis and to the difficulties that hamper a reality full of potential and that has always been at the forefront of tourism. T.H.ER.E. is the change of pace: on the coast the physical space of action is more limited, it is necessary to induce transformation processes from the outside, capable of balancing the urban growth, condensing the functions, reducing the consumption of land. T.H.ER.E. develops the idea of 'tourist infrastructure'. A port basin of 22 hectares and a stopover for cruises alongside other functions related to recreation, cultural production and research. A complex system, a new stretch of coast. A smart island in the heart of the Adriatic: the place where the future takes shape becoming a macro-scale model for the Adriatic-Ionian Macro-region.

At the beginning, the project uniqueness, at least at the Adriatic scale, has raised doubts about its administrative and legal procedures among regional and national institutions. In particular, they struggled in finding a standard reference procedure to be used in order to start the administrative procedures for its realization. So, such a maritime infrastructure hypothesis was compared with similar experiences by degrees of approximation and later accepted for submission by the Italian National

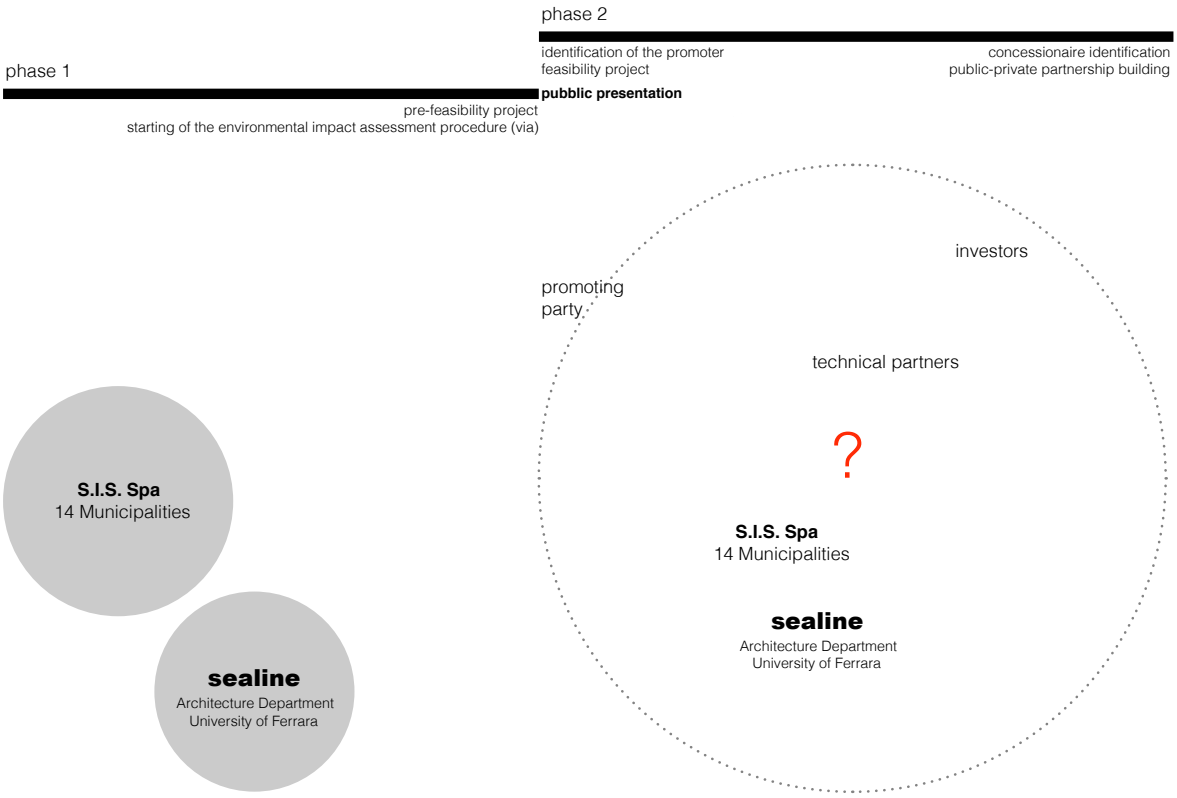
Figure 3.2: An extract from the document presented to begin the 'environmental impact assessment' procedure of THERE.



Commission responsible for the Environmental Impact Assessment.

Now, the project has undertaken the first administrative step toward its realization. Due to its dimension, complexity and wide scope, the project has been included, as said, among those undergoing the national procedure of Environmental Impact Assessment (EIA), pursuant to art. 20 D-Lgs.152/06 Environmental Code, (TUA). The documentation concerning the work environmental sustainability has been submitted, pursuant to art.21 TUA, to the preliminary stage of the EIA procedure, the so called 'Scoping' stage. The aim of this preliminary phase is to define the field of investigation to verify the potential impact of the work on the marine environment, in a cooperation logic between the promoter and the authorization responsible body. The EIA Commission replied positively also giving the guidelines to continue in the procedure with further studies needed to draw up a document named, according to art. 22 TUA, 'Environmental Impact Study' (EIS). Basing on this document, the EIA Commission will deliver its final opinion on the environmental compatibility of the project. By virtue of the uniqueness of the project, which actually cannot be compared to any other work ever realized at national level, it is essential to cooperate with the local authorities that will be in charge of granting the authorizations that the EIA Commission requires. This cooperation will be guaranteed

Figure 3.3: The two main phases concerning the procedure to obtain the concession to build and, highlighted, the subjects involved in the process.



through form of procedure ad hoc, called 'Conferenze di Servizi', which will be convened exactly with the aim to create a synergic relationship between the public and private sectors. The technical complexity of the project requires that procedures to identify and select international industrial and financial investors - through forms of elastic participation such as project financing and public-private partnership - will be activated .

In this framework of permanent uncertainty, the project had to be 'open-ended' towards investors and, at the same time, had to reach a sufficient level of detail in order to be evaluated by the EIA Commission. The challenge was giving a set of data and experimental findings on the basis of which to define sufficiently accurate scenarios under various points of view: urban, technological, energetic, financial and administrative.

According to the thesis objectives, the project is here reported mainly focusing on the strategic approach to the infrastructure sizing which has been the task in which we have been directly involved. Besides, several other studies have been carried on concerning the environmental impact analysis, marine weather and geology studies, economic and financial evaluations, as well as legal-administrative and procedural investigations.

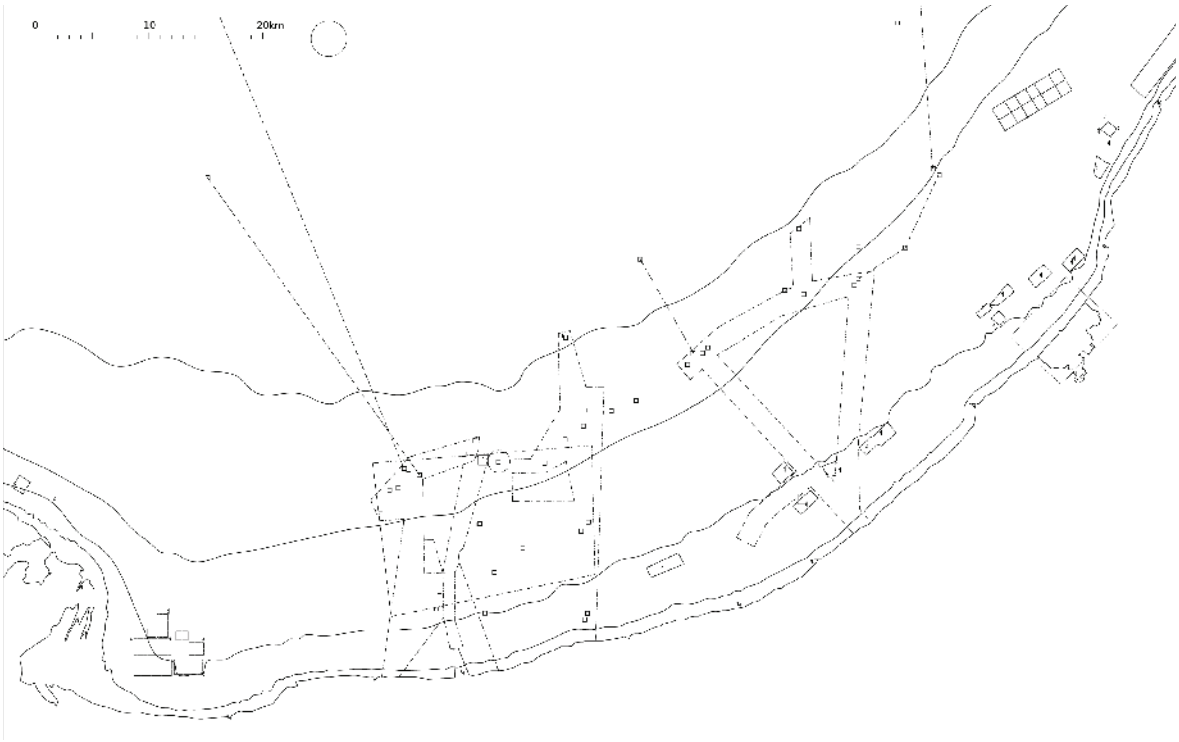
3.1.1 A new HyperNatural Landscape

The tourism competition has shifted to the global scale, between macro-regions; within the Adriatic metropolis, the challenge is to reconcile the upgrading of tourist facilities with that of cities as a whole. This is only possible overcoming obstacles that derive from a situation of density and propriety fragmentation of coasts. To replace the Riviera on the touristic imaginary, to renew and increase accommodation standards, to increase public spaces and natural areas in a dense built territory, in order to capture new types of tourism and to network destinations in the Adriatic Basins, it is now essential to develop new effective devices for tourists, capable of significantly affecting a large area. On the coast the physical space of action is increasingly restricted, for this reason it is necessary to induce transformation processes from the outside.

T.H.ER.E. explores the idea of a tourist hub off the coast of Emilia-Romagna: a device that can activate new relations between the two shores of the Adriatic and act as a catalyst to rethink the tourism supply. The stretch of coast between Riccione and Gabicce, and its inland, has the most interesting features for the development according to this vision. The location is strategic respect to routes in the northern Adriatic, compared to regional and national borders (San Marino), compared to the hinterland of the Apennines. The existing infrastructures equipment, the size and the population density of the area, its attitude to innovation; these are all reasons that make this location the right place where to develop a vanguard project on tourism. T.H.ER.E. proposes an innovative approach to the concept of infrastructure. An infrastructure able to absorb and exploit variables scenarios within a time-frame not defined a priori; capable of building relationships, of attracting interests and of fitting changing needs. With this aim, the research defines preliminary guidelines and criteria describing strategically qualities before quantities, that has to be pursued in the development of the project.

The project grounds on the idea of ‘HyperNatural’. For hypernatural we mean artificial environments that generate new landscapes, new sustainable habitats, radical scenarios of growth. Interventions whose aim is extremely pragmatic and so exasperated to blur-mix-build new relationships inside the environment. The THERE project insists on this idea proposing the creation of a new infrastructure that is able to relate to a regional scale, overcoming the separation between the coast and the sea and amplifying their mutual relationships.

Figure 3.4: The Emilia-Romagna coastline and the functional subdivision of the Adriatic sea in front of it; oil platforms, pipelines, drainage areas, mussel farms, navigation areas, administrative boundaries, etc. are highlighted.



The Riviera, toward the hypernatural

The Riviera coastline is largely artificial, a mixture of spaces in a constant mutation. This means working in an environment where 'nothing' is incongruous in advance and in which hybridization interventions affect the existing landscape with new infrastructure.

The coast landscape, artificial and heavily urbanized, extends beyond the coastline. Through an underwater mapping, you can see how much of the 'Adriatic City' extends across the sea with infrastructure, regulated roads, functional areas. Even the appearance of the littoral has been substantially modified over the time by the addition of barriers to contain erosion. The most significant changes are not represented by the barriers, but by the coastline changes derived from the interaction between the coastline, the sea currents, the waves and the wind that shape the coast transporting and depositing sand. The beach itself is in turn the result of continuous nourishment, interventions aimed to maintain or increase its amplitude.

Also the nature of the Adriatic Sea is controversial: some representations of it return the image of an almost urbanized, artificial area. The extraction platforms represent the most visible element of human intervention in the sea. But when looking more deeply at the sea, even beneath its surface, some

more appear: the foundations of the platforms, pipelines, drainage areas, mussel farms, submerged barriers, marker buoys, tetrapods, etc. These elements have been colonized by a flora and marine life, which in their absence would not be able to find an environment, an habitat suited to their existence. THERE is going to bring to the extreme these premises aiming at deriving from this territory a distinctive model affecting the evolution of landscape: according to hybrid mechanisms of synergy between artificial and natural.

Vision

T.H.ER.E. is the project for an hyper-natural landscape. Assuming hyper-natural those interventions whose aims are extremely functional, pragmatic and so exasperated to blend, to blur in, to structure new relationships with the environment. One of the main features of the Riviera is the extreme lability of the boundary between natural and artificial. The urbanized area is actually extended over the coastline and continues across the sea, sometimes in visible and sometimes in invisible ways. This tendency toward hybridization of artificial structures with natural elements can generate unusual environments, which we call hyper-natural. This condition occurs when a change induced on the existing enters into a procedural relationship with the environment to generate a new landscape.

T.H.ER.E. represents a synergic project in all its phases and in relation to different instances. As a complex and long-term operation, it needs a structure and a program both open to change, adaptable to variable interests that could enter the project at different stages. In relation to the context, it acts as a device able to attract new opportunities for growth and rejuvenation of the tourism. The goal is to expand the possibilities of a large area: it is the exact opposite of a touristic enclave or self-referential work. Specifically, as a maritime infrastructure, the project aims to boost the unexpressed potential of the coast, where several contingencies help to restrain the renewal. It provides more space to induce processes of transformation and overcome the actual limits of mainland. From the technical point of view the synergies between the infrastructure and the coast deal with the organization of connections, of the type of functions, and they require a careful prediction of hydrodynamic phenomena not to interfere with the natural sea currents along the coast.

T.H.ER.E. aims to energy self-sufficiency through the definition of closed loops in the management

Figure 3.5: A night representation of the Riviera highlighting urban settlements as well as underwater and inland infrastructural systems.

of water and waste and through the use of renewable energy sources. At this stage, several technologies have been considered: wind turbines, photovoltaic, hydro-dynamic, etc. Given the fast pace of evolution of these and other technologies, and given the time horizon of the project, it is necessary to leave the field open to different solutions without changing the substance of the ultimate goal. What is desirable is that the balance of energy generated in the island could exceed the actual necessities, generating a surplus that could be transferred to the mainland. Under this condition should be taken into account, however, the additional costs due to the physical connection with the mainland.

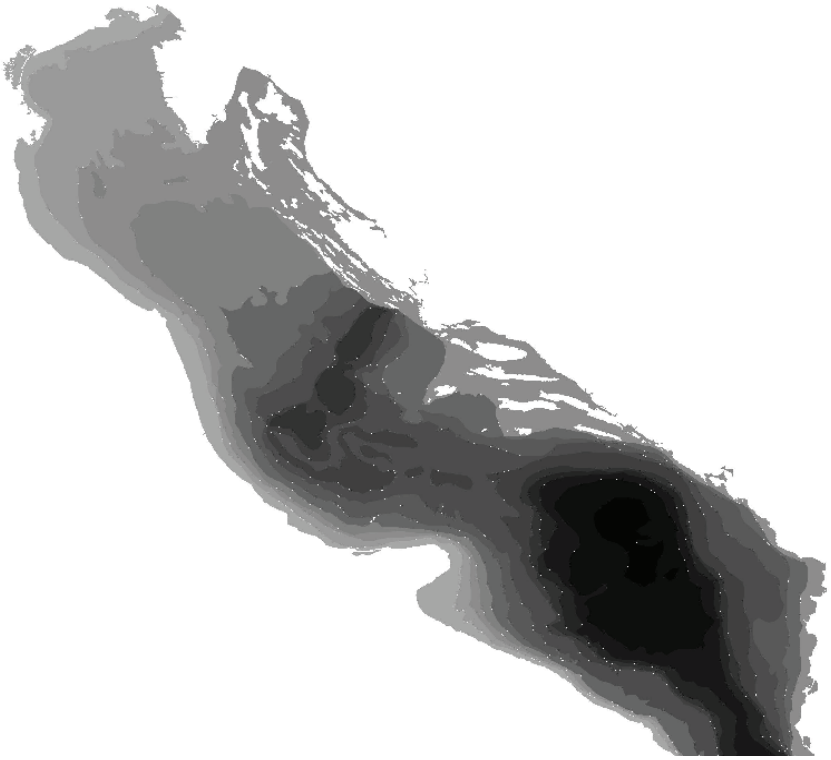
T.H.ER.E. calls into question the normal index between buildings density and functions. It does not follow the same logic of subdivision or land occupation typical of urbanized territory in mainland. It is not a piece of land detached from the coast to fill of buildings, it is instead a structure in which there is maximum correspondence between the spaces constructed and their actual use, including public spaces and relationships that they determine. It is assumed that any function or building has a footprint on the mainland significantly greater than that which can be in the sea. Just think to the roads or parkings and secondary urbanizations. In this light the space between the buildings can greatly be

compressed up to a minimal, essential scale. This different ratio, this extreme density, increases the intensity of the urban experience and emphasizes the value of the location, in the middle of the sea, where the view extends over a broader horizon.

T.H.ER.E. aims to be attractive, to be a catalyst for investments and visions. The project has a very strong local relevance, but its implications are at different levels both national and international. The opera is part of a macro-regional strategic vision of openness toward the Mediterranean and the countries that face the Adriatic, enhancing the potential for systemic international cooperation. This vision, however, requires a complex process of development of adequate procedural means, and a clear plan to attract the public institutions and the private sector interests on shared objectives.

THERE could be a chance to trigger at macro-regional scale a process of identification of new environmental systems that are created by hybridization between natural and artificial interventions.

Figure 3.6: The Adriatic basin's morphology.



3.1.2 Sizing by Tourism

Tourism is one of the phenomena that most affects a territory dynamics, its economic and physical structure. Among the impacts of tourism, especially nowadays, there is what could be defined as the need of a perspective change: every actor enters in global circuit that requires high attraction skills and competitive operating systems. In this sense a touristic infrastructure represents a device that allows to interfere on the relationships and the functioning of a vast area.

THERE aims at strengthening and expanding the existing tourism impact at a larger scale than the local. To do this it is compulsory to define a minimum threshold, a critical mass below which the proposal is likely to turn into a burden rather than a driving force for the territory. The goal is then to define a scale, a catchment area to which to refer and identify a program that can trigger relationships within a complex system that does not stop on the single opera, but engages and interacts with a more vast territory.

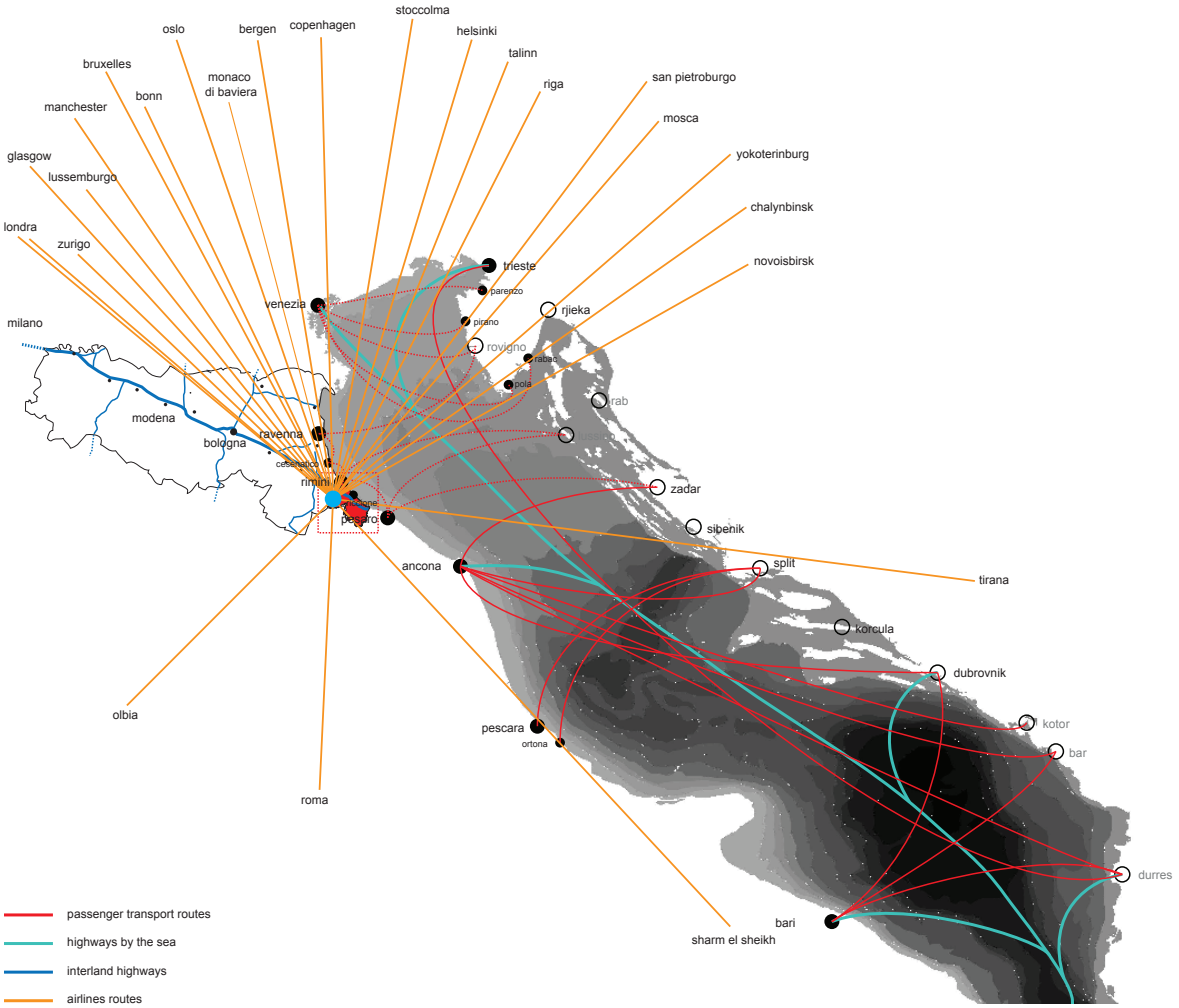
Territorial Placement & Flows Interception

The extra-territorial importance of THERE is confirmed by analysing, at different scales, the relationships that it would be able to promote. Its originality in the Adriatic, and not only, makes it a device with high tourist potential. An opportunity for the Riviera, for its hinterland and in respect to the goal of integrating into a single planning vision the two shores of the Adriatic. The stretch of coast between Riccione and Gabicce, in addition to its strategic positioning with respect to the Adriatic routes, presents a series of morphological and structural features essential to the realization of an integrated system with the mainland.

Tourism globalization implies, in first instance, to act on a territory involving the wide basin into which it fits. In a broader perspective, for the Riviera, such basin matches with the entire Mediterranean. In today's fast transformation, it is becoming increasingly urgent to rethink the relationships on a larger scale, assuming new territorial structures.

Under a touristic point of view, cruises are an important device in this sense and THERE would be an important hotspot in the northern Adriatic for developing such economic sector which is continually looking for new destinations especially in this part of the Mediterranean. The typical cruiser

Figure 3.7: Above, the major cruise routes in the Mediterranean; at the bottom, the different connections concerning the Adriatic basin and in particular the Emilia-Romagna Riviera.



has evolved a lot compared the stereotypical image of the past, now its average age is between 40 and 45. Today, the cruise offers products for all tastes and all ages, paying extreme attention to the theming, not only of the routes, but also of the proposed activities on board and on the land. Families are definitely one of the best target of the cruise vacation. Follow the young married couples. Finally, large groups constitute one of the most exciting opportunities for cruising especially thanks to the increasing of group travel planning, both private and corporate.

To understand how the cruise tourism can directly affect a territory, it is also useful to highlight the two main landing typologies required: the, so called, 'Home Port', which is the departure or arrival point of a cruise; the 'Port of Call', as an intermediate step of the trip. There are also ports performing both functions. The main factors influencing a cruise company's choice for landing are:

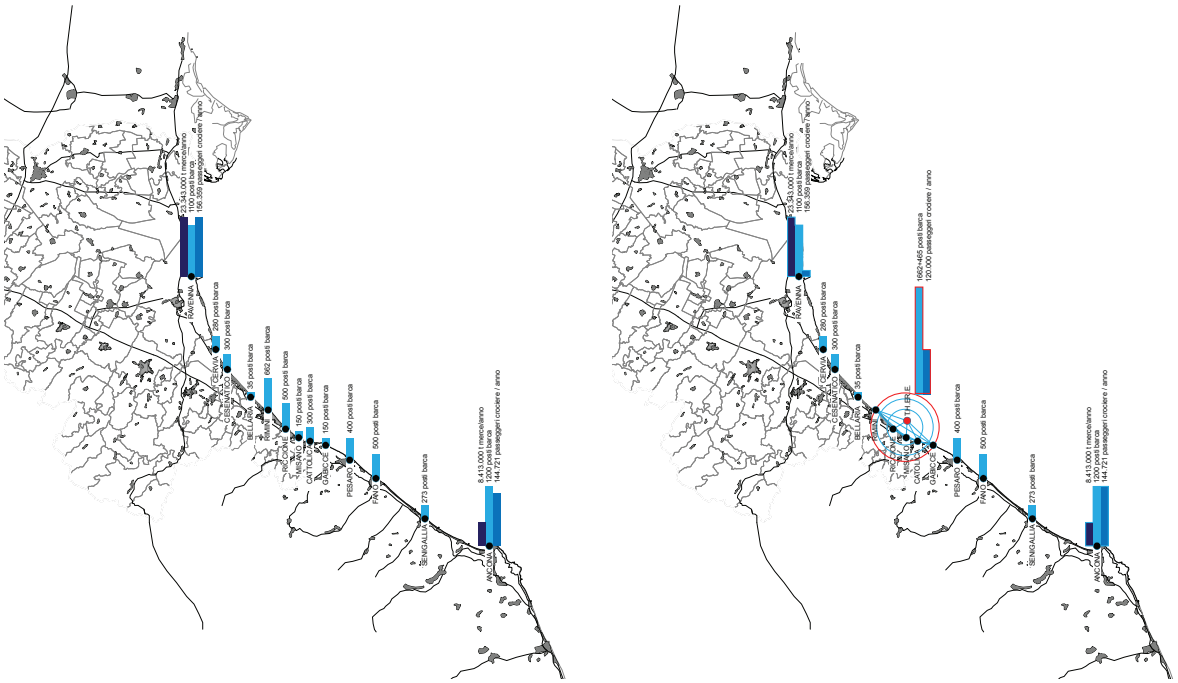
/ features and amenities in terms of repair, refuelling, maximum size of vessels, number of docks;
/ services in the port area including passenger terminals, parking, banks;
/ connections, the distances from city centres, airports, railway stations;
/ availability of hotel supply in destinations;
/ attractiveness of the surroundings.

All these factors allows to consider weaknesses and potentials of an area which aims at attracting the cruise industry, so as to effectively respond to its demands. Work on the quality and differentiation of existing tourism is the basis for the success of this operation.

In the Adriatic basin, in addition to wide-ranging cruises, daily connections between the major port cities of the east and west coast are common except for destinations of the northern coastal strip. Creating a new a new huge port in front of the Riviera would be strategic for establishing new tourist and commercial relations also with the eastern shore of the Adriatic. THERE would satisfy the need for a harbour useful for cruises and large ships. At the moment, a large and important territory, the one between Ravenna and Ancona, misses such an infrastructure mostly due to shallow water.

The area between the municipalities of Riccione and Gabicce, extending from the Adriatic littoral to the hinterland, along the southern Conca valley and the northern Marano river, is probably the Riviera's focal point. The natural scenery of the Conca Valley culminates upon the highly dense and urbanized strip that goes from Gabicce, parallel to the sea coast, to Riccione. This linear city, almost without interruption, occurs as the antithesis and the alternative scenarios that is possible to encounter in the hinterland. This is the landscape, the territorial situation, that THERE project has to face

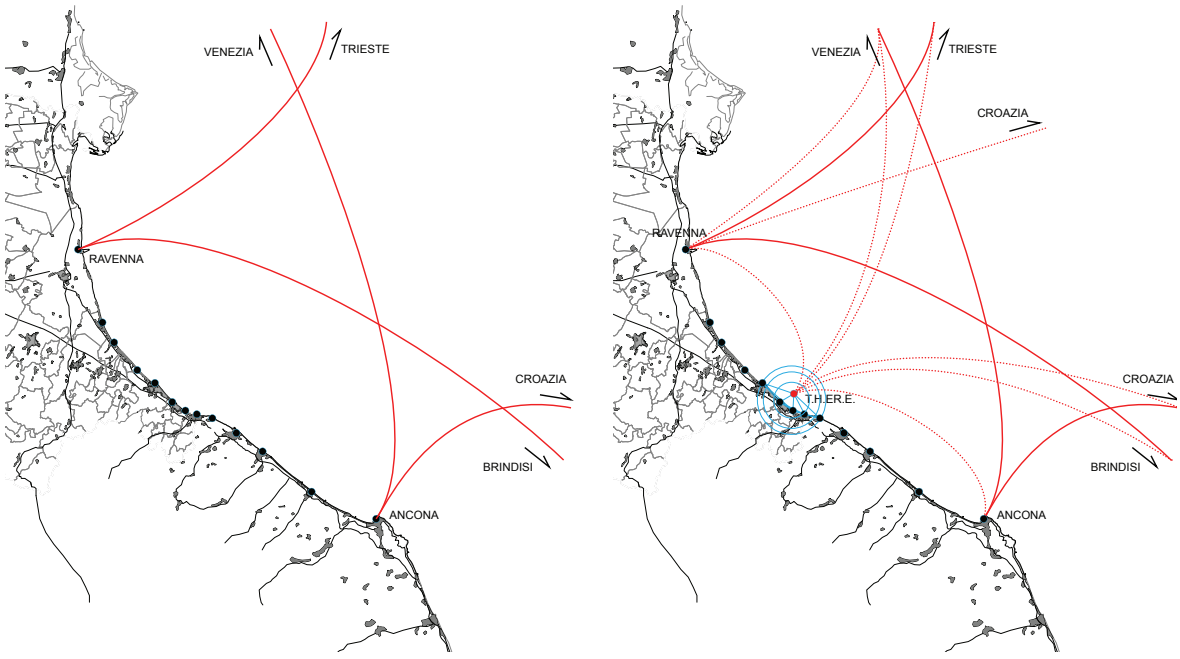
Figure 3.8: Summary data on the major ports and marinas between Ancona and Ravenna. On the left, the current situation; on the right, the development scenario through THERE.



and in front of which is located. The coast attracts lot of tourism thanks to its wide range of services but the territory misses spaces for developing a port in the mainland. An infrastructure in the sea, an artificial island in fact, is the only way to host big cruises and smaller vessels. Such placement takes advantage of being in an intermediate position between a cruise destination as prestigious as Venice, and two 'ports of call' as Ravenna and Ancona. The 'Federico Fellini Airport', the A14 Highway and the railway line that runs along the eastern Adriatic coast up to Milan, together constitute an important strategic resource for the territories between Rimini and the first part of the Apennines on south. This multi-access net has facilitated the presence of urban and tourism development, marked by increasingly flows concentrated during the summer weekends. Implementing access through a new access gate from the sea, on the one hand will allow to extend the tourism season, which now is concentrated between June and mid-September, to the other hand will enlarge the users catchment area. The artificial island will work as a 'Port of Call' and also as a 'Home Port'. This double role will permit to exploit the existing functions of the Riviera touristic model: facilities, hotels, clubbing, spa and wellness structures, amusement and theme parks, etc. Working as an Home Port the artificial island will represent a further hot spot in the intermodal network which spans through the area.

At the light of the current economic trends in tourism, the Emilia-Romagna coastline needs to keep

Figure 3.9: The main existing - on the left - and future - on the right - cruise connections concerning the stretch of coast between Ancona and Ravenna.



updated, attracting new users, offering new hosting models. The seaside is a catalyst, strong and fragile at the same time. Since the second part of '50es it was able to attract mass tourism flows, now things are changed, and collateral effects of mass tourism are mostly visible on the environment all over the coast. In perspective, it is important to think new accommodation forms as well as different ways to access the coast. Working on seaborne connections, discouraging individual road mobility. The enhancement of inter-modality, specifically the proximity to airports, is going to be increasingly important for what concerns the reception of tourists coming from more distant destinations, especially Eastern Europe. This area can get unexpected results from the reading back of its complexity and its multiple identities. The Riviera cities have not a single identity indeed. They form an open-net able to reach many identities instead of a single traditional one. A very sophisticated behavioural model. For this reasons, talking here about a tourist infrastructure means not only to provide an area equipped for hosting a last generation boats that before could not access the territory, but it means, above all, promoting the territory in its entirety and complexity. This can only happen through a careful setup of the latent potentials, through widening touristic targets, through the partnerships development with other Adriatic and Mediterranean destinations.

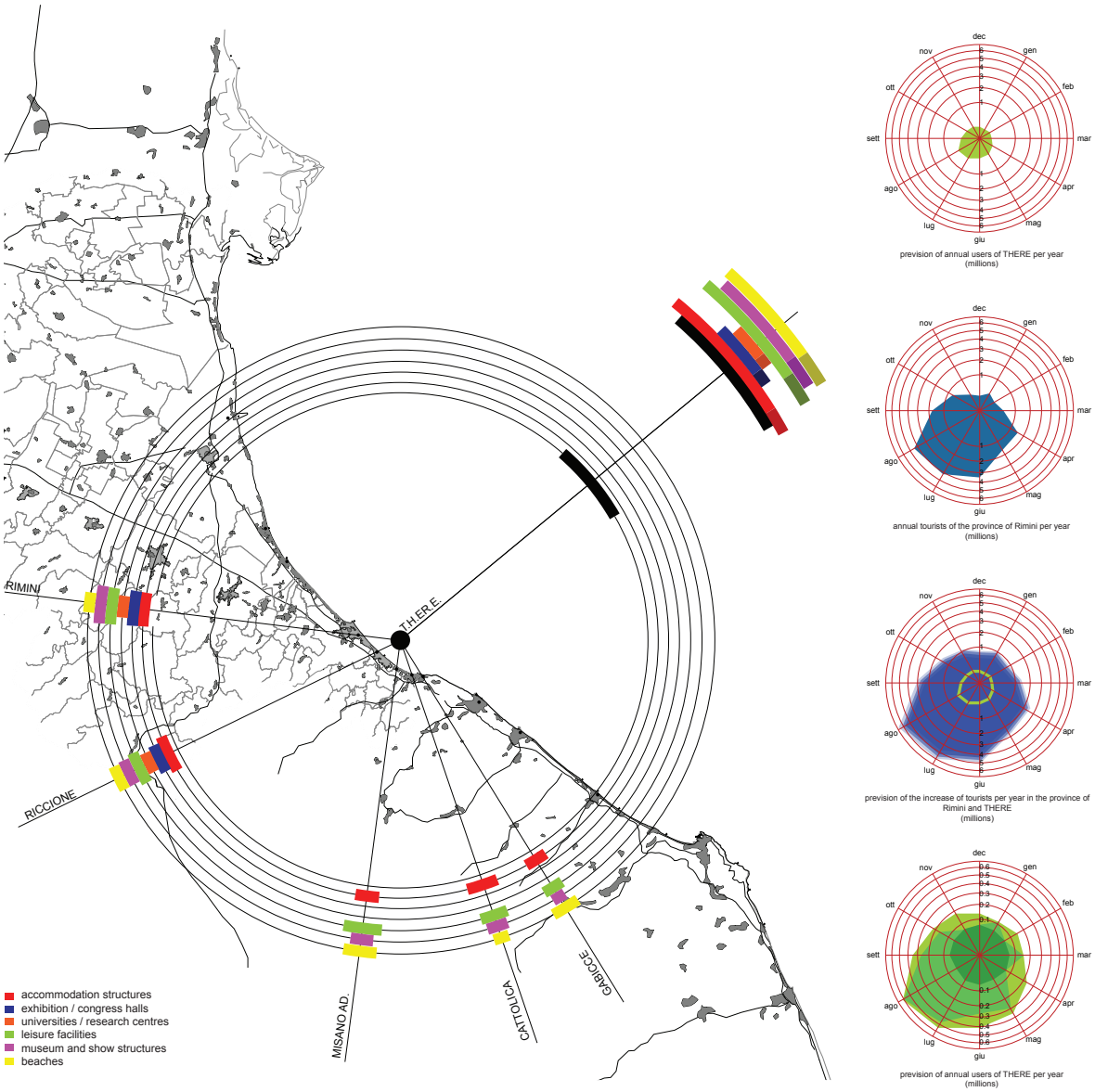
Program: a Vast Area flywheel

THERE operates as a driver for the innovation and strengthening of the tourism supply of the Riviera. Under any point of view it represents an advanced model for the experimentation and application of solutions transferable in a second moment on the coast. With this aim, it has to guarantee an operability level capable to influence significantly on the numbers of the reference system. It has to generate new and evident tourist flows, ensuring a certain level of infrastructures and adequate services. The role of THERE is that of amplify the attractive potentialities of the territory, by introducing new elements and devices capable to displaying the existing supply on coast. To success, THERE has to structure itself according to an urban logic: an organism self-sufficient and connected; an open place, reachable, not exclusive, with private activities and public services; a part of a territory, maritime, functioning 365 days per year.

THERE aims to amplify the dynamics active on coast, generating new tourist flows, contributing to the 'seasonal adjustment' and internationalization of the offer. In order to achieve this goal, the project has to provide a series of functions and involve a number of users capable of influencing significantly on annual flows. In relation to the Municipalities of the coast closer to the hypothesized location, the number of annual users has been set to a minimum of 4 million. This number represents the touristic flow that the island must generate in order to have a significant impact on territorial dynamics.

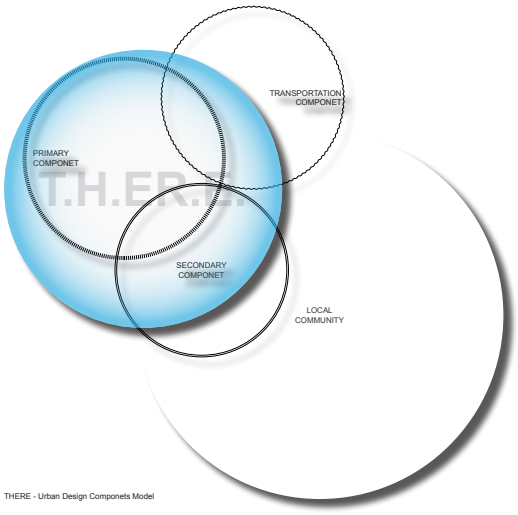
To guarantee an high frequentation of the island some essential conditions are requested, in order to attract and maintain a constant presence of users. The first of the requirements is the presence of activities and structures of high attractiveness, able to connect the island with a specific vision, and that will work as a catalyst for the tourist supply on coast. Moreover this may add occasional flows with significant numbers in therms of presences. Secondly, some permanent functions must be guaranteed, in relation with contexts of use not strictly related with tourism (offices, education, specific production and manufacturing, leisure, etc..). These functions must attract a wide amount of users, with a constant presence throughout the year. The more significant impact comes from the seasonal activities. With a peak of presences in summer and some other short periods of the year. In this scenario it is fundamental the presence of an efficient accessibility system, according to public and private means, and the definition of programs for the development of tourism, with a strong synergy between the island and the coast and an active exchange relation.

Figure 3.10: Economic activities' development scenario and touristic arrivals forecasting related to THERE and referred to the territorial scale.



As already explained, THERE is the occasion to create a new maritime hub that strengthen the connection and relation between different existing ports that nowadays, as isolated units, do not represent a competitive reality when compared with the rest of the upper adriatic area. In this scenario the project would trigger a change of scale in the supply of ports of all the Riviera basin, which nowadays does not present adequate physical conditions in order to attract cruises and large pleasure boats. The creation of a new maritime hub generates new scenarios related to mobility and connection between different destinations of the upper Adriatic and more. These connections represent a new entrance gate for the Riviera, an opportunity to access to a new or renewed tourist basin.

Figure 3.11: Above, the diagram representing the main components of THERE and their relationship with the context; below, three comparisons between the project expected 'sizes' and data concerning existing: islands, cruise terminals, amusement parks.



T.H.ER.E		ISOLA DI CAPRI		ISOLA DEL GIGLIO		ISOLA DI PROCIDA		ISOLA DI PONZA		ISOLA DI SANTORINI	
inhabitants	5000	surface	10,4 kmq	surface	23,80 kmq	surface	4,13 km2	surface	9,85 km2	surface	90.690 km2
annual inhabitants presence	1.825.000	inhabitants	14117	inhabitants	1439	inhabitants	10596	inhabitants	3360	inhabitants	13.670
		annual inhabitants presence	4,7 mln	annual inhabitants presence	0,5 mln	annual inhabitants presence	3,5 mln	annual inhabitants presence	1,1 mln	annual inhabitants presence	4,6 mln
		residence and migratory tourist presences	3,2 mln	residence and migratory tourist presences	1,5 mln	residence and migratory tourist presences	0,138 mln	residence and migratory tourist presences	0,414 mln	residence and migratory tourist presences	3 mln
annual users	4 mln	annual users	7,9 mln	annual users	2 mln	annual users	3,6 mln	annual users	1,5 mln	annual users	7,6 mln

T.H.ER.E		TERMINAL DI TRIESTE		TERMINAL DI VENEZIA		TERMINAL DI RAVENNA		TERMINAL DI ANCONA		TERMINAL DI BARI	
n. cruise moorings	1	n. cruise moorings	2	n. cruise moorings	7	n. cruise moorings	2	n. cruise moorings	6	n. cruise moorings	5
n. cruise transits	40	n. cruise transits	40	n. cruise transits	654	n. cruise transits	79	n. cruise transits	- -	n. cruise transits	209
annual presences	120.000	annual presences	28.251	annual presences	1.777.000	annual presences	163.000	annual presences	144.721	annual presences	586.848

T.H.ER.E		AQUAFAN RICCIONE		MIRABILANDIA		ACQUARIO GENOVA		ITALIA IN MINIATURA		MISANO WORLD CIRCUIT	
surface		surface	150.000 mq	surface	850.000 mq	surface	9.000 mq	surface	85.000 mq	surface	600.000 mq
annual presences	1.100.000	annual presences	500.000	annual presences	1.900.000	annual presences	1.100.000	annual presences	500.000	annual presences	550.000

3.1.3 Sizing by Infrastructures

On the basis of the predictions made about the flow of tourists that will insist on the structure, it is defined a urban scenario that takes into account the particular conditions in which this infrastructure will be inserted. This scenario develops, in relation to the island's position at sea, a series of valid data on the land, which in this particular case require a different approach. In order to develop an urban system in a closed-loop, the goal of the project is to define the criteria and features of a smart island. Self-sufficient in terms of energy, connected to the coast and lived throughout the year: these conditions are reached only in relation to a certain critical mass of the intervention.

Sizing the Urban Scale

To understand and define the urban scale of THERE, some study cases were selected and analysed, under their morphology and attractiveness, then compared with the THERE scenario. Some of the functional components that characterize the structure were also subjected to comparative testing to define their consinstency.

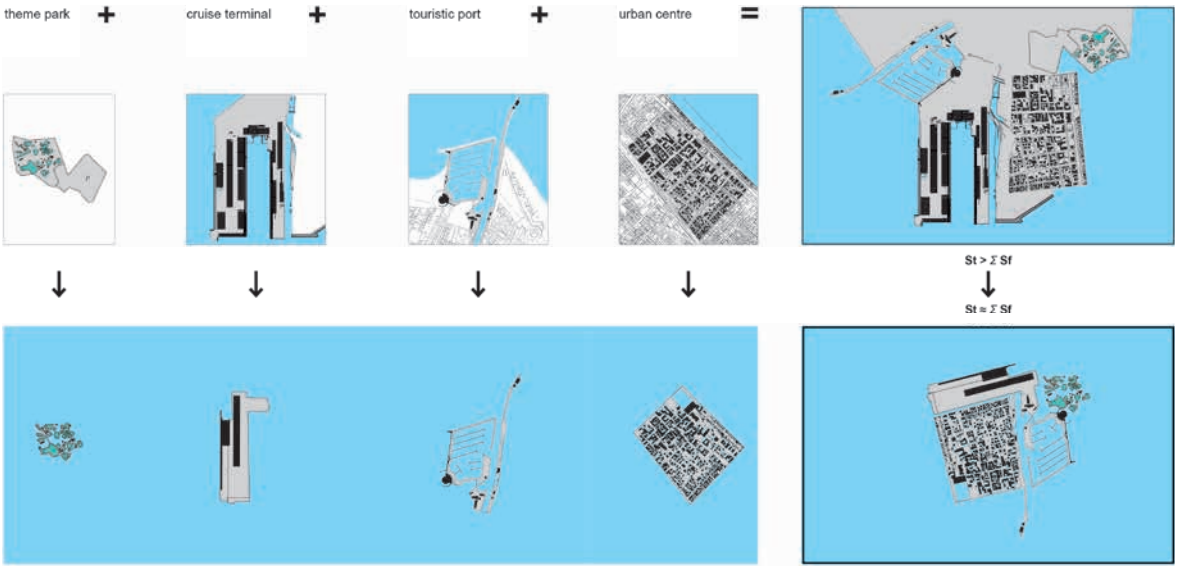
THERE expects 4 million visitors per year, with an average daily occupancy of 5000 permanent residents. The data includes all the functions: primary, secondary and related to the accessibility of the island.

The infrastructure component gather a series of functions connected with maritime transportation. In this scenario THERE will be able to intercept the cruise tourism through a cruise terminal with the capacity of 120 thousand visitors per year.

The primary component of attraction gathers a series of functions among which stands out the presence of an amusement park. The attractive potential of such a structure is estimated at around one million visitors per year.

At this stage, in front of an estimated 4 million visitors per year, some macro functions were defined, that represent a preliminary scenario from which to remove, add or replace some parts, depending on the progress of the project.

Figure 3.12: The diagram shows a simulation of a possible composition between macro environments (urban centre, port, terminal, theme park) both in land and in maritime environment.



Spatial Index

The sizing of THERE is obtained in an inductive way: starting from the spatial incidence that the main functions assume if transposed in water; identifying consequently an index of use of the surface emerged, to define the reciprocal consistency of the parts destined to the port infrastructure, to the services and to the urban structure.

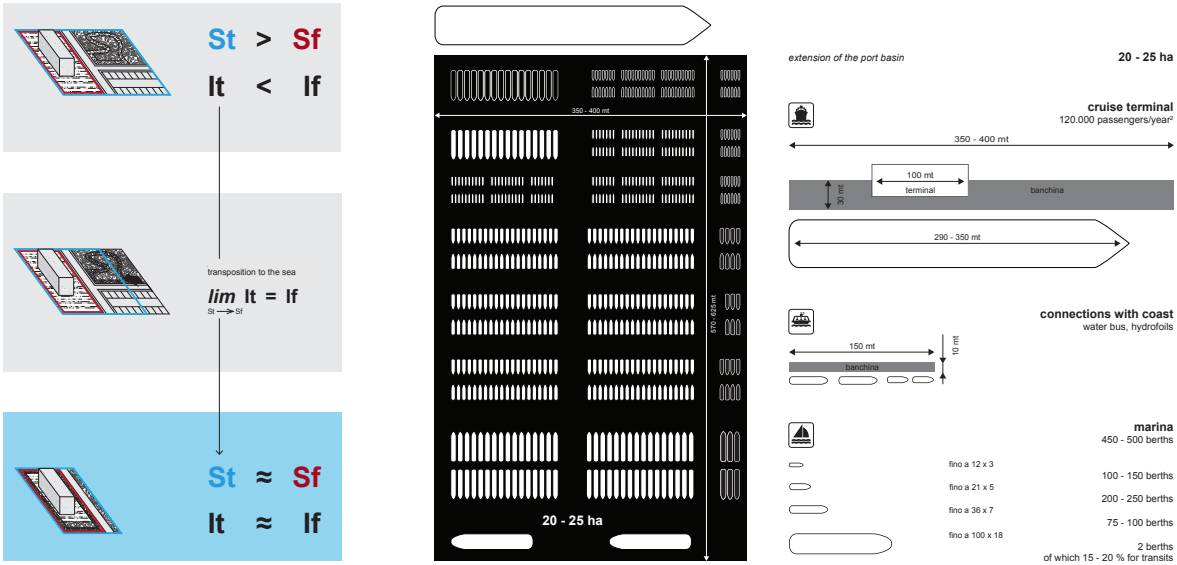
To size the main functions of THERE some existing structures on land (ports, parks, cruise terminal, etc..) were taken as reference. Transporting them to the sea it is evident as a series of spaces, appliances and services related to them can be eliminated. This operation not only clarify the scale of the intervention but also shows that the shift of certain functions in the sea define a much lower space consumption, allowing it to give more breath to the coast.

By reducing the impact of certain functions, eliminating the space for vehicular traffic and parking it is possible to reduce the footprint of the built environment. This allows, from the same volume, to increase the density and to incline the value of the surface area to the sum of the land surfaces.

Beginning from the daily average attendance on THERE, the volume that has to insist on the land surface of the infrastructure has been estimated

The sizing of the port infrastructure1 takes into account the need to attract, through a port of call for cruises, an average of 120,000 passengers a year. In addition, the port will consist also of a docking area for touristic and residential uses, aligned in dimensions to the realities of greater consistency in the northern Adriatic. Therefore able to accommodate berths of medium and large dimensions

Figure 3.13: The three diagrams shows the dimensioning process related to the construction index of THERE - on the left - and its harbour basin extension - on the right.



St (Site Area): sum of the buildable areas and of those dedicated to urban services (roads, infrastructures, primary and secondary services, etc.).
Sf (Building Area): part of the Sf destined only to buildings and their appurtenances with exclusion of the areas destined to services and roads system.

that now can hardly land on the coast facing THERE. Here will find place between 450-500 units depending on the incidence of the different types of vessel. The component represented by the means of connection with the coast is also represented.

The parameters that describe the urban scenario in this phase of the project are related to a series of macro-functions and components of the model of tourist attractiveness. The consistency of the work is defined by a range that takes into account a number of technical and programmatic variables relatable to the positioning of THERE on the coast as well as to the progress of some further deepening of economic and financial topics.

Scenario synthesis:

presences per year

4.000.000

average daily presences

10.000

total area

50 - 65 ha

of which port basin surface 20 - 25 ha site area (St) 25 - 40 ha

with

site ratio (It) 2,5 - 4 m^3/m^2 built volume (V) about 1.000.000 m^3

Figure 3.14: The three placement hypothesises of THERE analysed according to different factors concerning technical, functional, energetic and economic assessments.

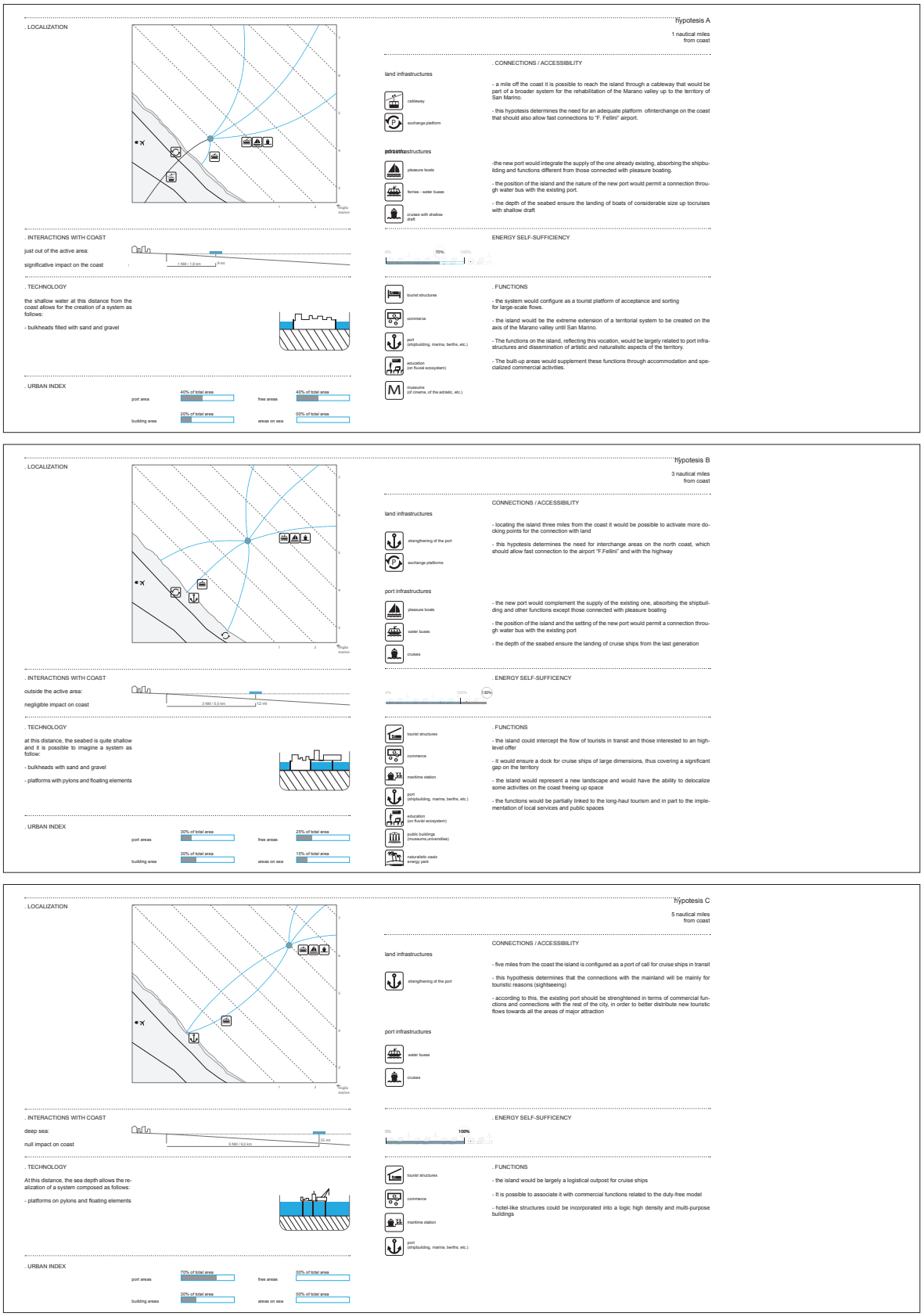
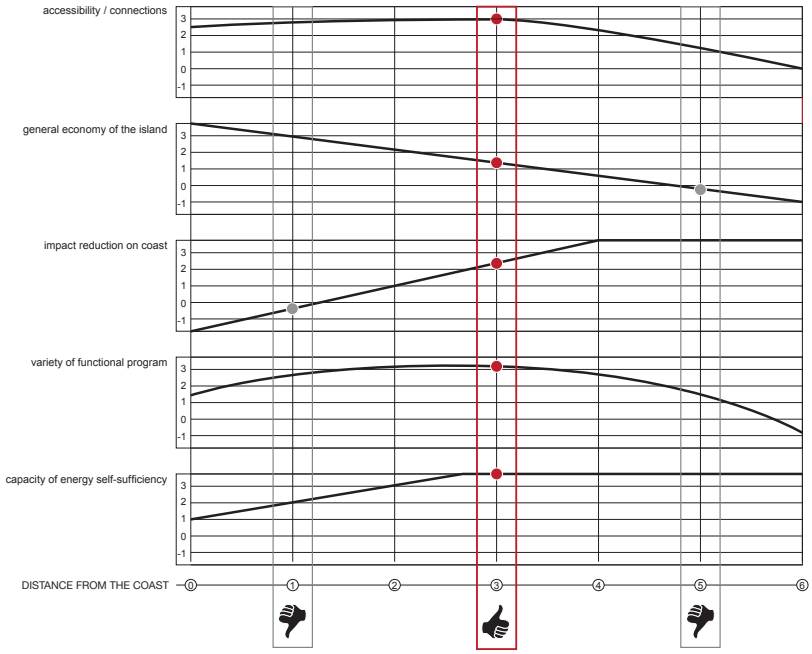


Figure 3.15: The diagram synthesizes the considerations made about the three main placement scenarios.



Placement Assessments

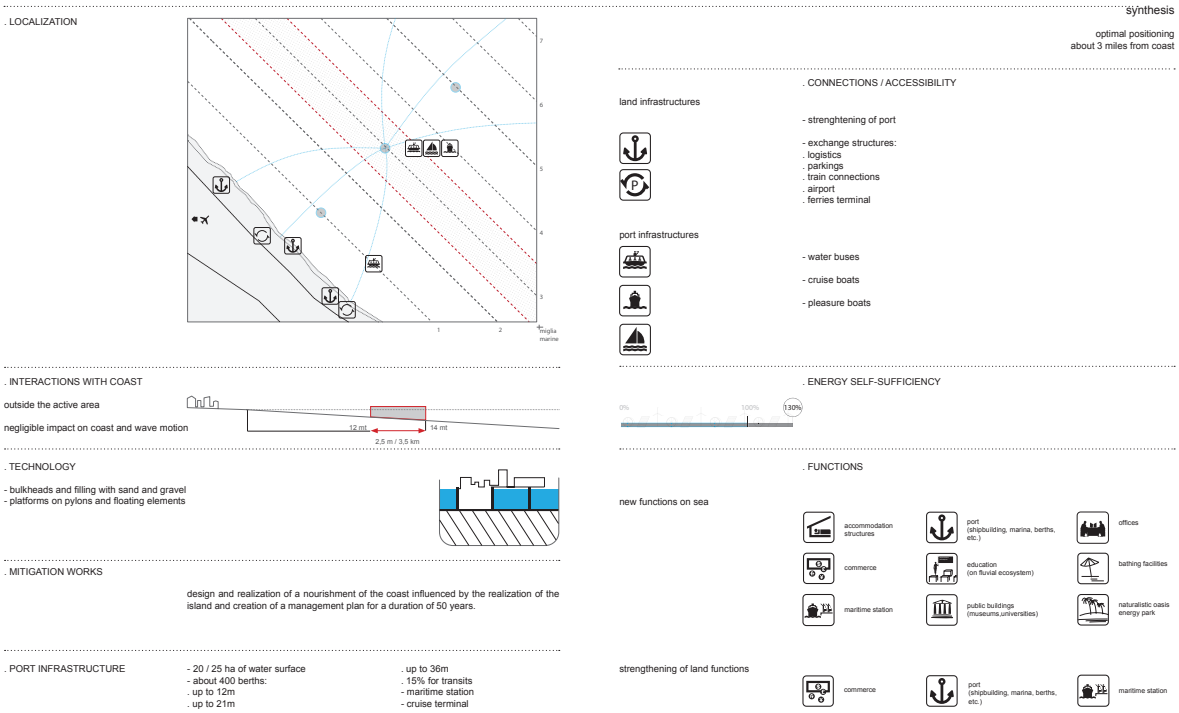
At this stage of pre-feasibility, several hypotheses of localization were evaluated in relation to the coast. This aspect affects substantially on technological choices and relationship with the mainland. From the analysis of different scenarios and the available data on the status of the seabed, the most suitable distance for the maritime infrastructure was identified in a range between 2.5 and 3.5 nautical miles from the coast.

The analysis and comparation of the hypotesis is adressed to the definition of a model which define a general layout for the island in relation to its main features: dimension, accessibility, functions, sustainability, technology.

This model has to be developed in accordance with specific factors as the ease of access for a wide range of potential users, the capability of developing a functional program lively and vivid, the necessity to reduce to the minimum the impact on coast and maximize the capacity of the structure to be energy self-sufficient; on the base of programmatic considerations connected with a vision for the territory for the next years.

The infrastructure indeed represents a flywheel useful for the revitalization of the territory that needs to update on contents and containers, by strengthening some of its parts and connecting its excellences, thus reinforcing them thanks to the contribution of new energy and resources available from the island.

Figure 3.16: The data sheet reports the main features tied to the 3 nautical miles placement from the coast, evaluated as optimal for the infrastructure.



Accessibility / Connections

Accessibility meant in terms of types of users and amount of people able to easily reach the island. The short distance allows a high turnout directly from the coast, through public or private boats, and by means of cable transport systems such as cable cars. The average distance makes it impossible to imagine moving through cableways, however, allows to intercept the flow resulting from cruise tourism, while maintaining high the affluence to the sea. A major distance makes it more difficult to access from the coast, limiting the utility mainly to cruise tourism and pleasure boating of long-haul.

General Economy of the Infrastructure

Overall assessment in terms of general cost of construction, commissioning, management of the island. The economic value is proportional to the distance from the coast.

Reduction of impact on coast

The impact on the coast is inversely proportional to the distance. Under the 3-mile the infrastructure interferes significantly on the wave motion and can affect the configuration of the coastline. From three miles on, the impact on costs is considered irrelevant.

Variety of the Functional Program

It is considered in terms of variety and sustainability of the functions potentially placeable on the island, on the basis of the ability to create synergies with the coast and the hinterland. Up to a small distance, the functions would be related to the activities of the coast and its hinterland, and the structures would be mainly subsidiary to the dynamics already in place. At an intermediate distance, there could be activities self-efficient and complementary to those on the coast and inland: they could generate new scenarios and functions on the sea. Over the three miles, the distance complicates relations with the coast. The activities would be independent, and limited mainly to cruise tourism.

Capacity of Energy Self-Sufficiency

Below a certain distance the island hosts limited esystems of energy supply, facilitating the use of renewable energy, without being fully self-sufficient. Over 3 miles, the use of large-scale devices, such as wind turbines, allows to increase the energy produced in the island and ensure energy self-sufficience. At a medium-large distance the island could produce more energy than that required for its functioning: in this case the island could transfer the energy in excess to the coast.

Assessments in relation to the Distances from the Coast

At a mile from the coast the island has a critical issue related to the reduced distance: its influence on the wave motion is very strong, with likely repercussions on the coast line. 5 miles

5 miles from the coast distance implies very pronounced costs of construction and operation; the distance also limits the functional program of the island, bordering the activity to a model similar to that of duty-free, with logic related to cruise tourism and pleasure boating of long distance, thus limiting the synergy between the island and the coast.

The intermediate distance of three miles positively meets all the parameters chosen in the preliminary assessment, and therefore represents the optimal choice for the location of the island.

Energy Self-Sufficiency

On the basis of data still generic and in view of more contextual and technical analysis it has been assumed an energy program that sets out some guidelines:

/ energy self-sufficiency for the infrastructure;

/ use of technologies that mainly function on renewable sources;

/ assessment of the potential positive impact on some sectors of the mainland;

The main objective is to build a system for supplying and producing energy that fully meets the demand of the infrastructure through the use of technologies powered by renewable sources, possibly assisted by a gas microturbine system and fuel cells.

The main renewable energy sources (wind and sun) will be supplied through the use of photovoltaic panels, distributed on part of the roofs of the buildings, and wind turbines, whose location shall be determined in relation with the size of the specific models used and therefore their distance from the island and the coast. The use of these devices will be able to produce enough power to cover the domestic demand both electric and thermal. During peak periods it is also possible to imagine that the energy produced in excess will be sold to the grid, hence to the coastal urban system.

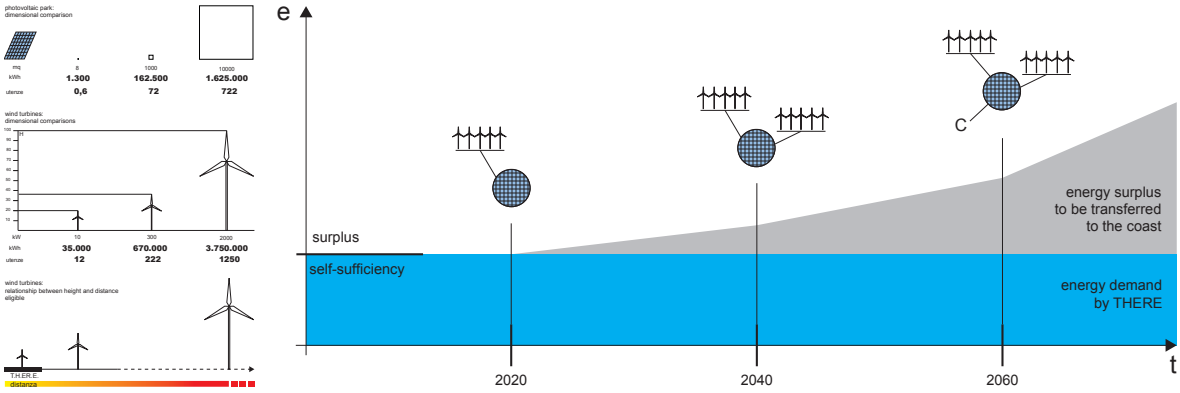
In order to cover the base heat load during the winter season, it is possible to imagine the use of a gas microturbine cogeneration. It will be also assessed the feasibility and the use of an hydrogen-fueled cogeneration system supplied by molten carbonate fuel cells. The fuel cell will be in the future fueled with the hydrogen produced and stored in water by electrolysis using any surplus production of solar and wind power.

In relation to the maximum size of the island, the number of users and a hypothetical functional distribution, it is proposed a rough estimate of the energy required to the functioning of THERE (in terms of electricity and thermal energy) and a proposal for the recovery and production of energy to meet this request, using only renewable sources (sun and wind).

Starting data:

59,5 ha island surface	45%	residential, accommodation
	25%	commercial, accommodation, services
	18%	service sector
	8%	theme park
	4%	port services

Figure 3.17: Provision and use of renewable energies. On the left, some dimensional comparisons concerning photovoltaic and wind turbine plants; on the right, a diagram demonstrating the infrastructure potential at providing energy to the coast after some decades.



For this simulation the total demand of energy is estimated as follow:

14.040 MWht	annual thermal	energy for heating
4.680 MWhf	annual thermal	energy for cooling
14.040 MWhe	annual thermal	energy for electrical end-use

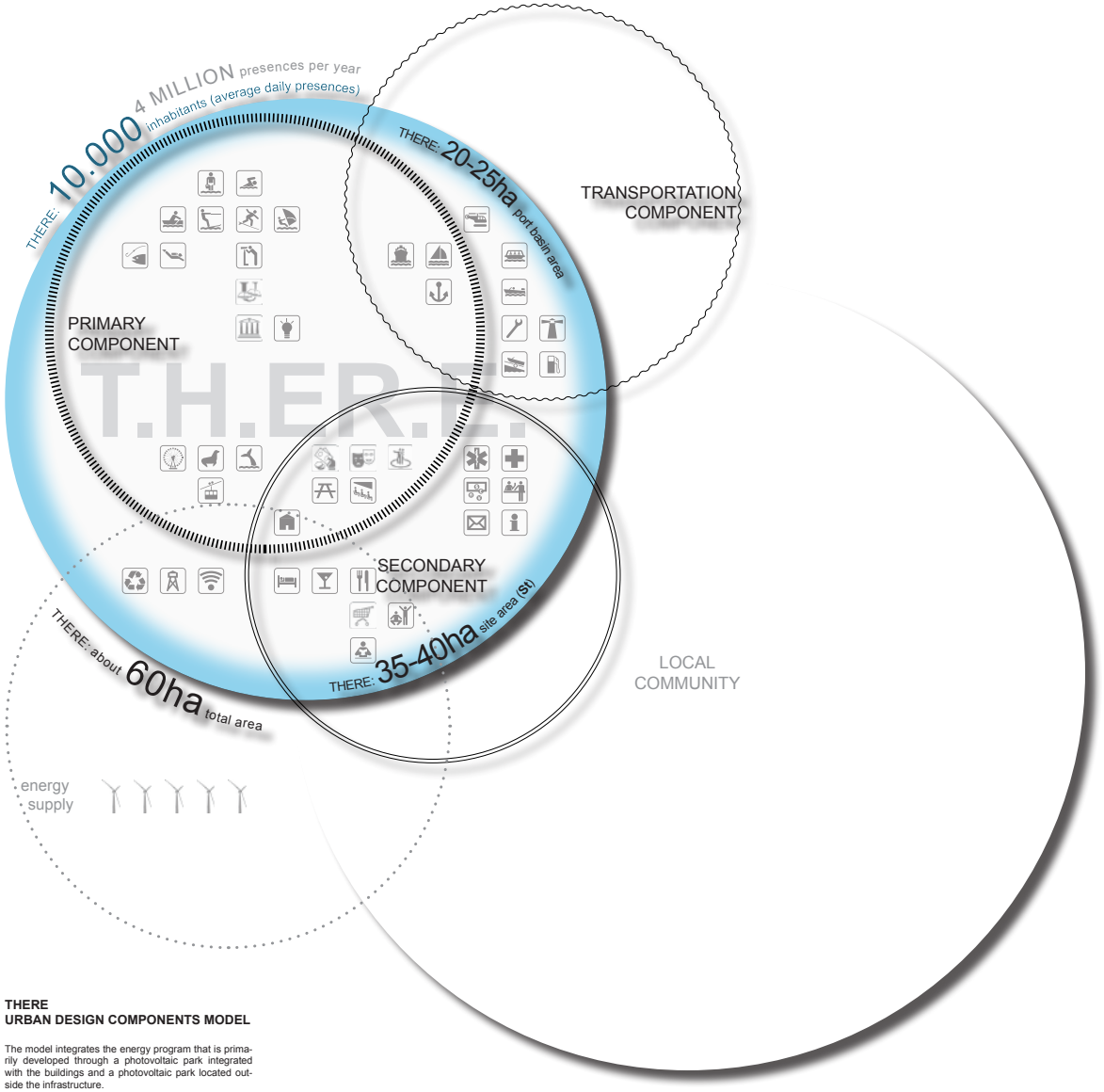
Behind the choice of which energy recovery devices to prefer, it is proposed a comparison that, assuming the same production of energy, highlights the quantity of devices required to meet the demand.

The comparison is done by considering the annual production of thermal energy for electrical end-use, estimated of 14,040 MWhe.

14.040.000 KWh =	N	3,7	2000 KW	wind turbines
	N	21	300 KW	wind turbines
	N	395	10 KW	wind turbines
	MQ	86.400	photovoltaic panels	

The most efficient devices appear to be the wind turbines of large size,whose use thus facilitates the production of energy required. In order to meet the overall demand of the island, it is proposed a mixed configuration with a predominance of the wind system and the use of 2000 kW wind turbines, assisted by a solar park. The system consists of the distribution of photovoltaic panels on the built area of the island, and wind turbines located at a proper distance from the island. This system is considered open and developable in time. In fact, the efficiency of the photovoltaic park in the coming years is likely to increase significantly, as well as the energy production from the wind turbines. In this way, any increases in energy demand will be easily supplied, and the infrastructure will provide more and more energy to the mainland.

Figure 3.18: Functional program and users quantities concerning THERE, organized around the diagram representing the infrastructure's main components and their relationship with the context.



3.1.4 Open-Ended Scenario Devices

In this stage the project focuses on the development of alternative scenarios in which some choices are crucial, necessary, but subject to variations in size and structure. The intention is to provide a vision capable of absorbing the necessary adjustments without affect the fundamental principles of the island.

The masterplan is developed on the basis of an urban model whose parameters are assumed from the attractiveness espected from the infrastructure. To carry out an assessment of the architectural, functional and technical-economic aspects, it was necessary to specify, within the range suggested by the urban scenario, the value for the maximum extension of the infrastructure. The other values and indices will be specified in relation to the layout instead. Fixed points are the distance from the coast and the systems for the energy supply. The result is a concrete model that meets the requirements for the opera and becomes a reference for reasoning about the layout and conducting the analysis of a sample case.

Layout Strategy

THERE is an open project. In this pre-feasibility stage the definition of a closed layout would be little significant. The constant change of perspectives and economic externalities requires, in this type of situation, a more strategic approach. Given some points, such as density and low impact on the coast, the project leaves many degrees of freedom to the internal composition, the relationship and the configuration of the macro functional areas. The strategy, aiming to indicate a form still open to a series of variants, is implemented by means of parametric calculations capable of arranging the volumes, according to precise indications, on the basis of the following steps:

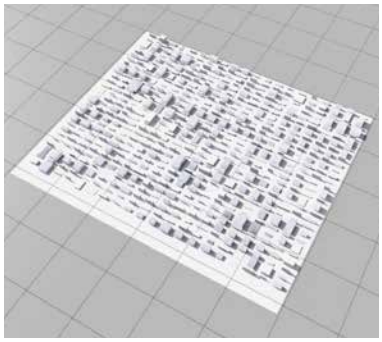
Starting Model

Section of the coastal territory where the built volume corresponds to the maximum amount of volume expected in the infrastructure. The disposition of buildings and land occupation are influenced by the planning standards related to vehicular mobility.

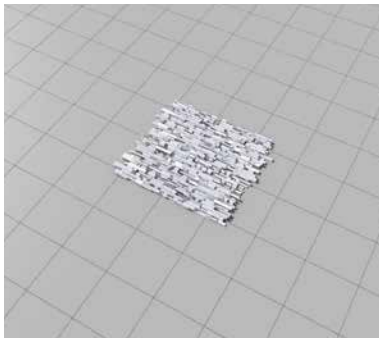
Model of Densification

The location at sea allows to get rid of several planning constraints, and to rethink the volumetric ra-

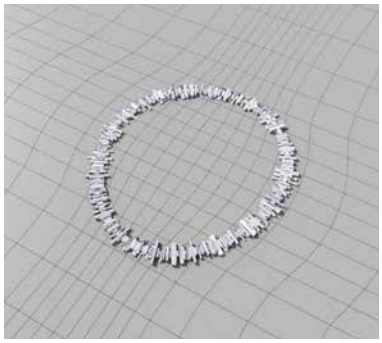
Figure 3.19: The parametric modelling workflow applied to generate several different open-layouts of THERE starting from some fixed dimensions inferred by the previous planning phases. On the right, the main layouts considered and the one chosen.



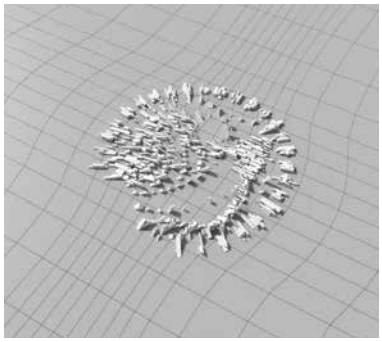
starting model



+density



zero impact on coast



open layouts

total area

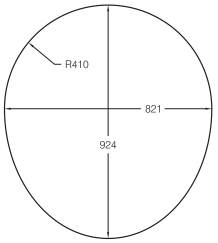
59,5 ha

surface

0,8 x 0,9 km

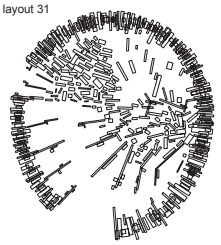
perimeter

2,7 km



layout 24

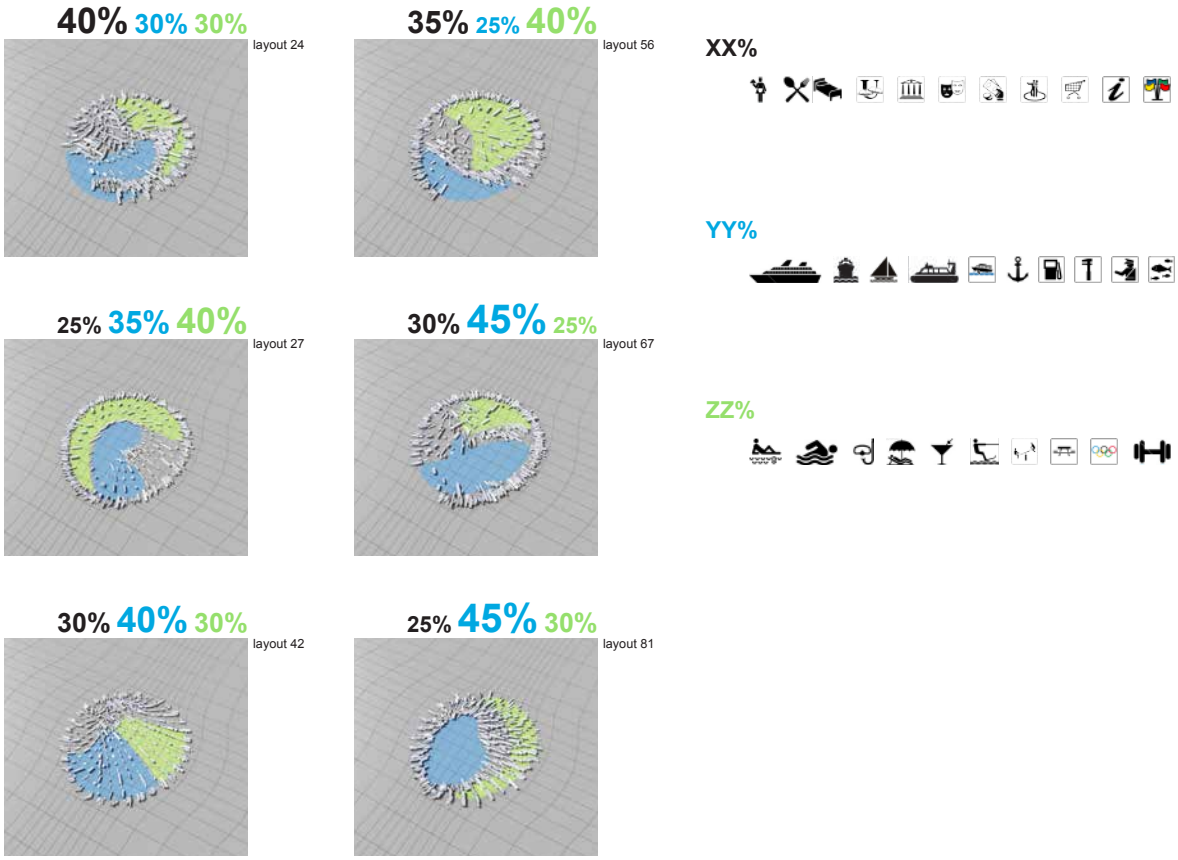
layout 31



layout 67

layout 81

Figure 3.20: A selection of possible layouts with variable incidence of the macro-functional areas. The layout is open to different scenarios which may change according to the different investors and stakeholders involved.



tios. The condensation of the built allows to optimize the engineering work, establish new functional relationships and control the degree of 'climate exposure' of certain areas ensuring a more continuous usability throughout the year.

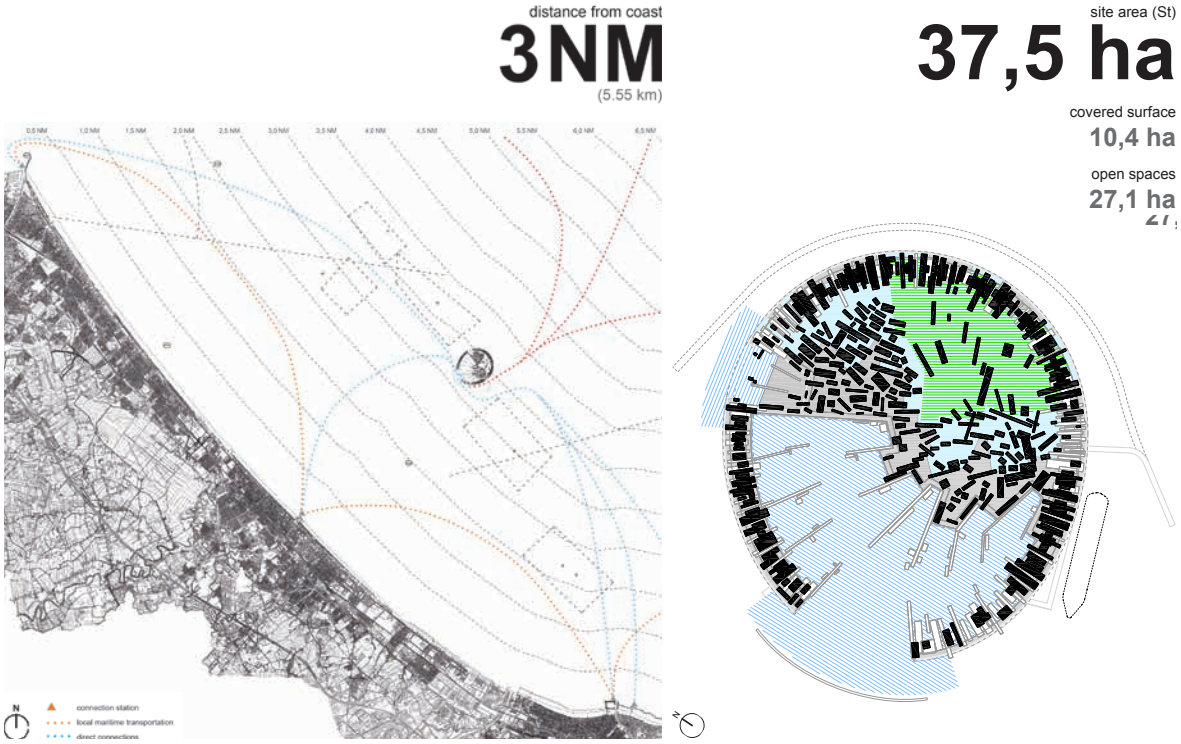
Model of Fluid-Dynamic System

The conformation of the infrastructure should interfere as little as possible on sea currents affecting the coast. Through the development of mathematical models it is possible to monitor the impact of fluid dynamics under different conditions. At a given distance from the coast, orientation and form factors are crucial variables for the control and verification of this report. The volumes are therefore distributed along the perimeter of a shape that fulfills these prerogatives covering an area of 50-65 ha.

Occupation Model

The volumes are distributed on the surface of the infrastructure in accordance with endless combinations that keep unchanged some parameters such as the building ratio and the covered surface. These combinations determine different scenarios of land occupation , of major and minor density, and consequently different layouts in terms of open spaces.

Figure 3.21: THERE is situated about 3 nautical miles offshore of the Riccione 'Porto Canale'; the area presents a very low depth, in the order of 10 to 12 meters. On the right, the infrastructure's general dimensions.



Open Layouts

A selection of possible layouts with variable incidence of the macro-functional areas. The layout is open to different scenarios; it will be defined in parallel with the process of identifying investors and stakeholders.

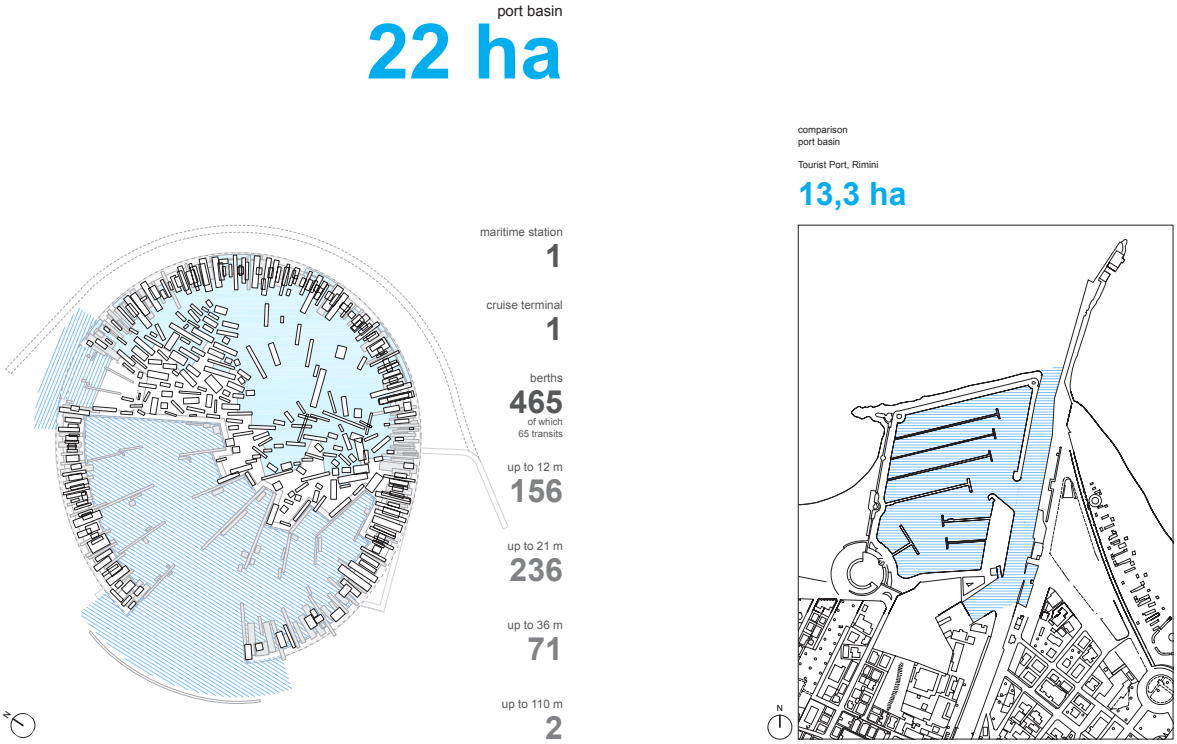
It is proposed here one of the possible configurations of THERE, selected from the multiple layouts generated on the basis of the parameters previously assigned. This specific sample responds to defined quantities and indeces. The distribution of the volumes is in line with the needs of the functional program and reflects better than others the need to present a certain variety in relation to the different constructed and free areas. This allows to identify areas with most outstanding urban vocation and others destined to different functions, more in line with the needs of lower density.

Below, the values of the parameters according to the urban model.

The location identified is situated about 3 nautical miles offshore of the 'Porto Canale' of Riccione, in a sea area that presents a very low depth, in the order of 10 to 12 meters asl.

The structure has a total area of approximately 375,000 m^2 emerged, with in addition approximately 220,000 m^2 of water surface of the inner harbor. The overall development of the perimeter of the area emerged is about 5 km, to which must be added the 130 m of submerged perimeter at the open beach

Figure 3.22: The port basin dimensions are compared to the ones of the near touristic port in Rimini, on the right.

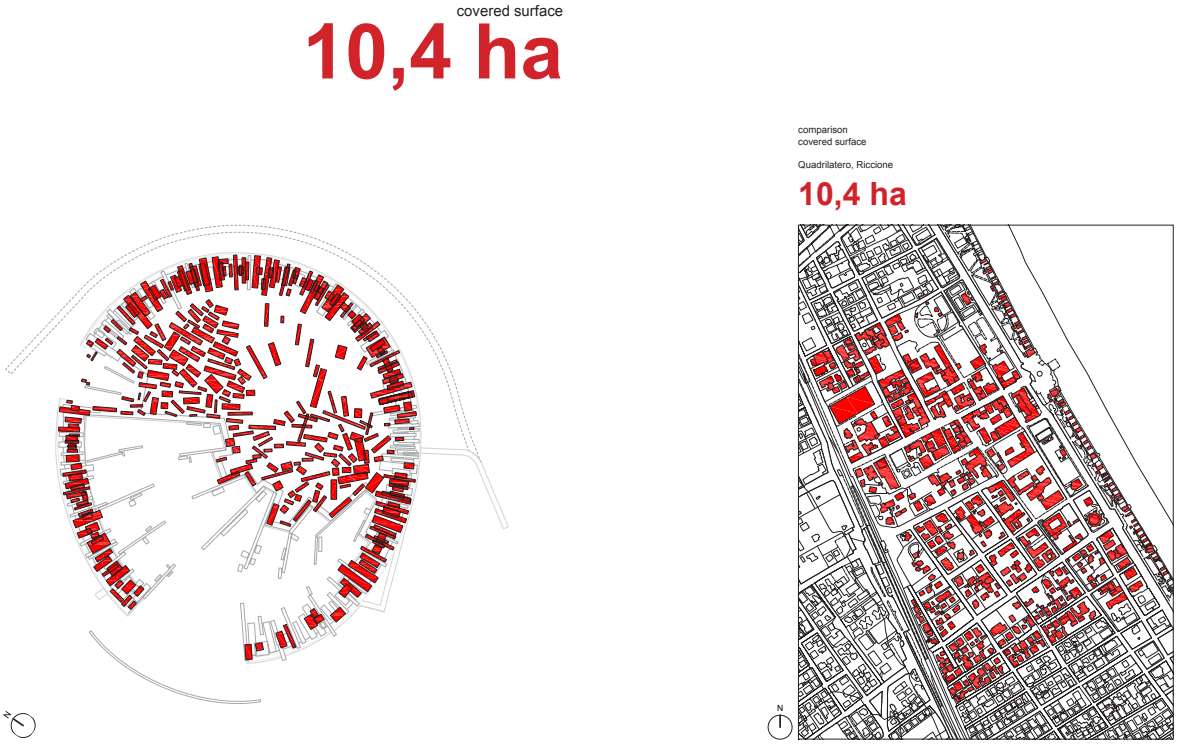


towards the sea, and 300 m of the breakwater of the cruise dock and minor ancillary works. The outer barrier submerged has a total length of about 1450 m, with a section width of approximately 16 m and altitude crowning of -0.5 masl. The development of the cruise deck is over 350 m of lenght and is suitable for use by all the cruise ships currently on the market. The development of floating breakwaters is a total of approximately 500 m, and it is expected to be made out of modules in reinforced concrete with a displacement of more than 7 t/m. The emerged surface corresponds to the site area. The index 2.5 m^3/m^2 allows a total volume of 940,000 m^3; in line with the theoretical volume required by the 10,000 users of the infrastructure. On the basis of these values and the previous reasoning developed in the urban settings, the quantities in relation with the scenario are:

The inner dock can accommodate about 465 boats up to 120 m of length, but this number could be increased with additional moorings during summer, to accommodate the pleasure boats in transit, since the island can easily be reached from the mainland by small boats.

The expected built surface is 10.4 ha. The reduction of appurtenance areas and standards related to vehicular traffic, and the related urbanization, allows to identify areas of high density and other with lower density and major open areas. This creates the conditions for areas with different functional vocation and to a higher or lower intensity of use.

Figure 3.23: The expected built surface is 10.4 ha; here campared with the same surface in Riccione city-centre, on the right.



The creation of areas with high tourist attractiveness requires space in which the built component is reduced to essential services in favor of open spaces. The heterogeneous distribution of the volumes identifies an area of about 15 ha where to organize this activity, similar in morphology and size to a theme park.

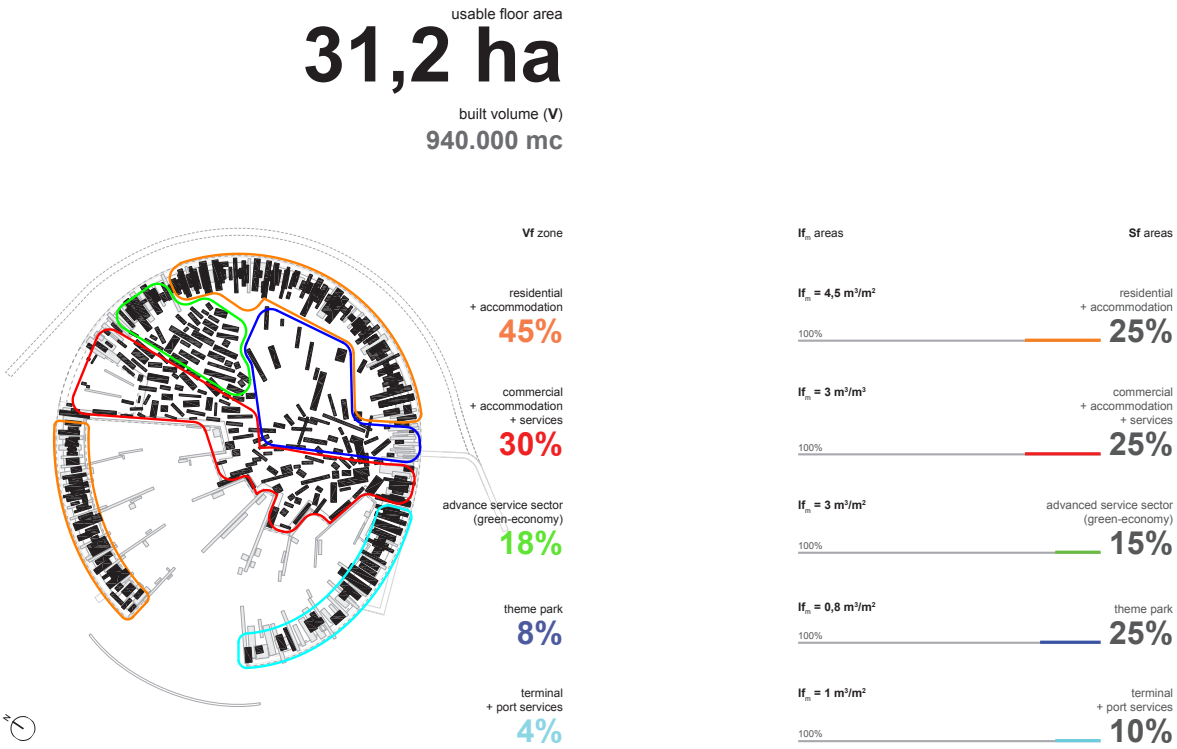
On the base of the layout previously outlined, it is possible to define areas that meet the functional program and relate to the accessibility system designed for the infrastructure. The ratio between the volumetric incidence and extention of the single area results in a land density variable on the base of different ambits, but within the range defined by the urban scenario: 2.6 <If <5.3.

Possibility of reducing the urban load in strategic areas of the coast by moving volumes and functions at sea. Through processes of equalization, it is possible to trigger the regeneration of certain areas without encouraging further use of the land.

Technologies

The infrastructure will consist of a large embankment of pseudo-elliptical shape bordered by vertical containment walls; in the portion of the embankment facing the mainland a large harbour will take place, while the remainder will be organized with public and private buildings and a large and pro-

Figure 3.24: One of the potential use scenarios applied to the layout in order to present the environmental impact assessment to the pertinent national authority. On the right, the main data and indexes.

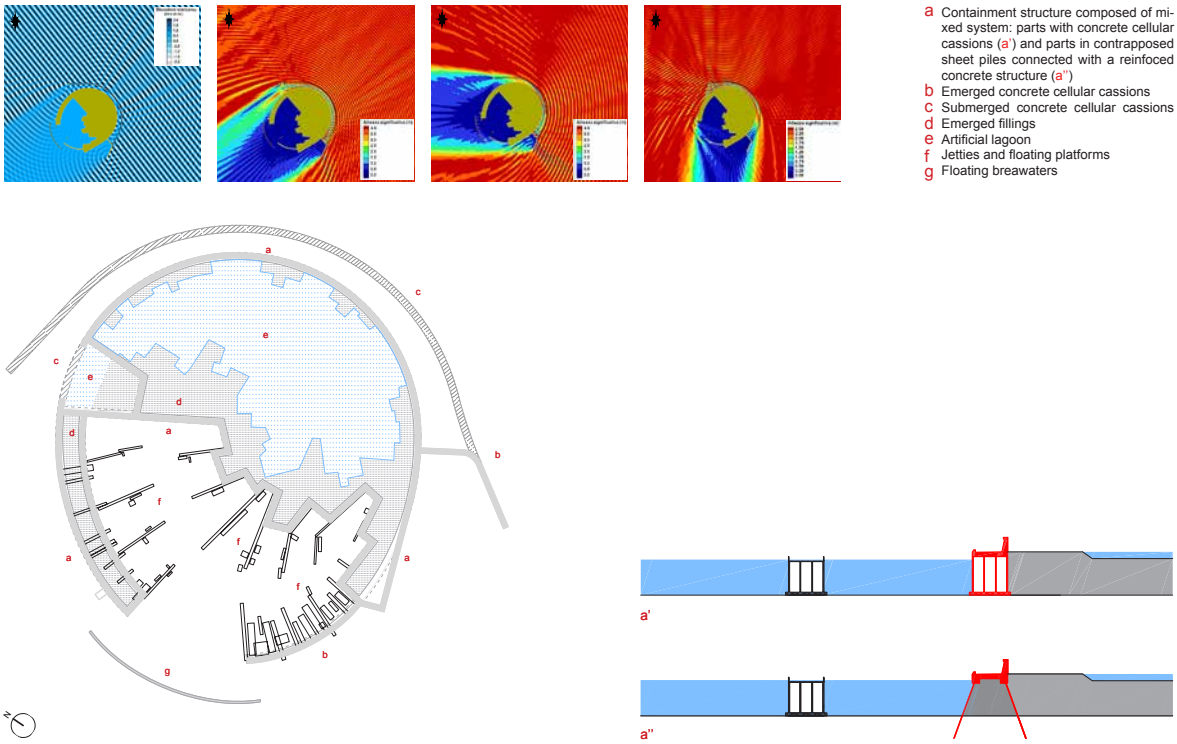


tected swimming area.

On the sidelines of the main embankment, a submerged reef will take place towards the open sea, with the aim of reducing the incident wave motion, and a floating breakwater (g) will take place towards the mainland, to protect the mouth of the harbor. A specific berth for cruises will be arranged on the south-est side of the embankment.1

The main structure, defined above as ‘embankment’, is in substance a filling delimited by vertical wall structures (a). In this preliminary phase these walls have been identified as concrete cellular caissons (a ‘), with the possibility that the caissons will be locally replaced by composite structures in steel and reinforced concrete (sheet piles) or by elements casted in site (a’’), in particular with regard to the inner perimeter. In principle, we opted for a vertical wall structures to reduce the dimensions and impacts of the island; indeed this constructive solution is normally used for marine works in relatively high seabeds, with the common idea that it will be easily possible to overcome the main contraindications (overflow, landscape impact and vulnerability) through the creation of a submerged barrier able to substantially reduce the effect of incident wave motion (c). The submerged outer barrier will be built in reinforced concrete cellular caissons, that will be positioned at a distance of 50 m from the island. The caissons will be firstly placed, and then partially demolished to bring the pro-

Figure 3.25: The layout has been analysed in relation to the required features in terms of hydraulics; in particular, in relation to the reduction of the residual wave motion inside the harbour. Below, the building technologies composing the infrastructure.



portion of crowning height below the average sea level. The dock for cruises will also be made with cellular caissons (b). All the works consisting in vertical walls will be partially supported with boulders and stones to prevent undermining processes and promote colonization by marine organisms.

The large filling (d) of the island will be realized with material coming from the areas of loan that will be available at the time of realization of the island. At this stage, some sources have been identified: dredging of the channels of access to ports of Emilia-Romagna and neighbouring regions, inert materials compatible with the intended use, marine and terrestrial quarries. The filling will be treated to obtain suitable mechanical characteristics for the foundation soils; and in this preliminary scenario it is expected to proceed with the treatments of vibroflotation and subsequent preload of areas to be infra-structured.

3.1.5 Pending Issues

As we tried to demonstrate above, THERE experience has brought to refine some designing processes related to the sizing of infrastructures. On the other hand, it lacks a sufficiently clear and concrete procedural framework in which inscribing the infrastructure development procedure, so it has turned to be useless in grounding a proper approach dealing with scenarios. Much is due to the legal and administrative originality of such an operation in Italy, but also some problems descend from the way in which the proposal has been set up since its beginning.

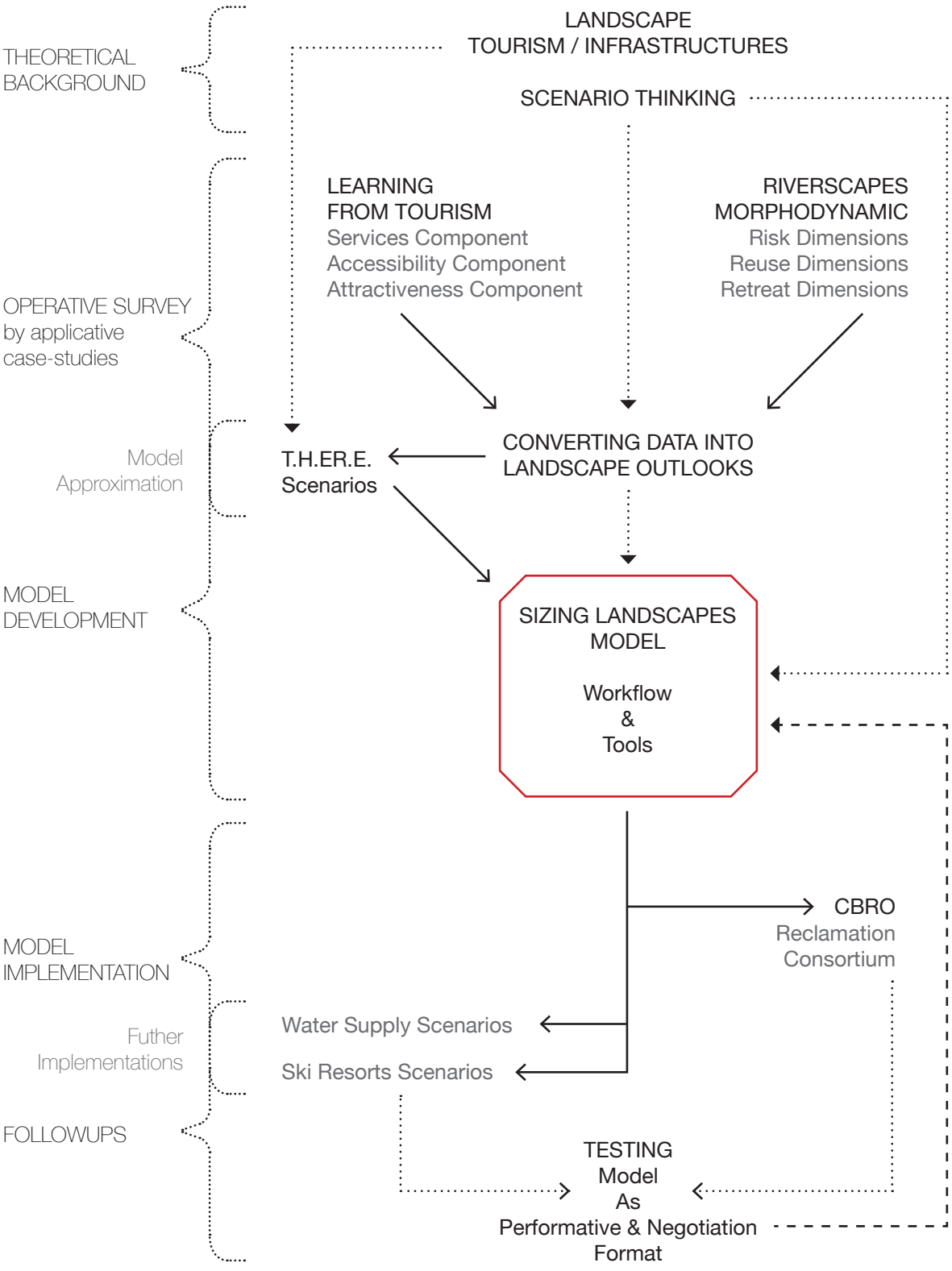
All things considered, the main issue concerns the fact that - in order to obtain permissions and start environmental assessment procedures, as well as finding investors and carrying on the necessary technical investigations related with the work technical feasibility - the project would have need a main and strong developer able to manage a negotiating table with national institutions where to set a consistent and affordable procedure of building permission granting. Such requirement did not occur mostly because the partnership was mostly composed by local authorities and municipalities which have not the capacity and the 'time' of supporting long-term visions.

So, the intention to develop a well-structured approach based on scenarios, and testing its effectiveness on the field, has been turned directly to specific infrastructure developers. We focused on finding partnership with public-private authorities managing territorial networks related with water supply infrastructures and risk management.

This choice main reason lies in the fact that such authorities, beside having a market mission, have to deal by statute with a public commitment. This first condition give a guarantee about their interest in developing long-term strategies according to public constrains, but in a framework of higher flexibility and profit-care.

A last condition that we have found as essential in the developer concerns the organization size and its operative structure. In fact, in order to effectively develop landscape scenarios, it is essential to coordinate the workflow in the way there is a constant feedback with the organization decision-makers as well as with their operative collaborators and mostly the dialog between them needs to be stable. Such prerequisite allows to get specific data you need to design scenarios, but always keeping in mind the general strategic aim of the process.

Figure 3.26: The flow chart indicating the sequential steps being taken by the thesis. Highlighted in red the model development phase explained in the following pages.



3.2 Model Development

After the T.h.er.e. experience, it has been clear that the approach by scenarios for managing complex planning procedures can be as much effective as some conditions exist. Firstly, the main interlocutor should match with an infrastructure developer which constantly has the necessity to set up long term strategies to fulfil a public mission or to be competitive in its business environment. That means also that such authority or company is characterized by a stable structure sharing a common outlook on the future, but, at the same time, it is quite clear who takes decisions. The second condition concerns the moment in which the scenario approach has to be applied, that is at the very beginning of the decision-making process when still all the forecasts, analysis and data, pertaining to different disciplines, are in the process of being collected and elaborated. In this moment, the landscape planning contribution can actually take advantage of them and, at the same time, affect hypotheses and further investigations.

By referring to the 'scenario thinking' as an effective tool for testing potential strategies against unknown and unpredictable futures, this thesis elaborates a model, i.e. the 'Sizing Landscapes Model', establishing an efficient workflow to assist decision-makers in their strategic choices by visualizing and elaborating prospective landscape scenarios. The following paragraphs report the steps made in this direction starting from the 'Scenario Planning' businesses model which has been adapted and used for building the landscape one.

The model aims at reducing uncertainty by creating and identifying possible alternative paths of landscape development whereby a limited number of possibilities are created, and systematically compared against one another. It is grounded on the main assumption that, by running multiple narratives within alternative frameworks of forthcoming changes in the landscape, unexpected outcomes could be anticipated and more adaptable strategies elaborated.

In fact, the model implies a series of steps that should bring to outline four alternative landscape scenarios designed to size the temporal and spatial field of action in which the infrastructure development will take place according to different directions. Finally, such raw scenarios need to be processed together in order to be transferred to decision makers as a clear and synthetic landscape format addressing also mid-term choices.

3.2.1 What Are Scenarios?

"Few companies today would say they are happy with the way they plan for an increasingly fluid and turbulent business environment. Traditional planning was based on forecasts ... Forecasts are not always wrong; more often than not, they can be reasonably accurate. And that is what makes them so dangerous. They are usually constructed on the assumption that tomorrow's world will be much like today's. [...] (The problem is) in anticipating major shifts in the business environment ... the way to solve this problem is not to look for better forecasts ... the right forecast. The future is no longer stable; it has become a moving target... The better approach, I believe, is to accept uncertainty, try to understand it, and make it part of your reasoning. Uncertainty today is not just an occasional, temporary deviation from a reasonable predictability; it is a basic structural feature of the business environment" (Wack, 1985: 1).

The first academic articles on this topic date mid-1980s. Specifically, Michael Porter (1985) gave one of the first definitions of scenarios, as *"an internally consistent view of what the future might turn out to be" (p. 24)*. Later in the article, Porter also explains that *"each scenario is, in effect, a full analysis of industry structure, competitor behaviour and the sources of competitive advantage under a particular set of assumptions about the future" (p.35)*. By his definition, the author suggests that scenarios are concerned with the particular results of the main driving forces, rather than analysing the driver itself. Pierre Wack (1985), probably the best known among the pioneers of the scenario thinking process, sums this up with the analogy that *"Scenarios are like cherry trees: their fruit grows neither on the trunk nor on the boughs, but rather on the small branches" (p.125)*, also meaning that the added value resulting from the scenario thinking process is in analysing the end results, rather than the main drivers that determine them.

Later definitions focused more on the practical uses of scenarios: Schoemaker (1991), for example, defines scenarios as *"a thinking tool and a communication device that aids the managerial mind rather than replacing it" (p.120)*. Godet's definition (2000) also focusing on their practical uses, states that, *"a scenario is not a future reality, but a way of foreseeing the future, thereby throwing light on the present in terms of all possible and desirable futures" (p.102)*.

As scenarios were increasingly used for aiding management decision making, it became important to also explain how to use such scenarios. With this aim, it was essential to define the drivers that determined the resulting scenarios and their role in illuminating how these scenarios may become reality. In this perspective, Godet (2000) specifies that *"a scenario is the set formed by the description of a future situation and the course of events that enable one to progress from the original situation to the future situation" (p.111)*.

Most recent definitions (Van Der Heijden & Schutte, 2000) focus on distinguishing them from forecasts and strategies, emphasising the scenario hypothetical nature and its role in aiding future comprehension, rather than predicting it. The difference between scenarios and plans is an important one, as the misuse of scenario thinking frequently arises from a lack of understanding about what they actually are: whereas planning can be defined, with Godet (2000b), as *"to conceive of a desired future as well as the practical means of achieving it" (p. 89)*, scenarios reflect plausible - rather than desired - futures, and are not concerned with the means to achieving those futures.
Rather than imagining scenarios as a means to creating plans, MacKay & McKiernan (2004) encourage us to *"imagine them as postcards that describe business conditions surrounding the organisation in the future and sent back to you by a future analyst so that you can read them now" (p.76)*.

Although there are differences in the focus of how the definition of a scenario is explained, the literature on scenarios is consistent in the views of scenarios as hypothetical sets of conditions in the future that do not serve any purpose on their own, besides aiding the development of an understanding of how the future may develop. In fact, as remarked by Hiltunen (2009), scenario planning could help to be prepared for futures (with a plural 's'), and to innovate those very futures, for scenario planning is a good way to question the what is forthcoming (Barber, 2009). Scenarios provide an overall picture of the environment, and underline the interactions among several trends and events which might happen in the future (Martino, 2003); moreover, the added value of scenario planning is that it presents all complex elements together, into a coherent, systematic, comprehensive, and plausible way (Joseph, 2000). Also, Strauss and Radnor (2004) argued how the use of scenarios is extremely useful for highlighting implications of possible future system discontinues, identifying nature and timings of such implications, and projecting the consequences of a determined choice, or policy decision.

3.2.2 The Value of Landscape Scenarios

According to the literature in the economy and management fields, scenarios are alternative descriptions of the business environment. Our interest focuses on how such definition could be applied to the infrastructure developers about the mutual implications between the landscape and their mission. As already discussed in Chapter 1.2, 'Scenario Thinking' approaches have already been experimented in urban planning (Stojanović, Mitković & Mitković, 2014) to support local and regional authorities in their policy making. The approach application to the landscape planning field has also been tested especially having as interlocutors administrations and with the main aim of analysing more than driving spatial planning policies.

This thesis objective is, instead, to develop a model capable of building a permanent relationship between infrastructure developers and landscape professionals and/or academics since the very beginning of strategic reasoning about forthcoming developments they need to plan. In such perspective, the model is aimed at straightening the landscape-oriented thinking among those actors whose choices effectively and daily transform the environment through massive, but not so evident, works. We refer especially to network services providers whose mission deals with business as well as with physical environment. In their activity, they are increasingly engaged in debates with territorial management authorities, stakeholders and target groups, concerning future scenarios, but they lack means by which rendering such outlooks and explaining their impacts. So alternative landscape scenarios can be used to ground such debates on more clear and understandable basis for the interlocutors, avoiding ideological conflicts and predetermined positions by shifting the discussion toward a prospective rather than a retrospective view.

Quoting from Pierre Wack (1985): *"Scenarios help managers structure uncertainty when they are based on a sound analysis of reality, and they change the decision makers' assumptions about how the world works ... their mental model of reality" (p.12)*. Therefore, the scenario planner objective should be to expand the envelope of decision makers' thinking by integrating in their mental maps of the future landscape issues, opportunities and challenges. In that respect, the process of landscape scenarios development is as important as the final product of landscape planning.

As the most literature states, scenarios are stories, images or maps of the future. They are internally

consistent and describe paths from the present to a future time horizon. Good scenarios are rooted in the past and in the present. They provide an interpretation of past and present events projected into the future. In particular, the key focus of scenarios is uncertainty. In this sense, as the thesis attempted to demonstrate in Chapter 2, the landscape planning process has inevitably to deal with scenarios by identifying the major uncertainties affecting the environment transformations. In fact, scenarios help 'chart the waters ahead' so that the consequences of today's decisions can be played out, evaluated and tested against the uncertainty of the future.

As Pierre Wack indicated, scenarios are an approach to thinking about the future by focusing on key uncertainties facing managers in making strategic decisions. An organization can then use them to think through their strategic options and decisions. But scenarios are most useful when the external environment is complex and uncertain and key decisions involve major investments or have long term consequences. Complex environments typically involve non-quantifiable factors, where structural change is a component of the uncertainty and where systems have complicated feedback loops. This is the reason why the thesis chose to develop a scenario-based approach addressed to infrastructure developers. Even though, their decision are often based on data analysis and complex forecasting, they are increasingly aware of the fact that these inputs, covering only partial and specialistic branches, struggle with synthesizing the contextual and physical framework in which the company activity will move. Increasingly, systems thinking, which recognizes how behaviour within systems can lead to unanticipated feedback (Richmond, 2001), is gaining attention in businesses (Gharajedaghi, 2005) and public sectors (Seddon, 2008) as an operative tool to face challenges within a global and interconnected world. Also landscape discipline, as already stated in the previous chapters, has been evolving in this direction and the scenario thinking approach seems the one which better can match such parallel trends.

According to the way the thesis tackles the landscape topic, our interest does not focus on the situations in which most of the variables are known and quantifiable; in this cases, scenarios are not very useful and risk to get the things more complicated. Similarly, for decisions with relatively short term outcomes, scenarios are not appropriate, too. Scenarios are valuable since they act in a long-term perspective under the force of complex phenomena. That means that landscape scenarios, to be

effective, have to deal with a large scale and most of all with an interlocutor having a sectorial mission concerning a clear infrastructural system. Otherwise, scenarios becomes preliminary projects or planning alternatives that is a further step that does not concern directly the subject of this research, as well as the model it proposes.

So, scenarios, as we intend them, provide insight. While the Sizing Landscape Model is designed to produce scenarios, the learning that occurs through the scenario development process may actually be more valuable than the specific scenarios developed. This is the main difference in respect with a project along with the fact the scenarios have to be opened to a constant update and review. In such perspective, scenarios can be though both as a product and a designing process.

The value of landscape scenarios as a product lies in:
/ building understanding of the broader physical environment in which the developer operates;
/ embracing and structuring uncertainty on such environment;
/ creating a vocabulary about the future and identifying alternative futures;
/ making key assumptions explicit and surfacing hidden risks;
/ providing a context for developing and testing strategic options or policies.

The value of landscape scenario as design process lies in:
/ providing a vehicle for increased communication and shared learning;
/ building the strategic capacity of managers, specialists and interlocutors;
/ providing a forum for sharing views from all institutions involved in the development;
/ allowing unconventional views and new ideas to surface;
/ building organizational alignment, commitment and performance inside the work group.

3.2.3 Landscape Scenarios Features

Landscape scenarios may be very broad or very focused depending on the inputs the the client gives. They may emphasize long term trends and how they work on the environment evolution or they might visualize the dynamics of key variables over time. They may explore key themes or ranges according to the data provided by other specialists about the infrastructural works consistence.
Nevertheless, there are 5 common characteristics of scenarios worth noting.

Multiple Views

Scenarios always involve more than one view of the future. That is their explicit objective. A single view is a forecast.

Qualitative Change

Scenarios are most appropriate when dealing with complex, highly uncertain situations in which qualitative, non-quantifiable forces are at work. (e.g., social values, technology, regulations, etc.).

Objective

Scenarios describe what could happen, not what we want to happen. Objectivity requires that scenarios be internally consistent and feasible. If scenarios are viewed as impossible or not feasible, they are rejected. The challenge is to broaden thinking without becoming unbelievable.

Open-Ended

Scenarios are stories. They do not provide precise details. Challenging and engaging scenarios allow the reader to add details which help bring the scenarios alive.

Focused and Relevant

Scenarios must be relevant to the situation at hand. They must focus on the driving forces and the critical uncertainties relevant to strategic decisions under consideration.

In his book, Art of the Long View, Peter Schwartz (1996) observed that scenarios are about perceiving futures in the present. The idea is that the seeds of the future are present today, if only we could interpret them. We apply this simple idea in developing landscape scenarios. Our challenge is to identify the ‘seeds’ by converting infrastructure dimensions into landscape outlooks, interpret their significance and project their implications into the future.

3.2.4 The Model Workflow & Chart

The model here proposed is based on the review of different techniques used in the 'Scenario Planning' which are adapted to the landscape topic's objectives, as well as the interlocutor typology that we have stated to be the first target of this research work. Before starting with the brief explanation concerning the operational steps composing the model workflow we set up, a preliminary clarification about the 'Scenarios Design' methodology is needed.

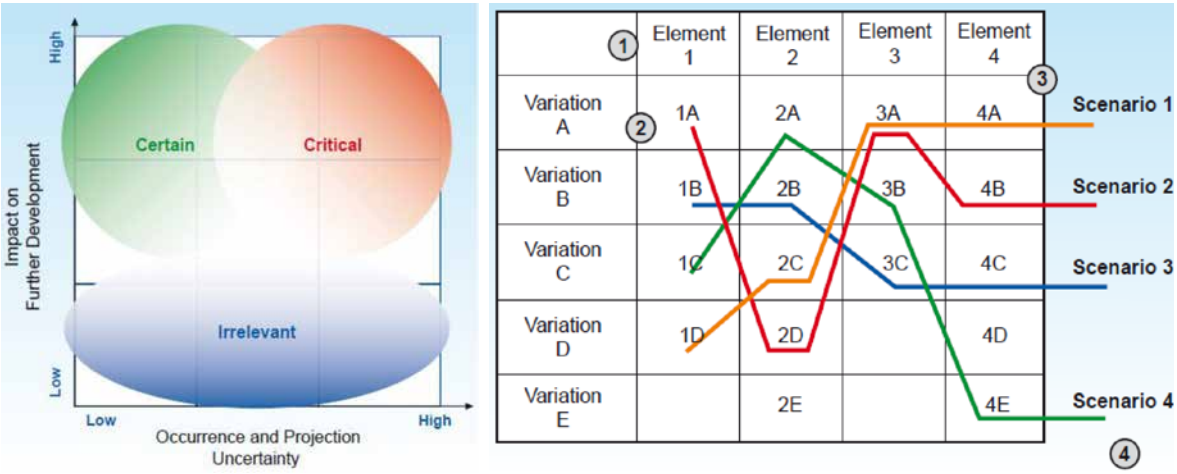
In fact, there is no precise answer to the question of how many future scenarios should be developed and various researchers recommend different number of alternative scenarios. Based on the literature analysis (Durance & Godet, 2010 ; Schwab, Cerutti & Von Reibnitz, 2003 ; van der Heijden, 1996) it can be concluded that 3-5 scenarios are optimal. If there is less than three scenarios all of the possible alternatives cannot be stressed. Also, a large number of scenarios is not desirable, because it would be counter-productive and impractical. Some of the researchers also believe that the number of scenarios should be even in order to prevent the desire to select the scenario that is in the middle (Cotes, 2000 ; Schnaars, 1987). Depending on the situation, one can choose minimal, standard and maximum approach (Amer, Daim & Jetter, 2013).

The minimal approach is considered appropriate if there are only two criteria or factors that are sufficient, and can be used to determine the future development. It is also called the double uncertainty or 2x2 matrix approach. Scenarios are developed in each of the four quadrants of the grid representing the most important and the most uncertain factors.

The Standard approach is recommended when it is not possible to reduce the number of uncertain factors to two. First, all elements are evaluated separately according to their estimated level of uncertainty in the context of continued development and their possible impact on the direction of development using the Wilson matrix *(Figure 3.27)*. Alternative development variations for each element can be explored using morphological analysis. It ensures the relevance, coherence and plausibility of scenarios. Critical elements are entered at the top of the column. A number of conceivable development variations is determined (at least two). Variations are combined into plausible strands and each of them forms the basis of scenario *(Figure 3.27)*.

The maximum approach is used for situations when there are even more uncertain elements, and the

Figure 3.27: On the left, use of Wilson matrix to prioritize scenario drivers; on the right, a diagram representing the 'Morphological analysis' in which scenarios are dependent on the variation of the individual elements of the future.



number of elements can be reduced using cross impact analysis. This is used to evaluate changes in the likelihood of occurrence within the entire range of possible future events and trends. In this approach, a cross-impact matrix is created which identifies the impact and effect of each factor or trend on other factors/trends. A simple example of cross-impact matrix involves 10 trends (T1 to T10). A score is assigned on a scale of 0-3. The trend with the strongest impact on the other trends is identified by summing the score. After cross impact analysis, the selected elements are analysed in the same way as in the case of the standard approach using the Wilson matrix and morphological analysis. Then, in the case of maximum approach a consistency analysis is carried out with the help of another matrix.

In the present work, the minimal approach has been chosen due to the fact that the other methods, developed in the economic management discipline, refer to a degree of complexity which would have bring the landscape application too far, given the physical variables involved. Furthermore, as we will demonstrate through the applicative case study, the Sizing Landscape Model aims at incorporating such additional variables by processing the operative tools which are used by the developer to transform the landscape. In this way, the model focuses on the main strategic issues and driving forces suggested by the client as overriding, treating further changing elements as a prospective matter to be updated, transformed, manipulated, augmented or removed.

Below, the sequence of actions that constitute the 'Sizing Landscapes Model' workflow is presented and finally summarized into the 'Model Chart' representing the instrument used in the model implementations, one of which will be reported at the point 3.3 of this chapter.

Operation Field of the Developer

Specify subject and scope of the model implementation by investigating the territorial framework in which the developer operates.

Examining past changes to identify ongoing trends and forces affecting its mission.

For the present situation, develop a clear understanding that will serve as the common departure point for each of the scenarios.

Driving Forces and Strategic Issues

Identify predetermined elements that are virtually certain to occur and that will be driving forces.

Besides, consult the developer about the strategic issues it has to face and for which the prospective landscape scenarios are needed.

Identify the two main critical 'key-factors' of uncertainty which will operate the landscape transformation according to the strategic issues. The two 'Key-factors' are fields of variables.

Operative Tools Taxonomy

Since critical key-factors and main driving forces impacting on the future landscape have been identified, investigate the physical operative tools that actually can be directly used, exploited and managed by the developer to face strategic issues.

Scenarios Design

The first operation consists into processing the two 'uncertainty key-factors' which are still fields of variables in order to identify for each of them the two most consistent 'alternatives' which could lead to distinctly different futures in terms of landscape transformations.

In this way, we obtain 4 'alternatives' whose interactions will be analysed in the logical framework of the scenarios resulting from their intertwining.

In practical terms, develop a matrix of scenarios using the two 'uncertainty Key-factors' and their possible 'alternatives'. Each cell in the matrix then represents a single scenario.

A scenario matrix might look something like that in *Figure 3.28*.

For easy reference in later discussion it is worthwhile to give each scenario a descriptive name.

One of these scenarios most likely will reflect the mainstream views of the future. The other scenarios will shed light on what else is possible.

The second operation consists into fleshing out the major characteristics and developing 'stories' for each scenario.

Figure 3.28: The 2x2 Scenario matrix used in the 'Sizing Landscapes Model'.

		VARIABLE 1	
		Outcome 1A | V	Outcome 1B | V
VARIABLE 2	Outcome 2A -->	*Scenario 1*	*Scenario 2*
	Outcome 2B -->	*Scenario 3*	*Scenario 4*

In fact, at this point there is not any detail associated with these 'first-generation' scenarios. They are simply high level descriptions of a combination of important environmental variables.

Specifics can be generated by discussing each scenario starting from the present (i.e. our 'stories').

To do that, we ground on the 'Operative tool Taxonomy' whose elements have to be processed quantitative and qualitative, according to the scenario impacts.

Their variation should be internally consistent for the selected scenario so that it describes that particular future as realistically as possible.

Experts in specific fields may be called upon to develop each scenario. In fact, in order to quantify the impact of each scenario on the developer activity, and formulate appropriate strategies further considerations have to be done about, for example, economic feasibility.

The scenarios developed provide a context for examining the risks and opportunities associated with different strategic choices or policy options. They become a tool to examine the future of consequences of decisions being made today.

Scenario Transfer

Process the 4 alternative scenarios together in order to provide strategic inputs about the scenarios' mutual adaptability, reversibility and transition potentials.

Do it by different techniques depending on the context: merging, adding, blending, etc.

The aim is to transfer to the developer a clear and synthetic format addressing mid-term decisions.

Figure 3.29: The proposed blank 'Model Chart' to be filled in order to synthesize the developer's data and to drive the landscape scenarios' generation.

MODEL CHART

1 Operation Field

TERRITORIAL FRAMEWORK

> Main Data

2 Driving Forces and Strategic Issues

LANDSCAPE & INFRASTRUCTURAL NETWORKS

> Analysis

3 Operative Tools Taxonomy

> Tools List

TOOL IMAGES

Scenarios Design 4

UNCERTAINTY KEY-FACTOR 2	UNCERTANTY KEY-FACTOR 1	
	ALTERNATIVE 1A	ALTERNATIVE 1B
ALTERNATIVE 2A	SCENARIO 1	SCENARIO 2
ALTERNATIVE 2B	SCENARIO 3	SCENARIO 4

Scenario Transfer 5

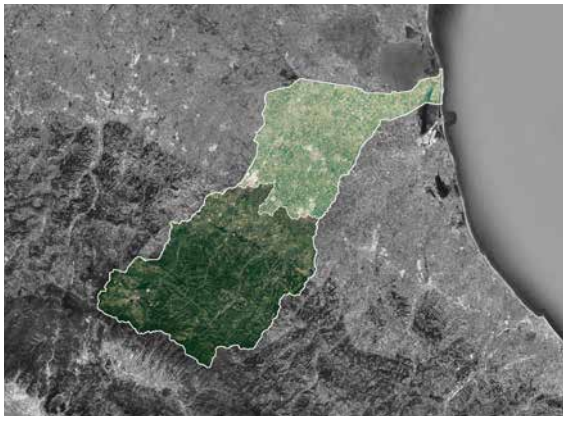
SCENARIO PROCESSING > COMMUNICATION

> Outputs

Figure 3.30: The proposed 'Model Chart' filled with data from the work developed for the CBRO Reclamation Consortium.

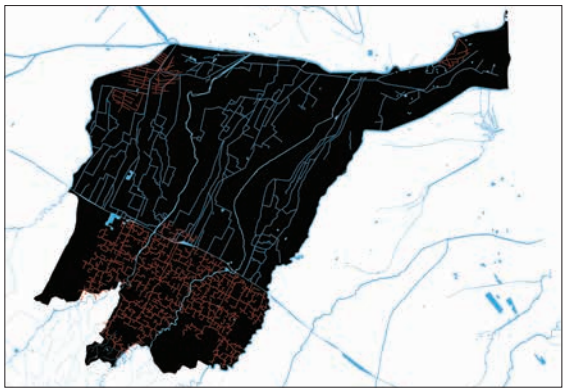
CBRO's MODEL CHART

1 Operation Field



Total District Area:	2.005 Km^2
Total Canals Network:	963 Km
Drainage Canals Network:	482 Km
Mixed-use Canals Network:	481 Km
Pressured Irrigation Network:	548 Km
Pumping Stations:	n° 20
Detention Basins:	n° 3
Irrigation Plants:	n° 33
Mountain Regimentation Works:	> 5.000
Lowland Regimentation Works:	> 1.000

2 Driving Forces and Strategic Issues



> optimizing water use in accordance with European policies and maintaining the existing level of safety in relation to the expected increase of climatic uncertainty.

> expanding the pressured irrigation system north of the C.E.R.

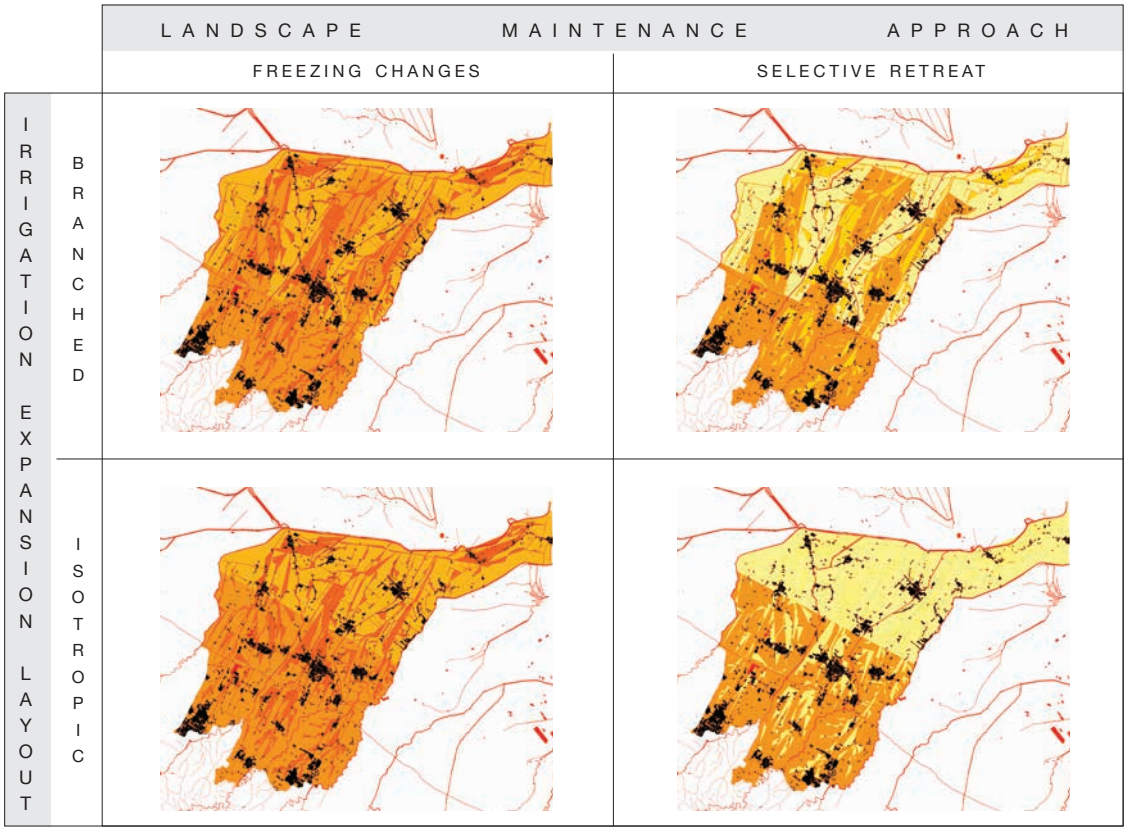
> landscape persistence or evolution with respect to risk management and resiliency policies.

3 Operative Tools Taxonomy

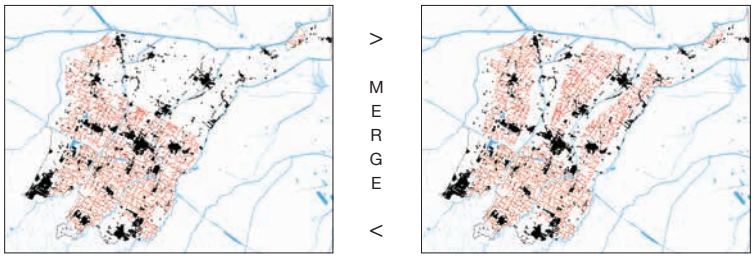
# 1 Floodways	# 7 Water Reservoirs	# 13 Pumping Stations
# 2 Dewatering Plants	# 8 Drainage Canals	# 14 Weirs
# 3 Culverts	# 9 Mixed-use Canals	# 15 Check Dams
# 4 Inverted Siphons	# 10 Photovoltaic Plants	# 16 Avalanche Protection
# 5 Sluice Gates	# 11 Micro Hydropower Plants	# 17 Flood-banks
# 6 Detention basins	# 12 Pressured Pipes	# 18 Artificial Dunes

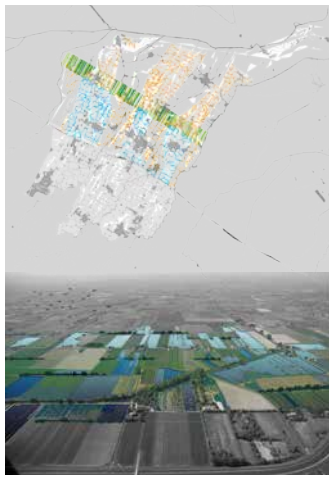
3.3 Model Implementation: Supporting the CBRO Reclamation Consortium

Scenarios Design 4



Scenario Transfer 5



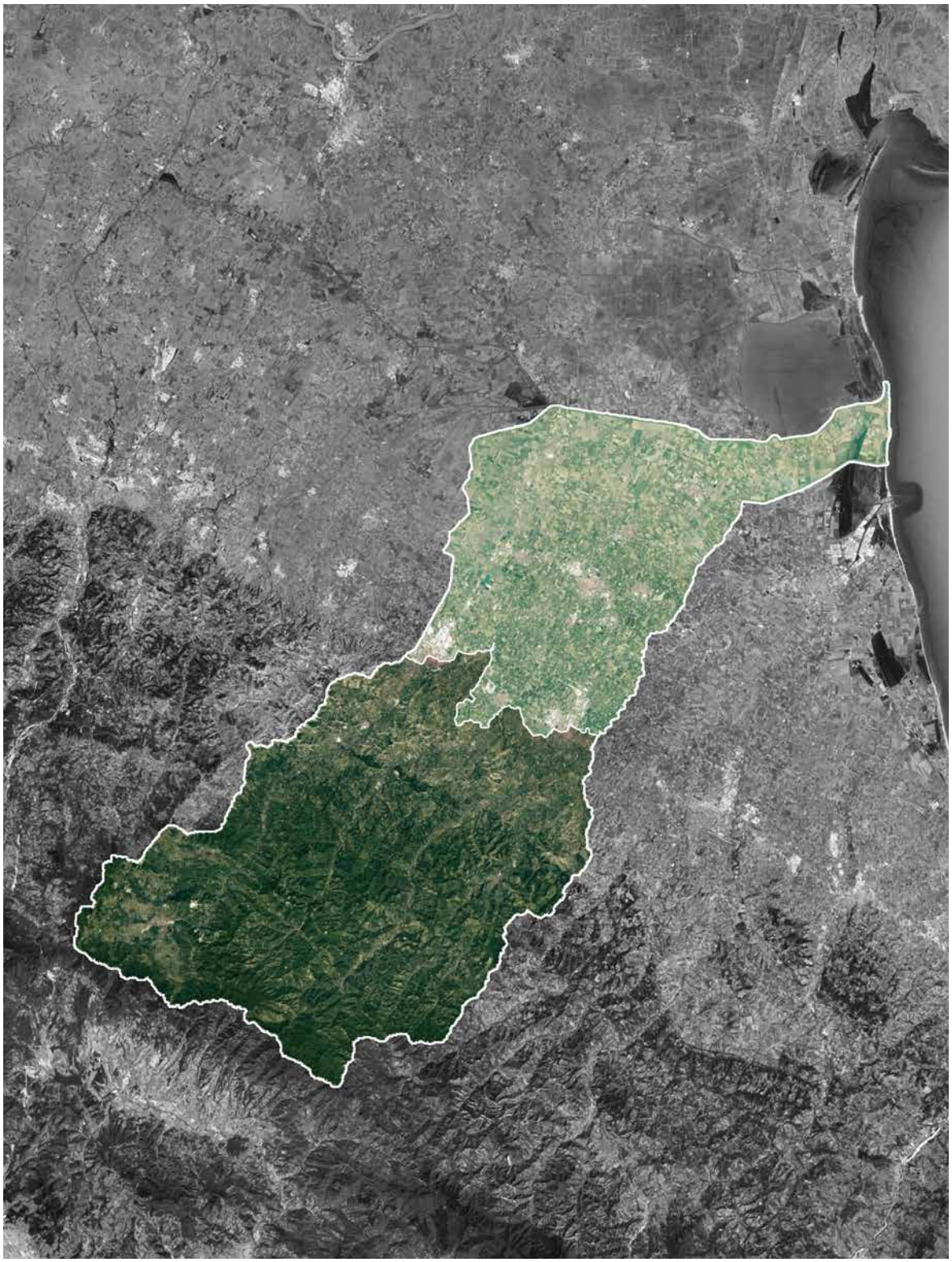


> medium term strategic inputs on scenarios' adaptability, reversibility and transition potentials.

> define development phases and priorities.

> identify a buffer-zone for risk management and energy supply.

Figure 3.31: The operation field of the CBRO Reclamation consortium divided into the lowland and the mountain districts.

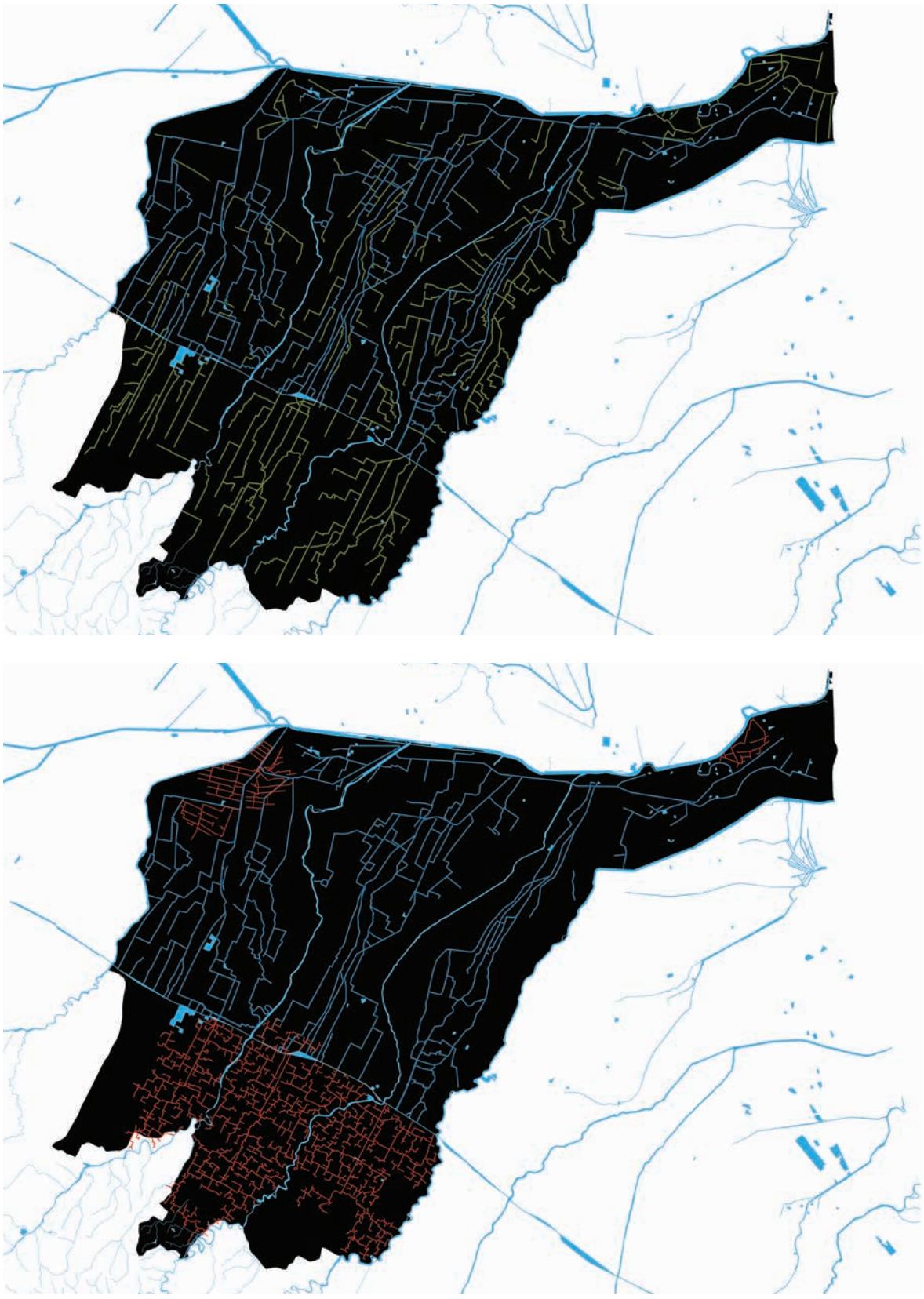


3.3.1 Operation Field: the CBRO Mission

The 'CBRO' (i.e. 'Consorzio di Bonifica della Romagna Occidentale') is the authority in charge of the maintenance, operation, protection and supervision of remediation works carried out in the 200.000 hectares mountain and plain districts framed by the Sillaro and the Lamone rivers. The Consortium activity ensures, to a territory otherwise intended to collapse and swamping, hydraulic safety, productivity and health. Being a consortium, such institution is administered by associates who are the real estate owners (land, houses, buildings in general, etc.) included into the institution's catchment area itself. The consortium members incur the expenditures for the remediation works through specific taxes (Carrato, 2008) which are proportional to the benefit accruing to their propriety. The Consortium operates mainly on and by two infrastructures: the hydraulic reclamation network and the water delivery system for agricultural purposes.

The lowland district, covering 80.000 hectares, coincides with the vast area where the rainwater drainage system is made exclusively by artificial works, given the fact that riverbeds are suspended above the reclamation plain ground level. Across the plain, altitudes vary between 40 m and -2 m above the sea-level, drainage canals extend along a total length of about 962 km, 19 water-pumping systems operates together with more than 1,000 artefacts and works of hydraulic regimentation such as culverts, barrels siphon, sluice gates, draining pumps. The hydraulic reclamation network partially overlaps the water delivery system for agriculture. In fact, nearly 50% of drainage canals have the secondary function of supplying farms with irrigation water picked up by the C.E.R. canal (i.e. Canale Emiliano-Romagnolo) which, by intercepting the Po River further upstream, is the territory's main water vector. Currently, such system of distribution through irrigation canals serves around 1.500 farms covering a total area of about 11.000 hectares. Besides it, a more efficient distribution network has been developed in the last few years in order to reach the productive districts located south of the C.E.R. due to their higher altitude and water demanding agricultural practices. Such system consists in a network of pressurized pipelines bringing the water from a pumping station directly to the delivery groups placed at the edges of the field. By broadening such advanced infrastructure, it has been possible to develop a multipurpose distributive scheme which involves not only the farmers, but also the industrial sector as well as civil one, for rough usages.

Figure 3.32: The two figures show the Consortium lowland district; above, the water drainage system composed by drainage (in green) and mixed-use canals (in blue); below, the irrigation system composed by pressured pipes (in red) and mixed-use canals (in blue).



3.3.2 Driving Forces and Strategic Issues

The Consortium, participating in land use planning, plays an essential role in tuning development perspectives and hydraulic system management in its territory. For this reason, it constantly works by programming interventions aimed at maintaining the infrastructures' same level of efficiency in relation to the expected changes in climate and urban configurations. The main driving force affecting the Consortium's strategic decisions in the last few years has been the 'EU Water Framework Directive 2000/60/EC' that has introduced an innovative approach to European Legislation on water, both from the environmental as management point of view. The Directive pursues ambitious goals as to prevent the water qualitative and quantitative deterioration, to improve its quality and to ensure its sustainable use by long-term protecting the available resources (EC, 2000).

The Consortium has to plan its infrastructures future development trying to mix 3 principal tasks:

/ optimizing water use in accordance with European policies;

/ maintaining the existing level of safety in relation to the expected increase of climatic uncertainty;

/ supporting economic development and modernization of the agricultural sector.

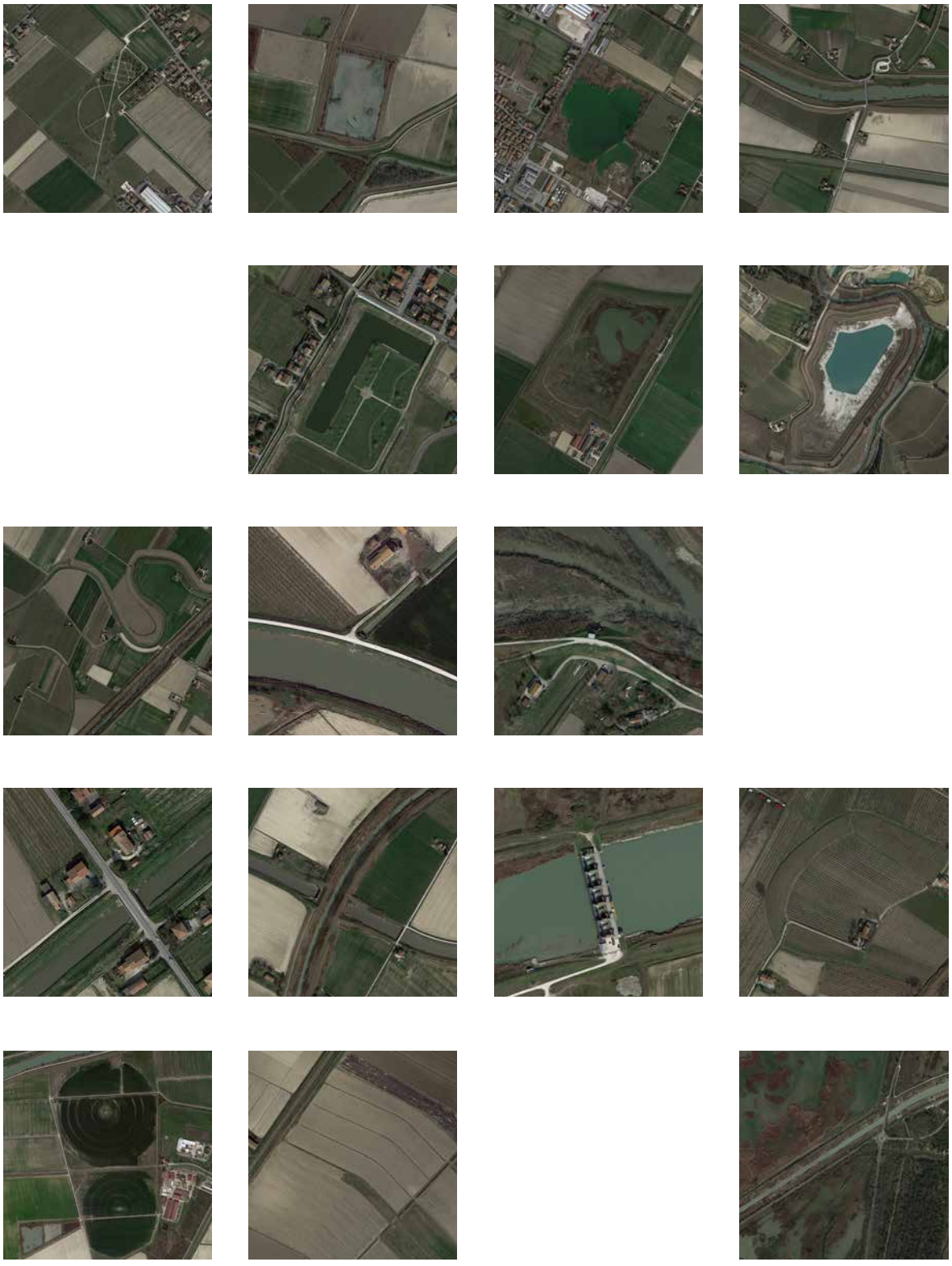
By doing this, the Consortium needs to understand how alternative decisions will affect the landscape and the current relationships between its elements, in order to figure out more adaptable strategies to operate according to regional and local polices avoiding contradictions.

Following this assumption, we've been committed of shaping alternative landscape scenarios corresponding to two specific strategic directions the Consortium needs to explore in advance to understand their impacts on the aforementioned tasks.

The first strategic issue concerns the pressured irrigation system expansion which has the potential to optimize the water consumption for agricultural purposes improving, at the same time, productivity and land values. The second strategic issue is related to the maintenance topic and the current landscape persistence or evolution with respect to risk management and resiliency policies.

Since these two factors have been identified as the main driving forces impacting on the future landscape, it is now essential to describe the physical operative tools that the Consortium can actually exploit, use and manage to reach its goals. Every prospective scenarios will be directly or indirectly sized by these tools and their effect on the landscape layout.

Figure 3.33: Some images showing the operative tools used by the Consortium to manage the landscape maintaining the territory and supporting the agricultural sector.



3.3.3 Operative Tools Taxonomy

The Consortium activity affects the landscape functioning and image through several tools which corresponds mainly to hydraulic works, but are not limited to them. In fact, the complex system the Consortium has to manage requires additional interventions aimed, for example, at providing with energy mechanized drainage systems, or protecting their works from disasters and degradation. As already mentioned, the overall network is divided into two main systems pertaining to irrigation and water drainage. Such elements are, though, very different according to the district which they serve: the mountain district and the lowland district. Since every intervention implemented in the first area has an effect downstream, our taxonomy has investigated all the operative tools across the two zones. On the other hand, being the applicative case-study focused on the lowland district, we will describe deeper, in the following pages, only some main tools pertaining to this context.

1 Floodways

2 Dewatering Plants

3 Culverts

4 Inverted Siphons

5 Sluice Gates

6 Detention basins

7 Water Reservoirs

8 Drainage Canals

9 Mixed-use Canals

10 Photovoltaic Plants

11 Micro Hydropower Plants

12 Pressured Pipes

13 Pumping Stations

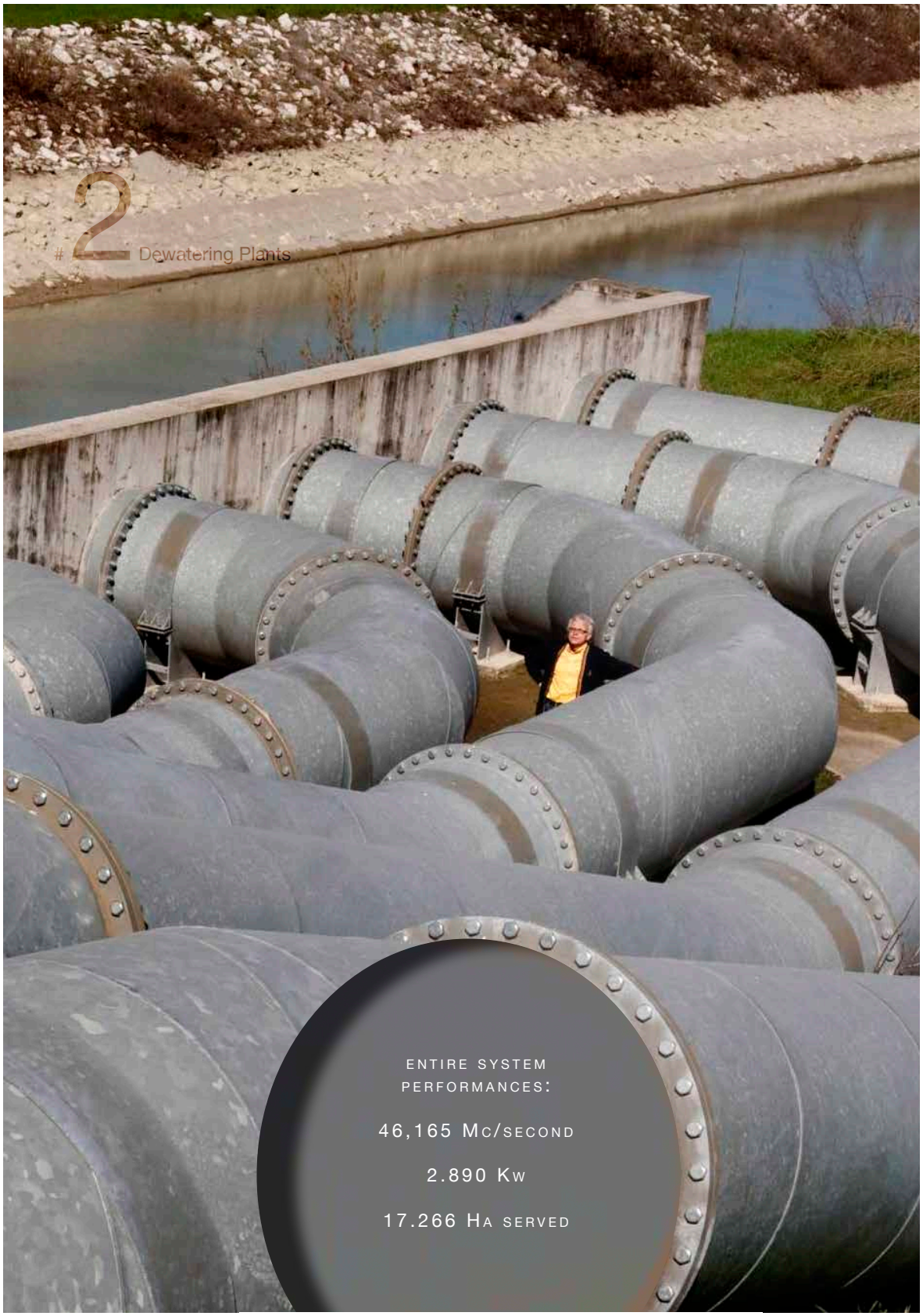
14 Weirs

15 Check Dams

16 Avalanche Protection Systems

17 Flood-banks

Figure 3.34: One of the 20 dewatering plants placed on the lowland district managed by the CBRO Consortium.



 # 2 Dewatering Plants

All placed in the the lowland district, the 20 pumping units managed by the Consortium have the function of draining waters from the territory's more depressed areas where it will be otherwise impossible to drain by gravity. As a whole, the plants serve 17.266 hectares and have the capacity of moving until 46.165 litres of water per second (i.e. 46,165 mc/s), employing a total power of 2.890 Kw. By comparing these numbers to the average load of main river passing through the district, the Santerno, which moves at the mouth 16 mc/s, is clear the impact of such infrastructure on the territory: even if for short periods of time, it may in fact represent a device capable of generating a truly 'inverse hydrography'.

Figure 3.35: Below, images of two dewatering stations managed by the Consortium; on the right, the '1° Bacino Mandriole', on the left, the 'Tratturo'. (Source: CBRO Documentation Archive)

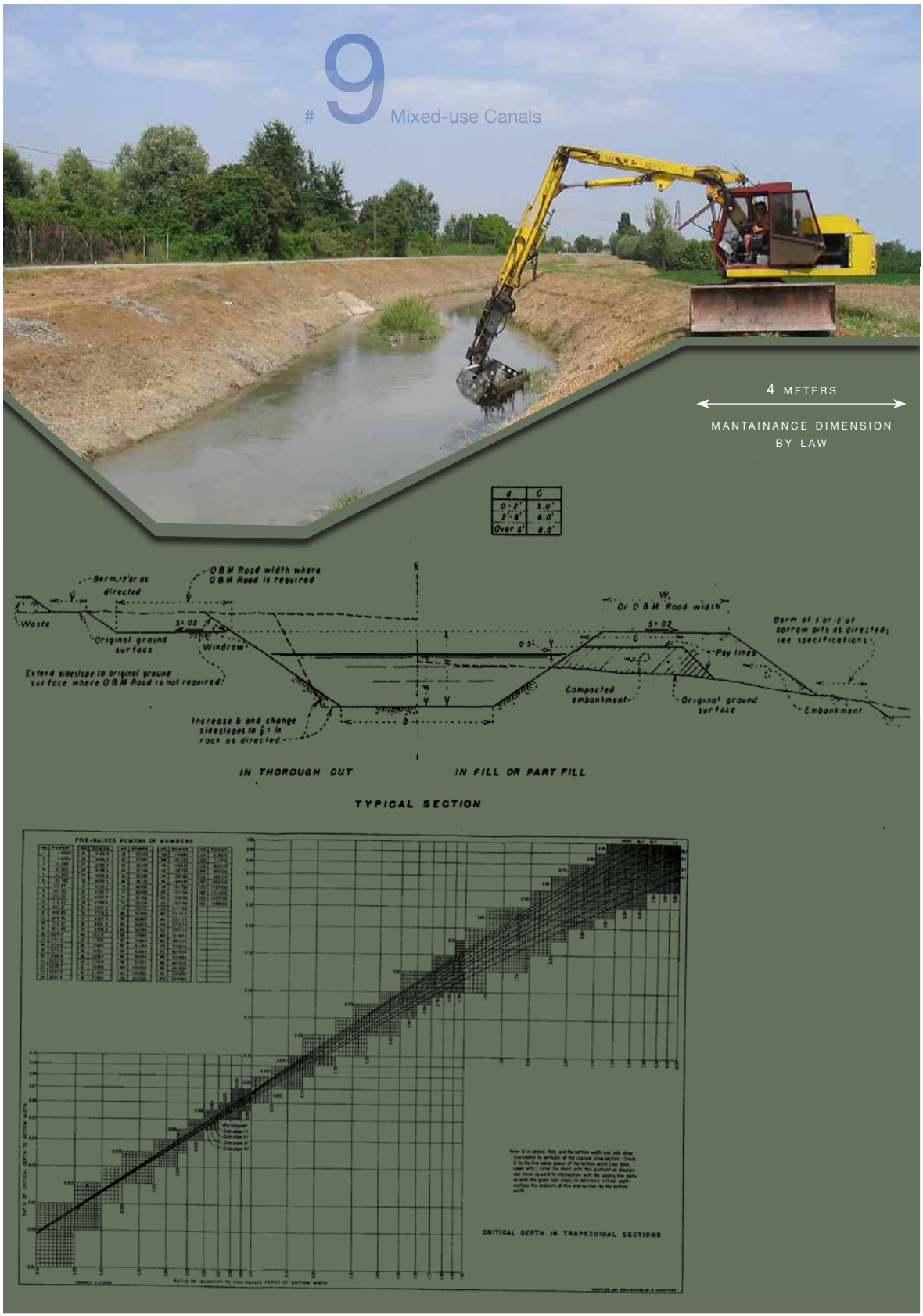
Figure 3.36: The image shows the 'Brignani' detention basin placed in the municipality of Lugo, near Ravenna.

 # 6 Detention basins

In the lowland district, the Consortium manages 3 detention basins (plus one under-construction) which have the basic function of protecting against flooding and, in some cases, downstream erosion by storing water for a limited period of time. These basins, being designed to permanently retain some volume of water, are 'wet ponds' also usable to manage water quality by phytoremediation. Both the three basins provide general flood protection managing the excess of urban runoff generated by newly constructed impervious surfaces such as roads, parking lots and rooftop. Their task is also to control extreme floods being designed to face a 1 in 50-year storm event. The overall performance of these infrastructures can be explained giving some numbers: their whole storage capacity reaches 648.000 cubic meters, while their total surface areas is about 35 hectares; together they could serve areas extending until 57 square kilometres. Besides these management purpose, the three basins provide also naturalistic and recreational services depending on their location more or less far from the urban centres.

Figure 3.37: Below, images of the two main detention basins managed by the Consortium; on the right, the one in Alfonsine, on the left, the one in Gambellara. (Source: CBRO Documentation Archive)

Figure 3.38: Maintenance works on one of the mixed-use canals managed by the Consortium.

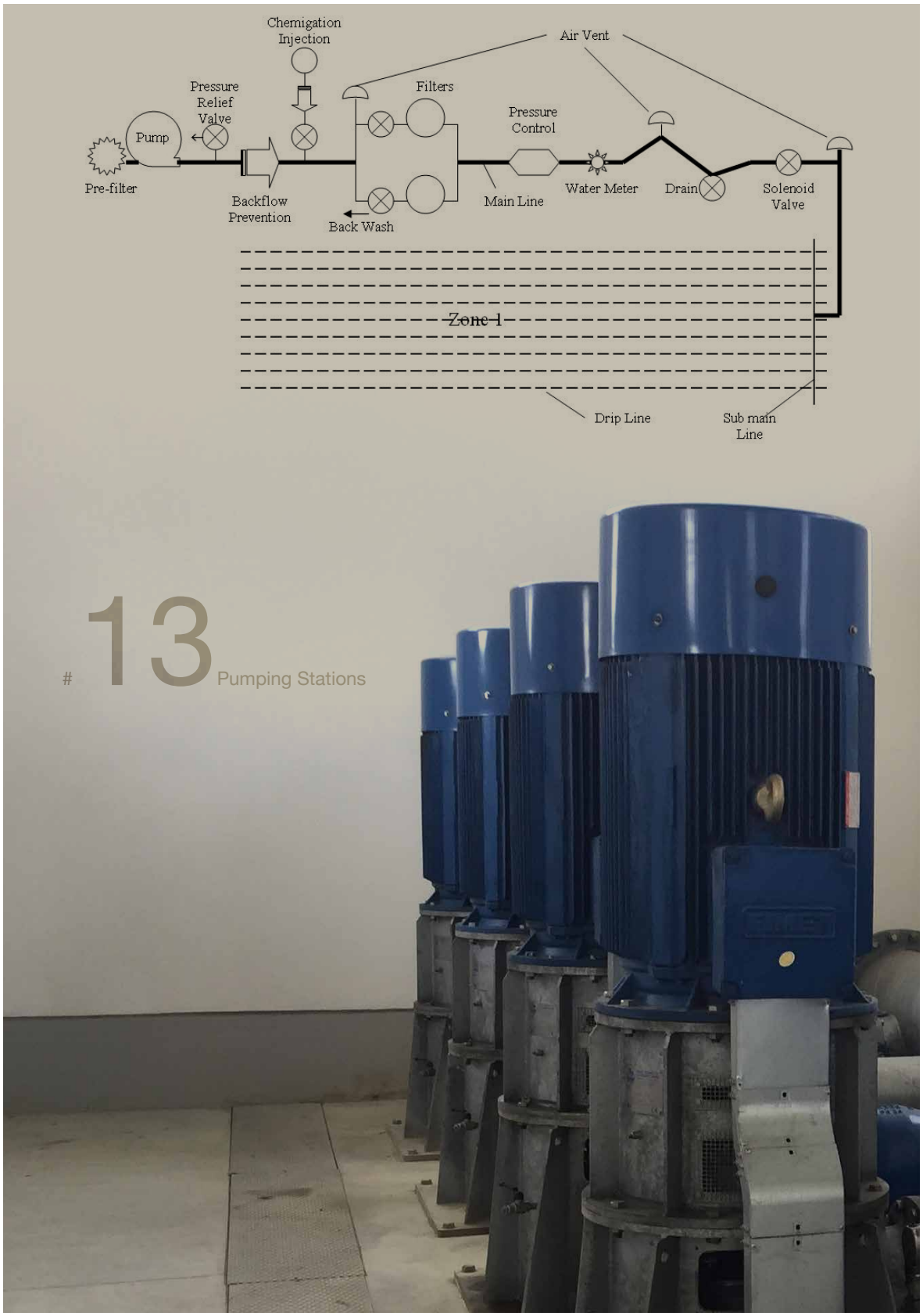


 # 9 Mixed-use Canals

The network composed by mixed-use canals, in the Consortium area, extends over 481 Km. These canals have the main function of draining water, but they are also fed mainly with the C.E.R.'s water for irrigation. A complex system composed by pumping units and sluice gates allows to introduce the water which then flows by gravity into the canals thanks to their slight tilt towards north. During this run, the water is further distributed across the farmlands where is picked up by each farmer according to different procedures depending on their field altitude with respect to the canal's one. Such a system is, therefore, feasible only in canals at the C.E.R. downstream, along which are placed additional regimentation works, having the function of maintaining the minimum water pulling to allow a constant flowing. During extreme raining periods and events, the system's dual function is interrupted in order to ensure the maximum drainage of rainwater, that is the primary task of the network. Currently, irrigation canals serve about 1.500 farms corresponding to a total area of about 11.000 hectares. In order to attain this goal, the network is constantly provided, by the 15 irrigation plants across the territory, with 3.810 litres of water per second, employing a total power of 373 Kw.

Figure 3.39: Below, some images of existing mixed-use canals. (Source: CBRO Documentation Archive)

Figure 3.40: Machines inside the pumping station 'San Silvestro' next to the A14 highway in Faenza.

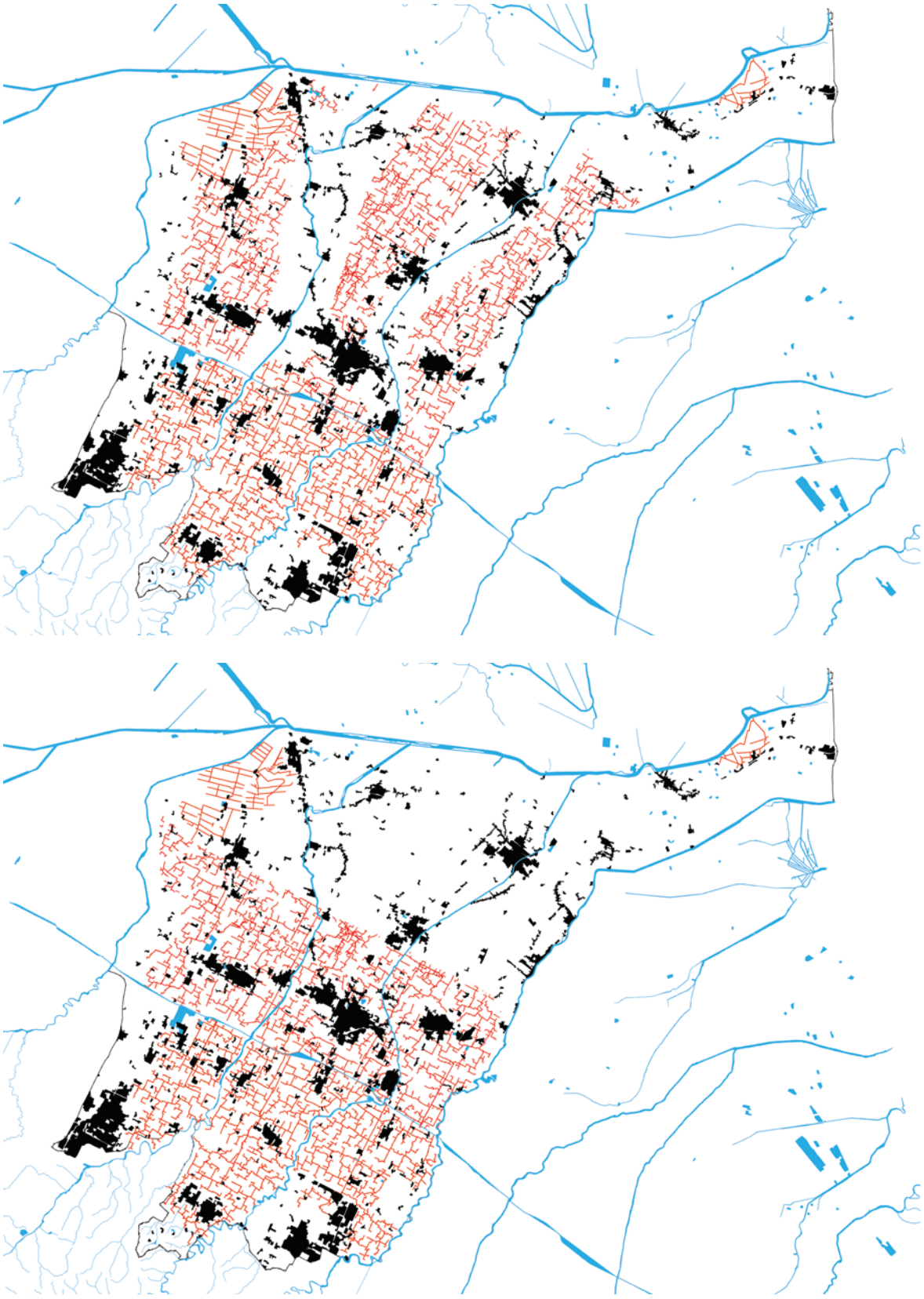


 # 13 Pumping Stations

Such plants are the core of a wider system that allows to supply farm with water for irrigation. The full distributive scheme can be summarized as follows: the water is derived from the C.E.R. through a first pumping station that leads both into a main 'rising pipe' and into the widespread pressured network serving the farm next to the station; the 'rising pipe' brings the water upstream until reaching a reservoir that works as compensation tank; from here, the water is again drawn through a second station which operates as the first one serving nearby the farms and pumping the water in an other 'rising pipe' that reaches a second reservoir; here a third pumping station distributes the water to the remaining farms. In the whole path the pressure is never less than 4 atmospheres. In the area where the system is already been developed, southern from the C.E.R., the 11 pumping stations serve 17.206 hectares and have the capacity of moving until 13.074 litres of water per second, employing a total power of 8.228 Kw.

Figure 3.41: Below, some images of existing pumping stations and their related equipments. (Source: CBRO Documentation Archive)

Figure 3.42: The two alternatives concerning the pressured network expansion; above, the 'branched' layout and, below, the 'isotropic' layout.



3.3.4 Scenarios Design

The alternative landscape scenarios are generated according to the Consortium mission and considering the two strategic issues identified as key-factors involving the most critical uncertainties which could lead to distinctly different landscapes in the future. Each factor has been firstly analysed at the light of past changes it has caused on the landscape, then it has been manipulated into two alternative directions grounded on the study of ongoing trends and forces that could affect such evolution in a time horizon of 20 years.

The first and principal key-factor of uncertainty deals with the way in which the pressured irrigation system will expand northern of the C.E.R. to optimize the water consumption for agricultural purposes. The two hypothetical alternatives, with an equal supposed extension of 600 km, are:

/ the network develops following a branched layout which slots in between the main rivers crossing the plain, keeping a safety distance from them;

/ the network develops according to an incremental isotropic grid covering a significant portion of the alluvial plain according to the scheme already tested south of the C.E.R.

The second key factor of uncertainty deals with the maintenance degree that the Consortium is going to provide to the territory with respect to risk management and resiliency policies. The two hypothetical orientations, in this sense, are:

/ a full and comprehensive freezing of the present environmental and landscape layout, composed by the aforementioned networks of canals and land reclamation works, assuming an almost undifferentiated level of exposure to hydrological risk for all the territory;

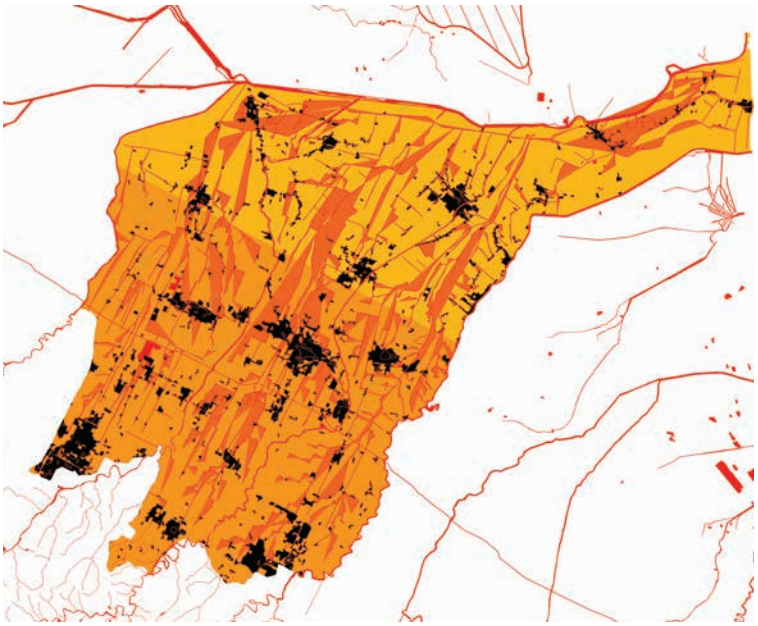
/ a selective retreat from the most endangered and less profitable areas in terms of common maintenance and risk reduction.

Considering these assumptions,, the 4 scenarios have been developed according to a 2x2 matrix in which each of the two key-factor's alternatives get intertwined with the others. Afterwards, each scenario, intended as a preliminary set of problem, has been described and investigated for its potential impact on the landscape in quantitative terms, highlighting the existing or new operative tools which the Consortium will need to develop in that particular framework.

Scenario1 /

Branched Expansion + Freezing Changes

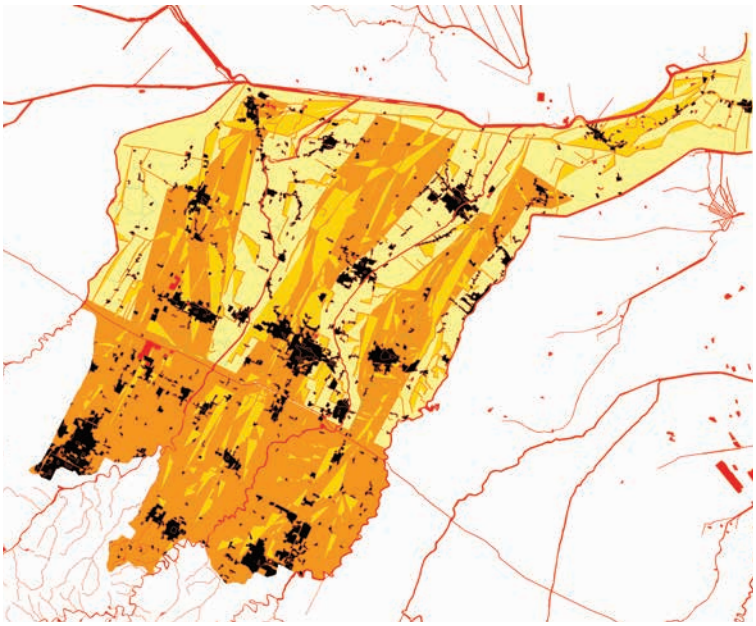
The scenario intertwines the branched expansion of the pressure irrigation network with a freezing approach facing the resulting environmental and landscape evolutions.



Scenario 2 /

Isotropic Expansion + Freezing Changes

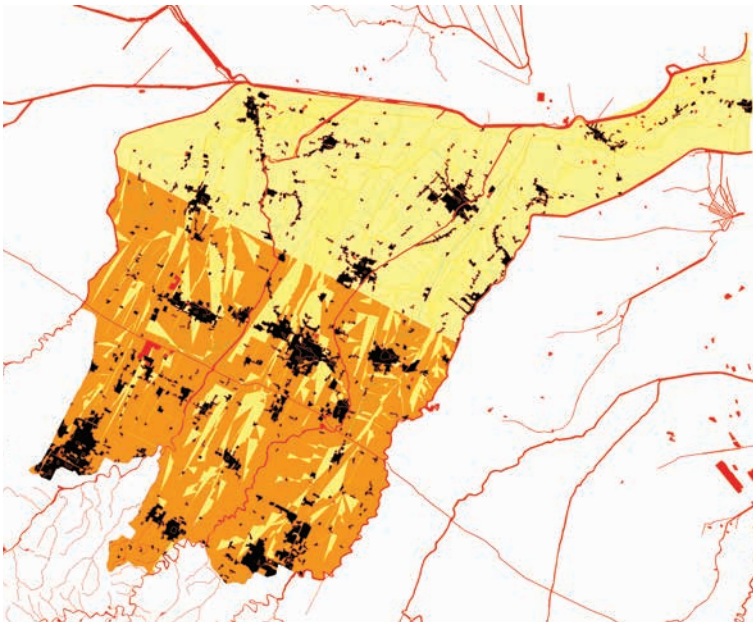
The scenario intertwines the isotropic expansion of the pressure irrigation network with a freezing approach facing the resulting environmental and landscape evolutions.



Scenario 3 /

Branched Expansion + Selective Retreat

The scenario intertwines the branched expansion of the pressure irrigation network with a selective retreat approach applied to the resulting most endangered and less profitable areas.



Scenario 4 /

Isotropic Expansion + Selective Retreat

The scenario intertwines the isotropic expansion of the pressure irrigation network with a selective retreat approach applied to the resulting most endangered and less profitable areas.

Figure 3.43: The plan shows the scenario developed for the lowland district according to the mix of the following alternatives: 'Branched Expansion' of the irrigation pressured system and 'Freezing Changes' of the actual landscape layout.

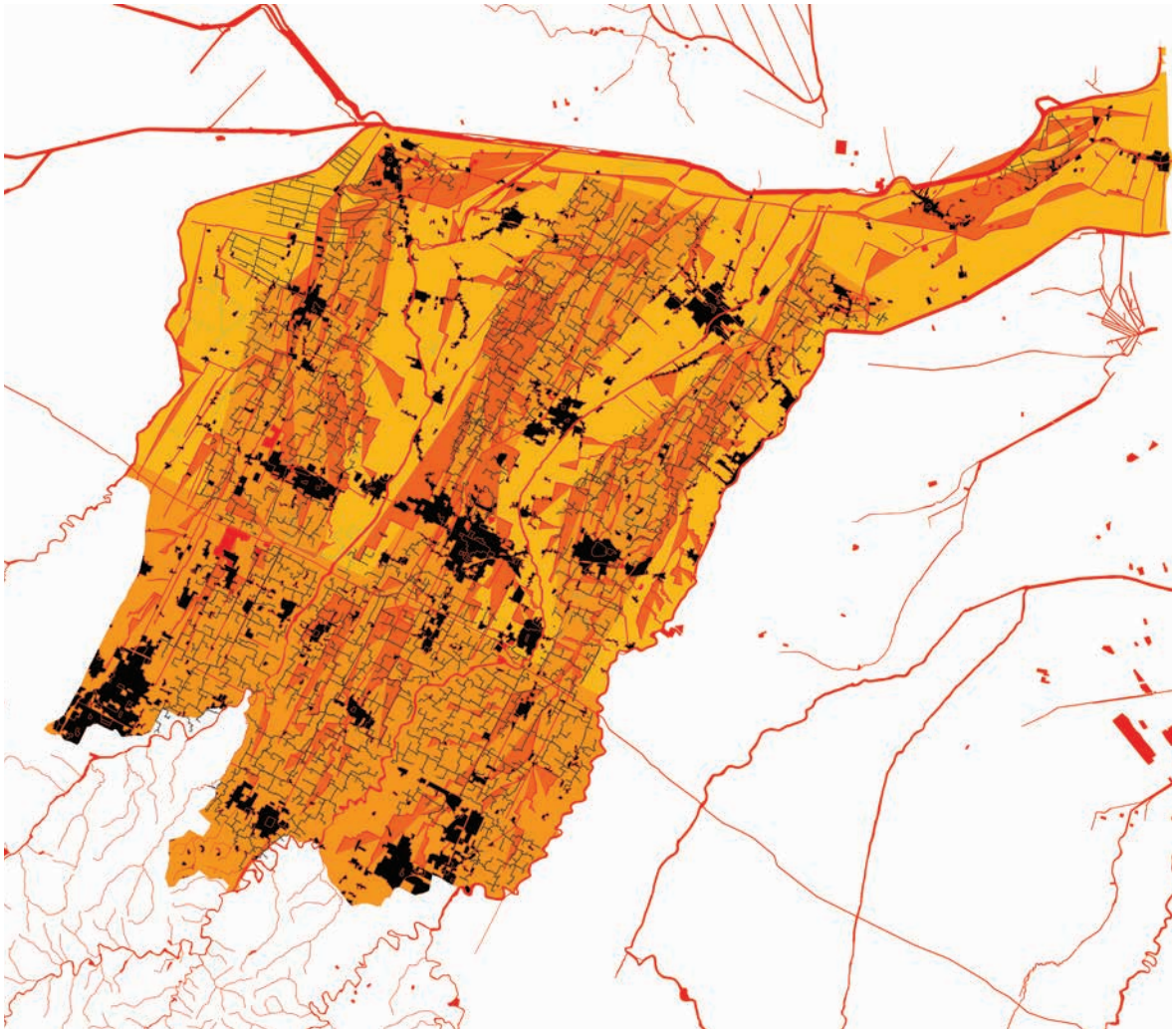


Figure 3.44: The pictures on the top of the two pages are referred to the Consortium 'Operative Tools' which, in this specific scenario, have to be empowered (edged in red) or can be abandoned (grayscale images).

Scenario 1 / Branched Expansion + Freezing Changes

Discussion

In this scenario the lowland district is developed by a branched pressured irrigation system which has a medium energy consumption thanks to the fact that the networks extends linearly following the natural land declivity towards the Reno River to the north. The fields served by this infrastructure have an higher value, due to the chance of better scheduling cultivation cycles and developing more water-demanding farmings. Such farmings are mostly characterized by organic crops increasingly requested by the agrifood industry which trusts in entering into long-term contracts with farmers for their supplies. By reducing pesticides and chemicals use, organic crops also contribute to the area biodiversity creating a parallel system to the rivers's one where new plant and animal species can settle. The Consortium's commitment in this framework is to ensure, at the same time, the hydrogeological risk management and the stability of the landscape character of the area. In order to attend these goals its maintenance activity includes the whole territory with a slight increase of attention to the most valuable areas reached by the pressured pipes. The mixed-used canals' network is still supplied with water, even if no longer especially for irrigation purposes, but for maintaining unchanged their landscape and biodiversity features. Such operation implies additional energy expenditures for preserving old irrigation plants and an extra water consumption affecting in part the pursued water-saving goal. Risk management is widely applied, but aided by the distance that the most valuable farmlands have from the main rivers. Within such buffer-zones, new detention basins are developed in order to face flooding events and manage the increasing urban runoff.

Figure 3.45: The plan shows the scenario developed for the lowland district according to the mix of the following alternatives: 'Isotropic Expansion' of the irrigation pressured system and 'Freezing Changes' of the actual landscape layout.

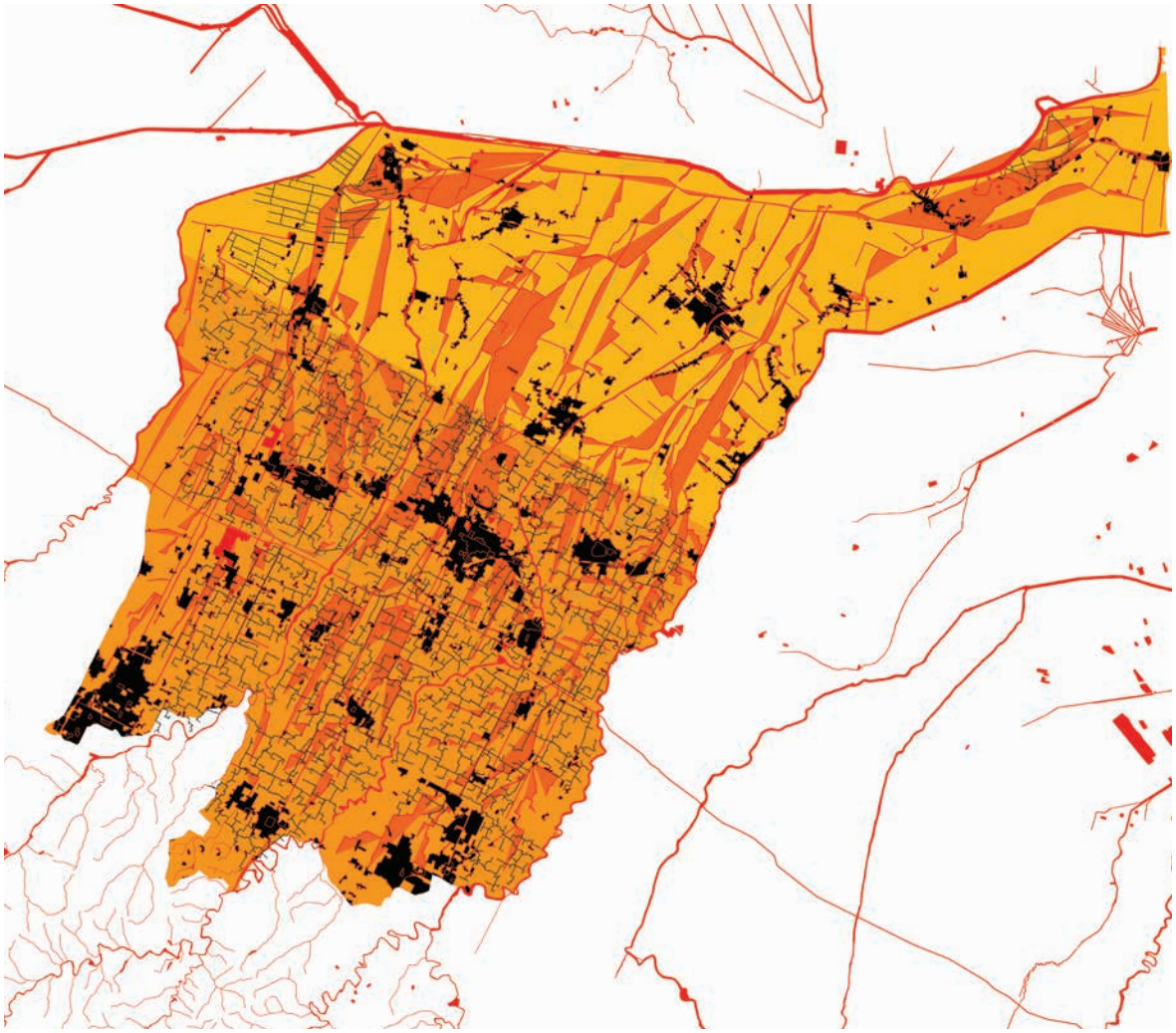


Figure 3.46: The pictures on the top of the two pages are referred to the Consortium 'Operative Tools' which, in this specific scenario, have to be empowered (edged in red) or can be abandoned (grayscale images).

Scenario 2 / Isotropic Expansion + Freezing Changes

Discussion

The lowland district is developed by an isotropic pressured irrigation grid covering a significant portion of the alluvial plain according to the scheme already tested south of the C.E.R. Its energy consumption is higher if compared to the previous case due to its horizontal layout. In this scheme, the farmlands served by the new infrastructure are arranged within a 8 km deep strip running parallel to the C.E.R. In this perspective, the most valuable farmings lay in areas which have different exposition levels to the hydrological risk depending on the river's proximity. On the other hand, they acts as ecological corridors between the rivers, thanks to organic crops they host to satisfy the market request.

As in the first scenario, within this framework the Consortium's commitment is to ensure, at the same time, a comprehensive hydrogeological risk management and the landscape features stability. Therefore, the Consortium activities are aimed at strengthening the defence works along the rivers as well as in those parts of the territory that are not involved by the pressured system development, with the additional problem of preserving much land as possible for the advanced agriculture. Such goal is perceived by operating on the draining canals' network raising the embarkments and by placing detention basins further north, beyond the 8 km range. The mixed-used canals' network is preserved to maintain unchanged their landscape and biodiversity features, as well as to reach provide with irrigation water the northern part of the plain district. Additional energy is therefore required along with extra water supply.

Figure 3.47: The plan shows the scenario developed for the lowland district according to the mix of the following alternatives: 'Branched Expansion' of the irrigation pressured system and 'Selective Retreat' from the landscape maintenance.

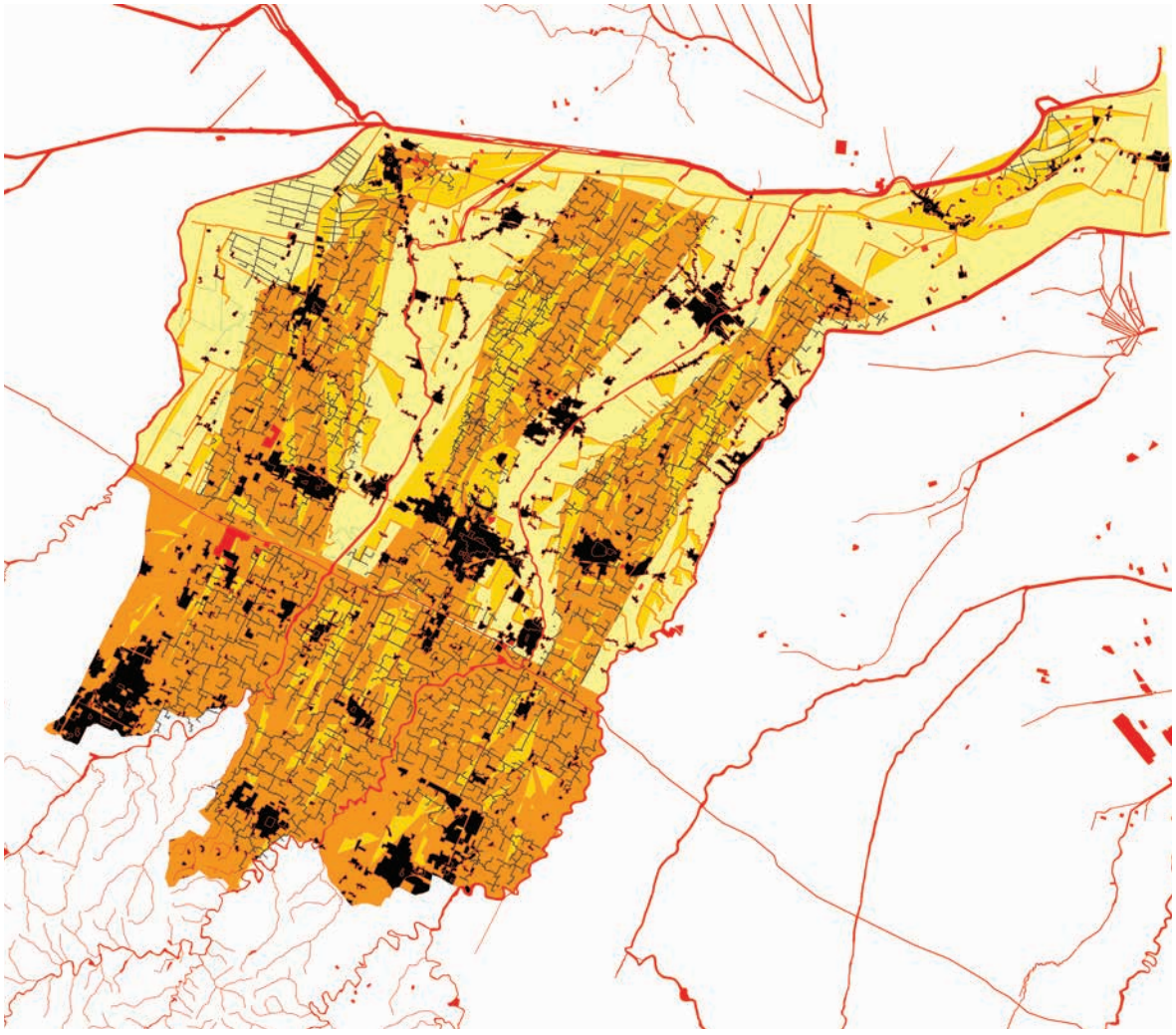


Figure 3.48: The pictures on the top of the two pages are referred to the Consortium 'Operative Tools' which, in this specific scenario, have to be empowered (edged in red) or can be abandoned (grayscale images).

Scenario 3 / Branched Expansion + Selective Retreat

Discussion

In this scenario the lowland district is developed by the branched pressured irrigation system and the Consortium activity focuses mainly on those areas reached by the network that, by being located far from the rivers, are less exposed to flooding events. Such condition is further strengthened by the selective retreat of dry cultivations from river borders and their replacement with wetlands or less water-demanding farming systems capable of exploiting the alternation of periodic drought and flooding. By these means, the aforementioned buffer-zones progressively evolve into a more resilient landscape whose main tasks is to replace the canals' drainage function and to tackle subsidence phenomena by collecting the floods' sediments. Their environmental value lays also in the capacity of reducing soil pollution generated by intensive farming.

In this framework, the Consortium manages the transition from a quite homogeneous to a more various landscape. The mixed-used canals' network is abandoned as well as the old irrigation plants to the benefit of the energetic consumption and water savings. The maintenance activities carried on before by the Consortium on the canals are shifted to the wetlands management. Those canals, no more supplied with irrigation water and less functional to drainage purposes, are used for accommodating some pressured pipes and other infrastructural networks. The energetic demand for operating the new irrigation system is met also through the implementation of new photovoltaic fields in the area where the select retreat takes place. The risk management policy is addressed to a more hierarchical differentiation between the parallel systems crossing the district north-south.

Figure 3.49: The plan shows the scenario developed for the lowland district according to the mix of the following alternatives: 'Isotropic Expansion' of the irrigation pressured system and 'Selective Retreat' from the landscape maintenance.

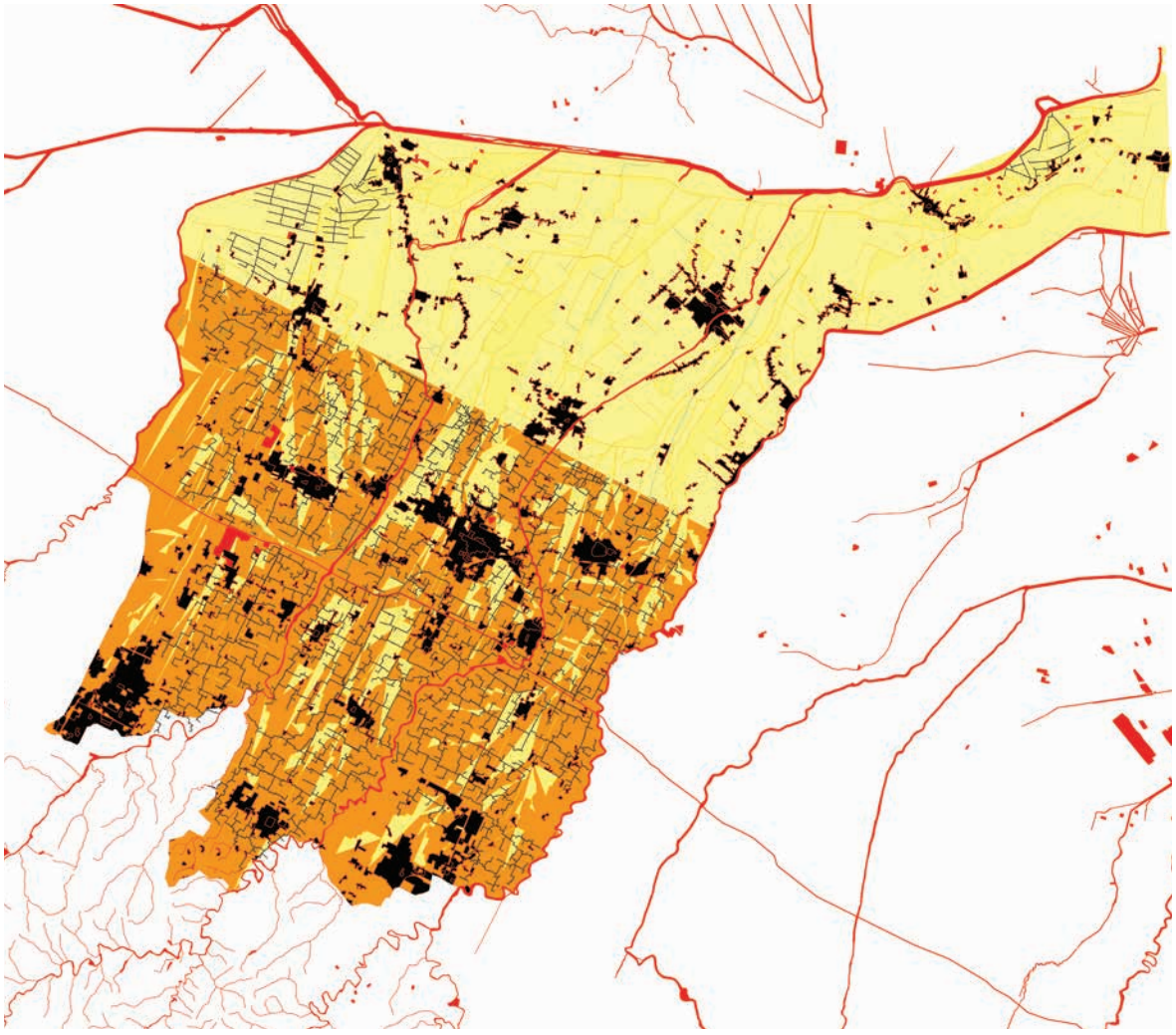


Figure 3.50: The pictures on the top of the two pages are referred to the Consortium 'Operative Tools' which, in this specific scenario, have to be empowered (edged in red) or can be abandoned (grayscale images).

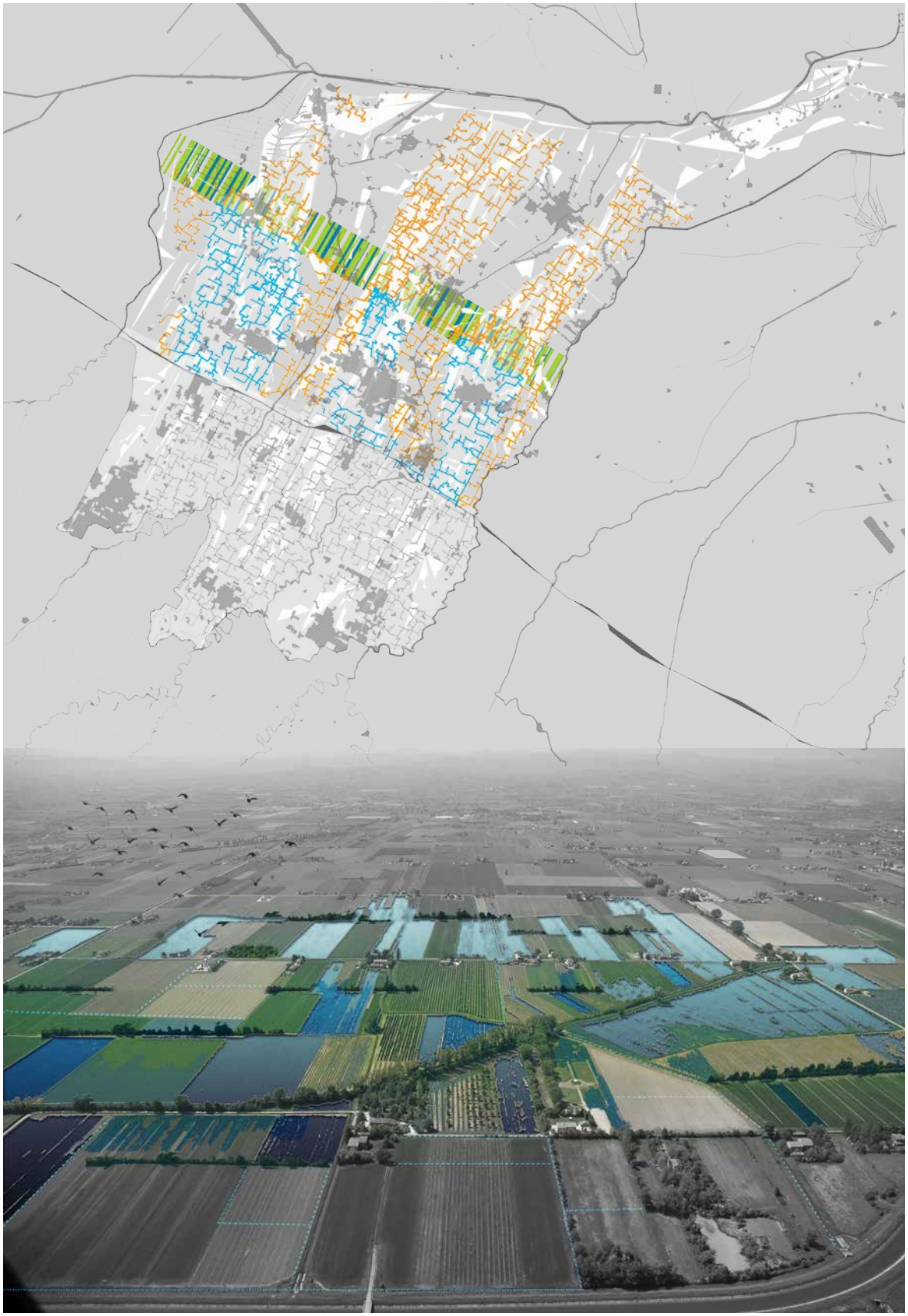
Scenario 4 / Isotropic Expansion + Selective Retreat

Discussion

The scenario is based based on a clear differentiation between the two areas north and south of the 8 km deep strip running parallel to the C.E.R. where the isotropic pressured irrigation grid is developed. The lowland district is thus split into a resiliency area and an over-infrastructured one. In this perspective, the most valuable farmings are protected by a vast part of the territory composed by wetlands and cultivation fields subject to flooding where to develop a less energy and water-demanding agriculture. The actual low productivity rate of soils does not justify the pressured system development up to this areas, but it allows anyway to imagine for them a new productive system based also on the PES (i.e. Payment for Ecosystem Services): incentives offered to farmers or landowners in exchange for managing their land to provide the ecological service represented by their role in the flood risk control.

As in the third scenario, within this framework the Consortium's commitment is managing these areas' transition to a new productive model, as well as to a new landscape. In this way the consortium is able to ensure a proper defence from the hydrogeological risk to the most valuable farmings, also by reinvesting the significant savings derived from the abandon of the useless networks. In fact, draining and mixed-used canals are largely dismissed in the whole district so the water disposal can be completely used for the pressured system permitting to effectively reach the water reduction goal. In this scenario too, the energetic demand for the new irrigation system is met by specific infrastructure developed in the area where the select retreat takes place.

Figure 3.51: The image synthesizes the 'Scenario Transfer' to the CBRO representing short and medium-terms adaptable actions.



3.3.5 Scenario Transfer

The 4 alternative scenarios give an overview of plausible and coherent futures on the basis of which, along with additional data provided by other specialists, the Consortium can set now a strategic direction and understand their implications on the organization. Scenarios act as an input in the decision-making process and are not intended as a project or a plan. Although the 20 years timespan envisioned for their development is a proper period to start planning such kind of infrastructural works, the Consortium needs also guidelines affecting the short and medium terms decisions. By processing the 4 alternatives, some strategic inputs are provided to the Consortium concerning the scenarios' adaptability, reversibility and transition potentials, in order to address the present landscape changes according to a more flexible attitude in relation to uncertainty. In this case, by overlapping and blending in the scenarios, a synchronic representation of prospective landscapes' evolution is obtained. It can be used to schedule progressive interventions checking their impacts, as well as to size the infrastructure development according to scale and time assessments. In our case, such scheme highlights two main development phases in the landscape transformation which also suggest the lowlands early subdivision into separate irrigation districts. A transversal buffer-zone is identified 8 km north of the C.E.R. corresponding to the system expansion limit in the first phase. It works as a transition area capable of reacting to the switch from one scenario to another by hosting risk reduction and energetic plants, in any case necessary. In this sense, it may be considered and adaptability territorial device.

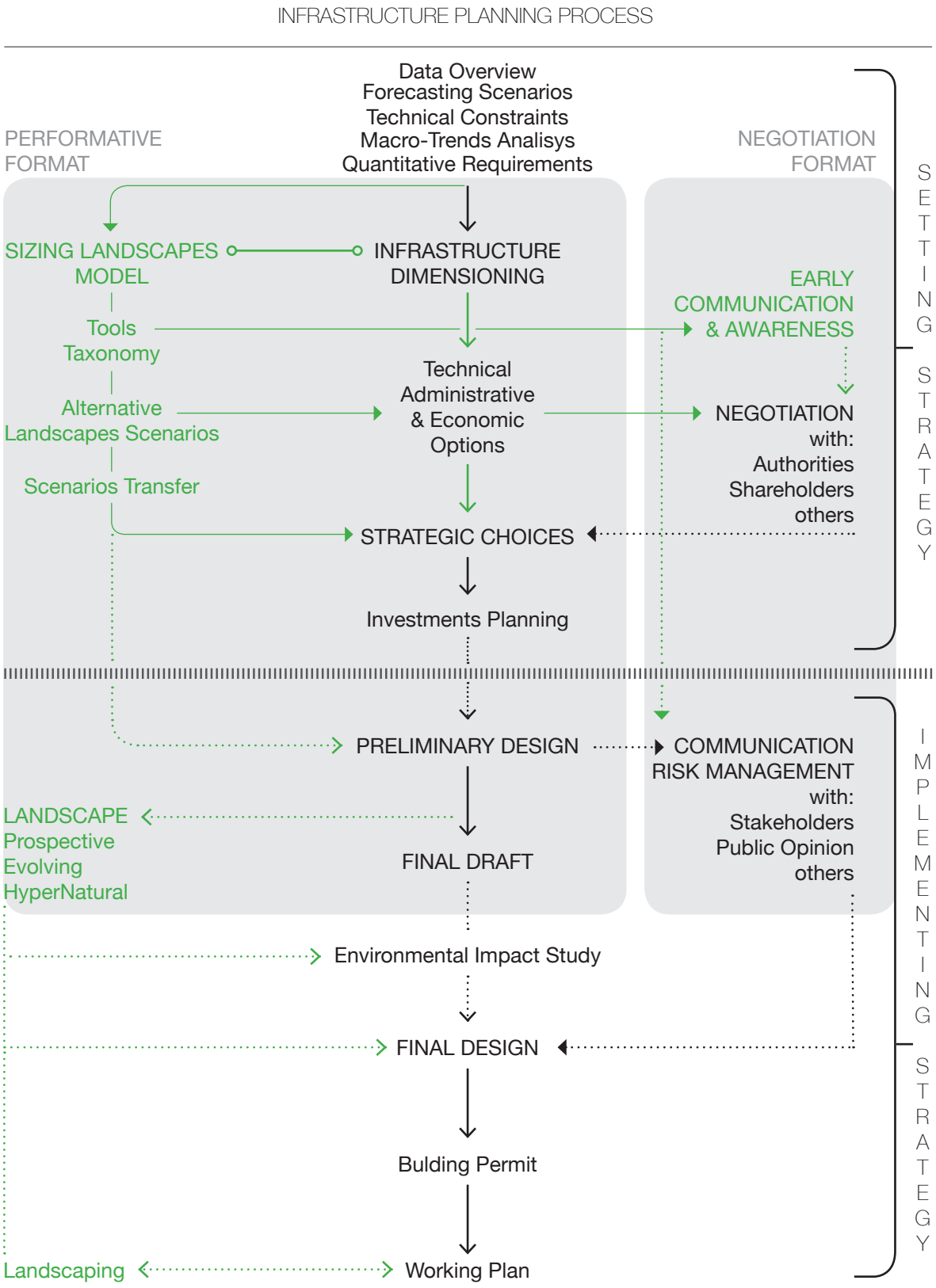
In Phase 1, the irrigation system develops corresponding with the initial portion of the branched layout (*Figure 3.51*, in blue) that underlies Scenario 1 and 3. In this phase, pumping stations (3 for each branch) and their water reservoirs have to be sized so as to be able in the next step to support the network expansion towards the longitudinal or the transversal direction. At this moment, the main buffer-zone is already operative: for example detention basins can be here developed working immediately as flooding control devices and, in perspective, as compensation tanks for pressured irrigation (in Scenario 1-2) or, more, as the inception of wetlands development (in Scenario 3-4).

In Phase 2, the pressured irrigation can be extended (*Figure 3.51*, in orange) according to the two main directions outlined in the scenarios or following an hybrid layout allowed by the buffer-zone presence which interfaces with all the prospective areas affected by the network development.

Chapter 4 / Discussion & Conclusion

Chapter 4 concludes the thesis by discussing the nuances of attempting to utilise the 'Sizing Landscapes Model' in the infrastructure planning process, as well as the outlook of the work in general towards feasible and desirable follow-ups. This final chapter thus breaks the discussion down into several sections. The first - chapters 4.1 -, by referring to the CBRO case study, discusses the Model value serving simultaneously as both a negotiation and performative format for infrastructure developments, highlighting pitfalls and opportunities of each with respect to landscape architecture and planning. The second section - chapters 4.2 - reports further Model implementations which we have been carrying on in the last period and, at the light of these experiences, it outlines the research follow-ups. Finally, chapter 4.3 examines the findings with respect to the scale topic which seems to influence the most the model integration with other disciplinary approaches.

Figure 4.1: The flow chart reports the thesis' contribution to the infrastructure planning process in the Italian context, showing especially the 'Sizing Landscapes Model' impact on the strategy set up phase and its value as a 'Performative & Negotiation' format (in grey).



4.1 Performative & Negotiation Format for Infrastructure Planning

The model implementation on the CBRO case-study has been reported as the most exemplar and advanced experience carried on so far with the aim of evaluating the proposed workflow effectiveness. In order to better explain this point, in this section we will focus on the two main goals that the CBRO wanted to achieve testing the model on its operational framework. The first one concerns the possibility of better addressing their long and mid-terms action plans in the direction of adaptability to different scenarios. The second goal deals with the chance to have an early representation of future landscapes that strategical choices would be able to generate on the territory so that they could rely on it during forthcoming negotiations with regional authorities and stakeholders. In such perspectives the 'Sizing Landscapes Model', aimed at working as both a 'performative' and 'negotiation' format, can be discussed at the light of the developer' feedbacks.

As already explained, the CBRO land Reclamation Consortium is a public body, managed by its members, which coordinates public interventions and private activities in the areas of water protection and irrigation. The consortium members are all the owners of properties (land and premises), included in the land reclamation district, a part of the territory identifies by the Emilia-Romagna Region. The expenses for the maintenance, operation and guarding of reclamation works are supported by the consortium members and are distributed on the basis of the benefit derived from the works and land reclamation activities, in accordance with the criteria set out in the plan, approved by the Region, which provides proper exercise of the power to tax.

In this framework, the main functions of the Consortium are:

/ Design, execute, maintain and manage the land reclamation works, which guarantee the hydraulic safety of the territory;

/ Participate in the formation of territorial plans and urban planning, as well as programs aimed at protecting the environment against pollution;

/ Contribute to the implementation of the activities of soil conservation, use and management of water resources and environmental protection;

/ Contribute to public action for the protection of agricultural water set for irrigation and of water down flowing in the land reclamation network;

Figure 4.2: The 'Mills' Canal' managed by the CBRO Consortium and declared. by the Emilia-Romagna Region, ecologic corridor in contrast with maintenance operations which require, as in the picture, enough space on the banks to be performed.

/ Prepare the 'General Land Reclamation and Rural Protection Plan' which is the regional planning instrument which sets the regulation concerning the measures for the selection and design of public land reclamation and irrigation works, as well as of other works including the protection of water resources.

By developing all these tasks, the Consortium actually shapes the landscape tackling day by day the incongruities resulting by the vast range of local, regional and national competent authorities which give advices and set regulation about the matter. Such context often generates conflicts between, for examples, ecosystem preservation requirements (by regional authorities) and operational needs (of the Consortium) concerning the canal network maintenance, the first aimed at preserving 'green corridors', the latter aimed at ensuring the irrigation and drainage system operability as well as the hydraulic safety. These problems arise from a misleading interpretation of landscape elements, such as the canals, which are rarely considered for their multi-purpose function and their essential artificial inception.

Continuing with the aforementioned example, the Consortium has been put in the position of having to keep supplying with water canals which are no more useful for irrigation purposes by order of the Region due to preserve green corridors. Such water 'expenditure' is in contrast with EU policy

Figure 4.3: One of the proposals made by the CBRO Consortium aimed at integrating energy supply and waters management infrastructures developing new retention basins.

which aims at reducing the water-demand and funds only infrastructural works consistent with this objective. Given the fact that most of the fundings used by the CBRO for huge infrastructural developments come from the EU, they need constantly to mediate with the regional authorities about these and other issues that basically ground on a partial approach to the topic. Furthermore, being the Consortium an operative body, it has to constantly plan investments demonstrating their consistency with the mission to its members. Any kind of additional expenditures has to be well explained and put in a general strategic framework.

In order to face 'communication risks' and to manage in time ideological oppositions, the Consortium decided to rely strategic decisions by the means of a prospective vision of the landscape capable of addressing the negotiation between the several authorities and stakeholders involved in the planning procedure at local, regional and national scale.

Looking back at the Model implementation in the CBRO applicative case-study, we are now able to highlight its potentials in fulfil such objectives in relation to the decision-making process that concerns the pressured irrigation network extension to the lowland district north of the CER. The benefits deriving from the model application can be resumed in two main categories: 'performative' and 'negotiation' potentials.

The model acts as a 'performative' format for the CBRO infrastructural planning allowing to estimate, in quantitative and qualitative terms, the impacts of different decisions about the pressured network layout and the maintenance degree that the Consortium will provide to the territory with respect to risk management and resiliency policies. These two factors have been intertwined to generate the four scenarios which represent a reference on which grounding deeper investigations and simulations about socio-economic impacts and other data-oriented analysis. By transferring the Scenarios to the CBRO, we have been able to inform short and medium-terms strategies about the placement and the way of implementing some infrastructural works dealing with the network energy provision and floods risk reduction. Such inputs are addressed at affecting the Consortium activity in this moment keeping a long-term outlook by developing an incremental strategy which is as much as possible adaptable to alternative scenarios.

On the other hand, the model can act as a 'negotiation' format thanks to the fact that the alternative scenarios should represent a concrete basis for the CBRO to discuss future choices with other authorities and stakeholders, as well as with its members. Instead of presenting abstract data and previsions, the Consortium can use physical scenarios, for example, to achieve in advance a 'market value' recognition for those activities carried on 'outside' of its mission. By simulating voluntary transaction approaches, such as the one based on PES (i.e. 'Payment for Ecosystem Services'), could be possible, in fact, to set up future infrastructural developments around shared visions and pre-assessments.

In summary, the proposed Model works in these two directions by:

/ building a more effective understanding of the broader physical environment in which the developer operates;

/ embracing uncertainty on such environment and structuring its impacts, also, within short and medium-terms adaptable actions;

/ creating a shared aptitude about the future by identifying alternative development scenarios to be further investigated and refined through the contribution of other disciplines;

/ providing a vehicle for an increased communication between the subjects, at several levels, concerned by the infrastructural planning;

/ providing a forum for sharing views from all institutions involved in the development allowing to simulate and test innovative procedures of trading, transaction and collaboration.

4.2 Further Implementations on Touristic Contexts

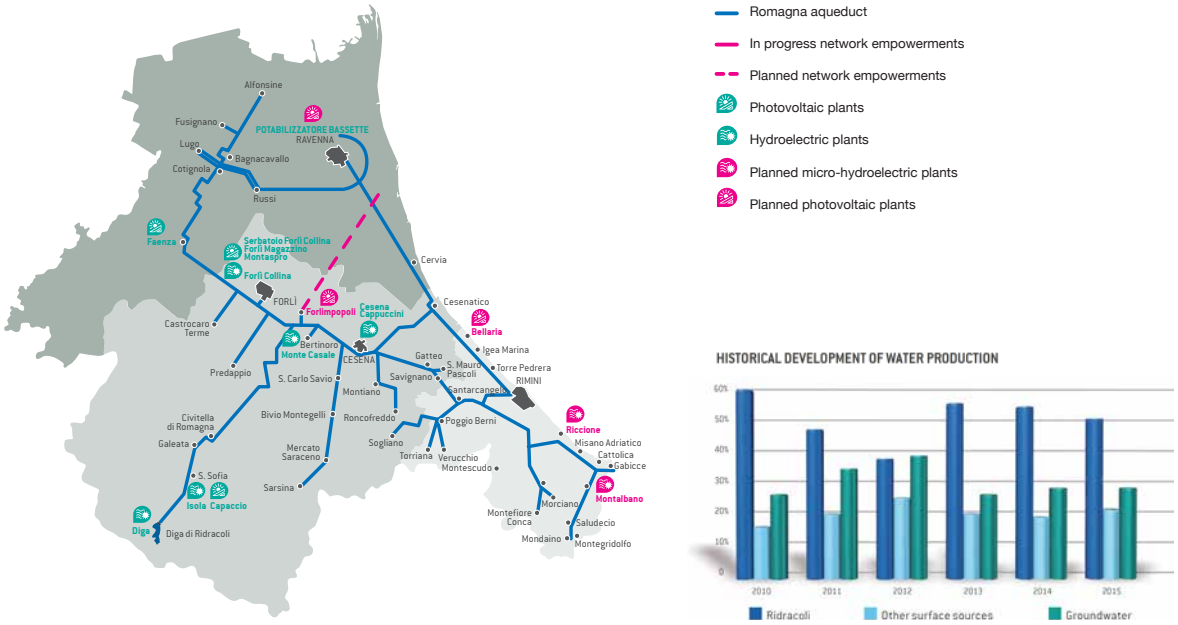
This thesis investigation grounds its hypothesis mainly on experiences and observations carried on within touristic contexts which have been analysed especially in chapter 2 as a 'borderline' case-study for the way in which tourism impacts on the dynamics affecting infrastructural planning and management. By operating in touristic territories, we realized the importance of creating an instrument capable of anticipating landscape outlooks in the infrastructure development process through a well-structured scenario-based approach in order to face uncertainty and build more resilient and adaptable strategies. The lesson we learned basically informed the thesis idea and aided in formulating the model workflow whose first implementation has intentionally concerned a different type of environment, the CBRO's one.

As already said, in parallel with the CBRO experience, other model implementations are ongoing; they focus more particularly on tourism by involving private companies operating in the field of infrastructure development on Italian territories affected by this phenomenon. In this section, we will briefly mention two of these case studies which seem to be more interesting for the purpose of these conclusions - although still at an early development stage - due to the fact of operating at different scales.

The first one concerns the consulting for a company, 'Romagna Acque', which owns and runs all the drinking water sources in Romagna for wholesale water production in the provinces of Forlì-Cesena, Ravenna and Rimini. Facing the forecasts about a progressive decrease in water availability in the next 20 years and having to deal with a territory subject to extreme fluctuations in water demand caused by coastal tourism, they need to set up a long term strategy to develop new huge and potentially impactful infrastructures related with water supply and storage.

The second case-study focuses on the topic of ski resorts and their progressive crisis facing to climate-change-related modifications which increasingly rise operating and infrastructural costs for snowmaking especially in those areas where resorts have been built at low altitudes, that is the case of Apennines mountains and some locations on the Alps. In this case, the work is in its very early stages, so we will just outline the general assumptions behind the research, also outlining the features of an hypothetical interlocutor among those which until now were approached to develop the project.

Figure 4.4: The territorial area served by the water supply network managed by 'Romagna Acque'. On the right, the historical development of water production highlighting the used sources.

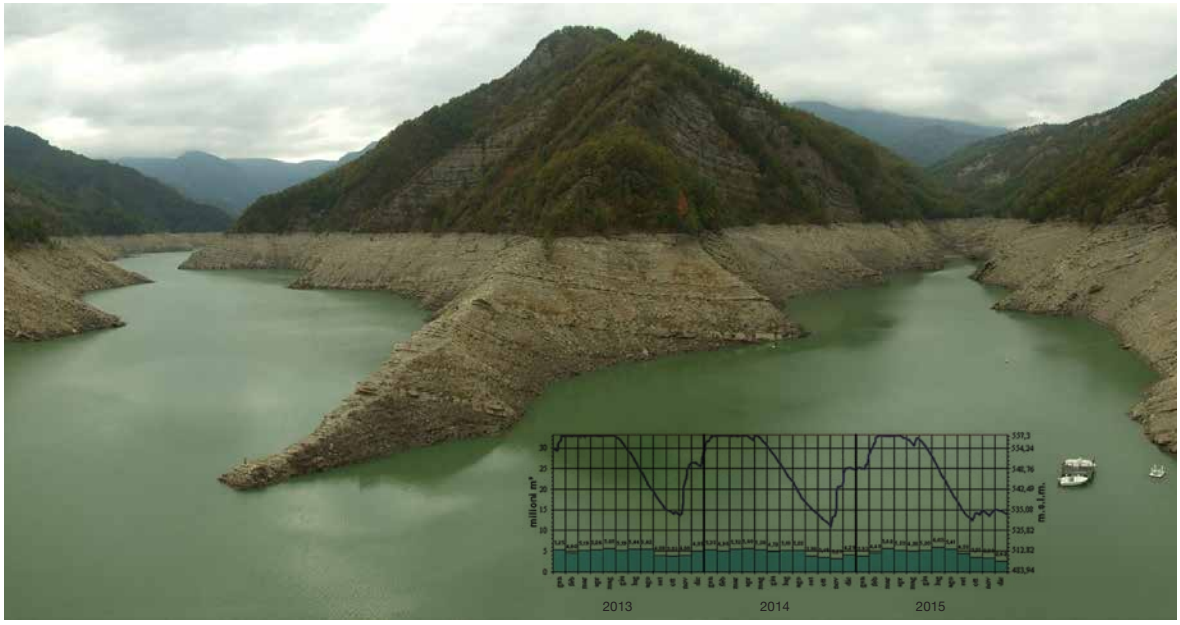


Building Water Supply Scenarios

As said before, Romagna Acque is a limited company with wholly public capital, which manages surface and groundwater sources in Romagna. It is a shareholding structure formed of 49 members: the group, either directly or through publicly controlled companies, includes the Municipalities and Provinces of the three relevant regional areas of Forlì-Cesena, Ravenna and Rimini. The Company's core objectives are linked to protect water and make it accessible to everyone keeping rates down for end users. The Company's role is therefore increasingly connected to the need of building infrastructures that can guarantee the availability of good resources for the future.

Following these objectives, 'Romagna Acque' has to plan long-terms investments aimed at providing the Company with a suitable plant structure to safeguard water supply for the Romagna territory under different hydrological situations in the future. A big challenge, given the fact that the area served by the company is characterized by a huge consumption inequality between the littoral and the hinterland, especially in terms of seasonal demand peaks generated by tourist arrivals. Tourism acts in this sense as a prominent factor affecting the actual water stock adequacy, not so much in terms of overall quantity, but in terms of seasonal availability, especially in summer. Even though available water resources are sufficient to meet the current average demand, the Company, relying on specialistic studies, forecasts a progressive reduction in this stock due to climate change which will be seriously critical within a time span of 20 years. Such trends, in addition to the necessity of pre-

Figure 4.5: The image shows the 'Ridracoli' Reservoir low level during the summer. On the bottom, the graph reports the seasonal level changes since 2013.



serving groundwaters prioritizing the use of the surface ones, are addressing the Company towards the research of alternative water sources by developing new infrastructures like dams, reservoirs and pipelines. In brief, two strategic issues inform the 'Model' to be implemented for 'Romagna Acque':

/ finding new surface water sources to face climate change and protect the environment from risks connected with groundwaters drawing;

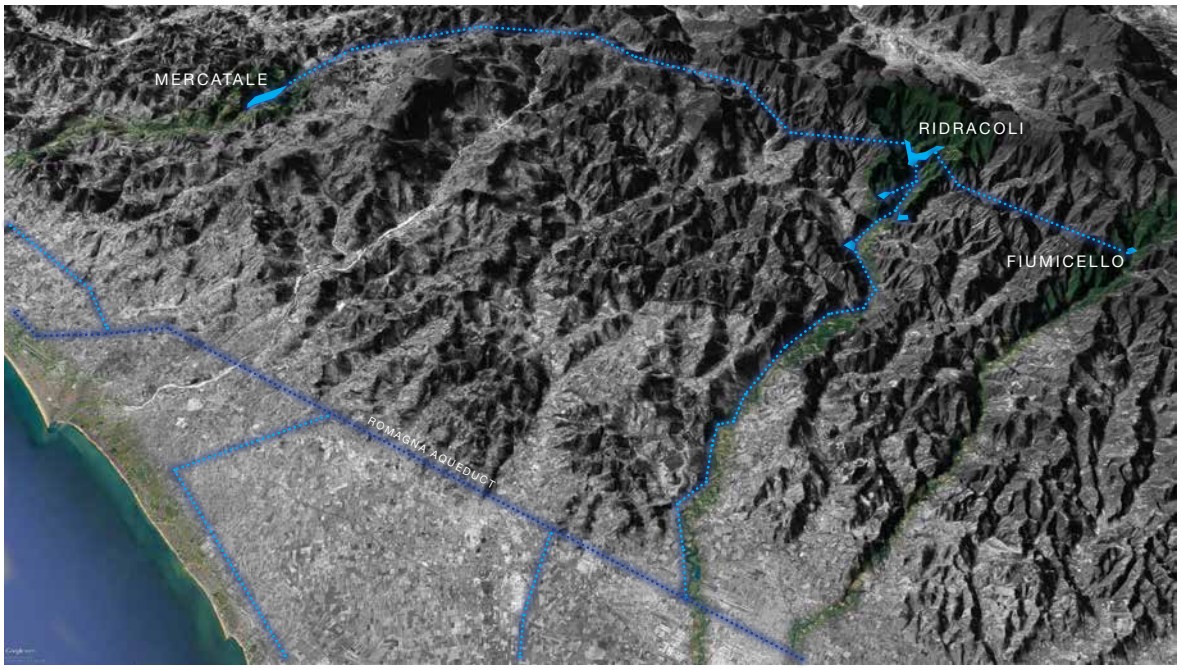
/ developing more responsive systems to store water facing the increments and peaks in the summer demand generated by the tourism.

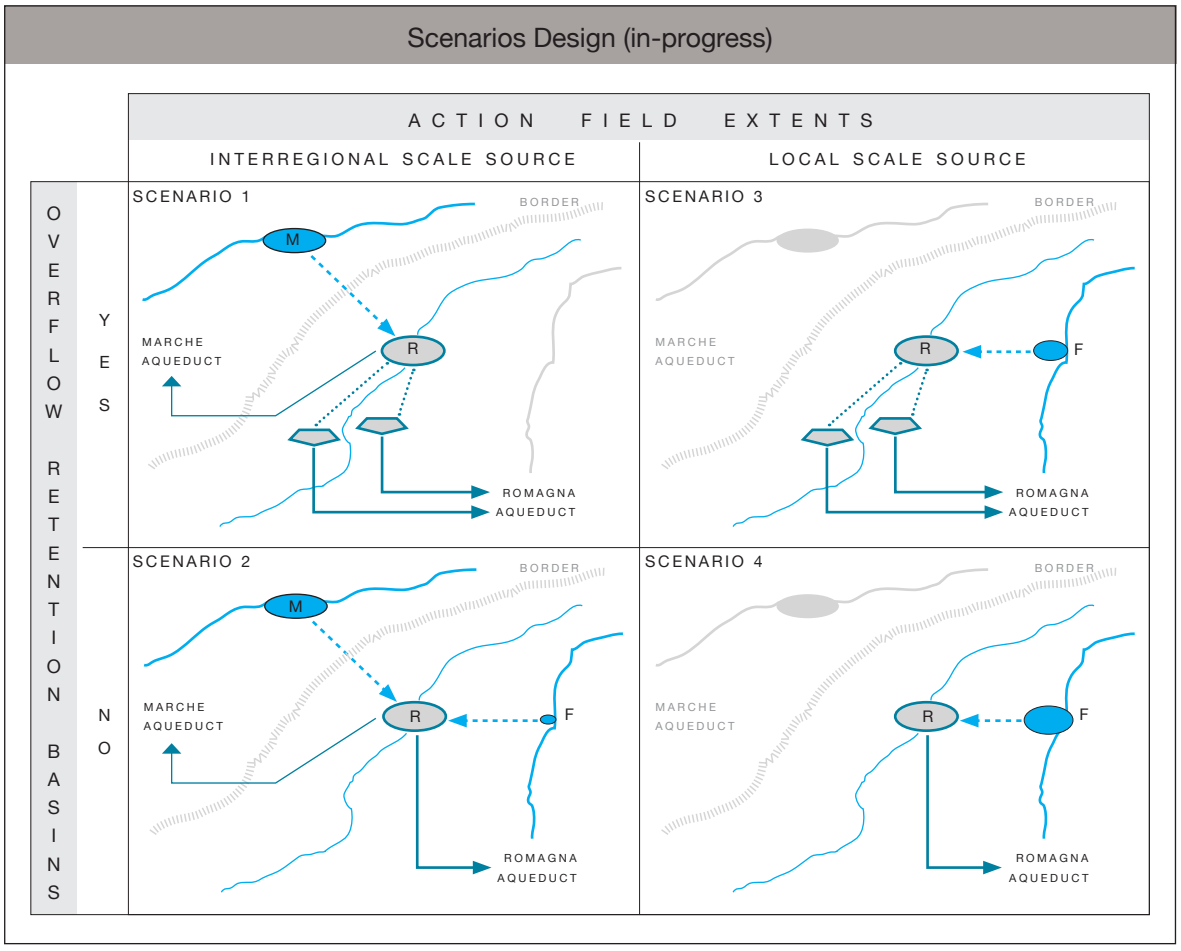
From these issues, in collaboration with the Company, we have identified the two 'key-factors' of uncertainty which will operate the landscape transformation according to the strategic issues. They deal mainly with the network headed by the Ridracoli Reservoir which provides approximately the 50% of the whole water volume of the entire system (i.e. 110.726.173 mc in 2015). Around this main work, the reasoning about the future landscape scenarios has been set up, according to the scheme provided by the model, upon the following two variables:

/ the chance of using new additional sources, to connect with the Ridracoli Reservoir, at a local (i.e. regional) or interregional scale; which mainly depends on political and economic negotiations, legislative constraints and normative issues;

/ the possibility and the overall convenience of developing 'overflow retention basins' downstream of the Ridracoli dam in order to accumulate the winter water excess so as to be used in summer for

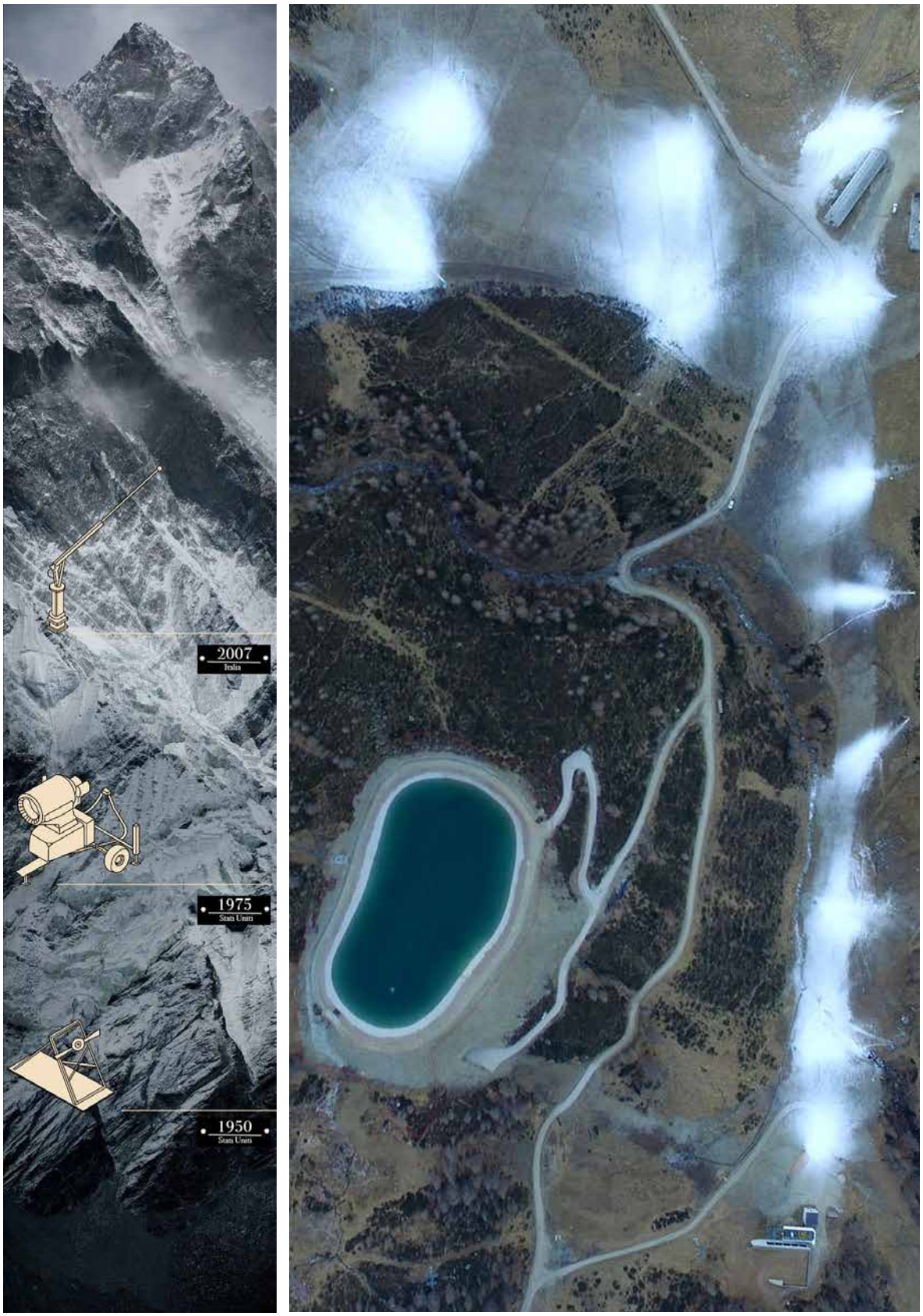
Figure 4.6: A draft stage representation of the Scenario Design developed for 'Romagna Acque'. On the bottom, the four scenarios generated by the 2x2 matrix, while, above, a territorial representation merging the four scenarios together.





the touristic demand; which would require likewise a significant effort in terms of infrastructures.
In the 'Scenario Design' phase, not yet complete due to the fact that hydrological assessments are still on-going, we have been able to intertwine the four 'alternatives' according to the 2x2 matrix adopted by the model and set up the four scenarios in a draft version (*Figure 4.6*).
Scenario 1 and 2, driven by the possibility of working within an interregional action field, involve the chance of connecting, by the means of pipelines, the Ridracoli's to the Mercatale Reservoir located in the Marche Region. This second basin is actually well oversized compared to its concerned area water demand, so it could work as an additional source of water for Romagna Acque which would use it in different ways depending on the fact that the 'overflow retention basins' are realized or not downstream of the Ridracoli Dam. This is what mostly differentiates Scenario 1 from 2, since the lack of retention basis would require to find an additional resource in order to balance the tourism-related summer peaks of water demand. For this purpose, Scenario 2 envisages to intercept the nearer Fiumicello River's waters by developing here instead a smaller retention basin connected with Ridracoli.
In both scenarios, the economic mechanism behind the operation feasibility grounds on the capacity by Romagna Acque, thanks to its purification plants and networks, of providing the Marche Region coastal areas with a part of water derived from Mercatale which is now not supplied to these zones.
Scenarios 3 and 4, driven by a more restricted field of action which not exceeds the regional administrative boundaries, are both tied to the Fiumicello River resource. Depending on whether or not the 'overflow detention basins' are realized around Ridracoli, the alternative scenarios involve different dimensions of the retention basin useful to intercept the Fiumicello's waters. In particular, Scenario 4 imply that this last basin should be sized in order to work as and additional source of water against future shortage, as well as a storage device placed 'upstream' of the network to face summer demand.
In a landscape perspective, these alternatives open a vast range of issues which still have to be investigated and cross-checked with the 'Operative Tools Taxonomy', still in-progress. Even though the resulting scenarios previously reported are just a provisional outcome of the process and additional considerations need to be done, about for example the topic of energy consumption, they contribute to outline the different futures in terms of landscape transformations which will be transferred, processed and analysed with 'Romagna Acque' to: address their strategic plans for next years; to facilitate their communication with shareholders about investments; and, finally, to support the negotiation process to be carried on by the Company at regional and national levels.

Figure 4.7: The image shows snowmaking operations and some of the infrastructures used to make it possible such as water basins, pumping stations, tanks, cannons, electricity networks, etc.



Building Ski Resort Scenarios

The second case-study is reported, even if in a very preliminary stage, because it aids us in highlighting, at the end of the present dissertation, some general issues concerning the dynamic relationships between tourism, environment, landscape and infrastructures.

As already mentioned, we are focusing on the topic of ski resorts and their progressive crisis facing to climate-change-related modifications which increasingly rise operating and infrastructural costs for snowmaking especially in those areas where resorts have been built at low altitudes, that is the case, in Italy, of Apennines mountains and some locations on the Alps. We are still trying to find a proper interlocutor - a company which manages ski areas - to implement the model, but in the meanwhile the research has been deepening the knowledge of existing forces, trends and main factors of uncertainty related with the topic. With this aim, a first investigation about the mountain landscape and its structural connection with tourism has been carried on in a way that follows the same principles applied in maritime contexts (Chapter 2.2).

Recent winter seasons, characterised by poor snowfalls during the usual periods for ski tourism, have contributed to 'unveil' a side of that intricate, complex and sophisticated 'machine' which allows ski resorts to work (*Figure 4.7*). Snowmaking devices as 'snow cannons', avalanche protections, wind barriers and ski-lifts are only some visible components of a much more extensive system aimed at preserving the touristic performances of the mountain landscape. The ski slopes tracking, for example, requires sometimes impressive terrain modelling operations and accurate vegetation planting on the borders to avoid wind effects. Less visible and recognisable about their function, the networks providing water and energy for the snowmaking constitute an even more impactful system on the landscape. In snowmaking systems, in fact, visible elements represent only a small part of the infrastructure. Normally, the snowmaking facilities are associated with additional equipments such as water tanks and reservoirs, pumping stations, refrigeration systems, meteorological stations, pipelines for water, electricity, compressed air, etc.

In order to grasp the overall dimensions of this system, we report a research by the Austrian WWF (2004) which points out that 40% of the Alps' ski slopes are provided with snowmaking plants, for a total of 24.000 hectares, corresponding to approximately one and a half the surface of Liechtenstein. Such numbers are potentially rising giving the fact that climate change forecasts, even if characterized by a great uncertainty, states that, for a 1° C increase in temperature, the limit of 0 degrees

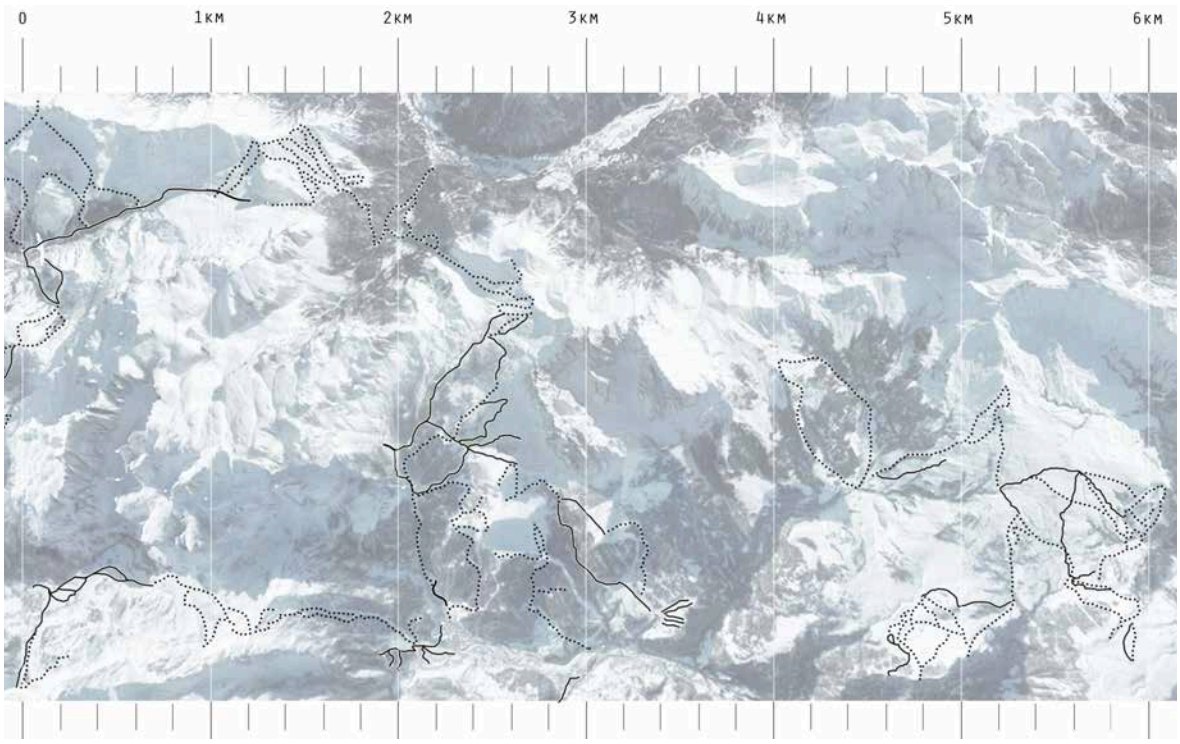
Figure 4.8: Two of the main operative tools used to manage the touristic landscape of ski resorts: avalanche protection barriers and snowmaking cannons.

moves 150 m upwards. One of the most obvious effects of rising temperatures is the reduction of certain 'snowy' days. For example, on the Col de Porte (1320m s.l.m.) in France, during the last forty years, the number of days with a 20 cm snow cover decreased by about one-seventh (SEATM, 2002). Possible future trends are even worst: according to the model developed by Météo France (SEATM, 2002), in all the southern French Alps (Hautes Alpes, Alpes de Haute Provence, Alpes Maritimes) up to at least 1,500 m would no longer be probable have ski resorts with reliable snow. According to Bürki (2000), in the period from 2030 to 2050, only the ski resorts over 1.600 - 2.000 meters will be able to be defined as 'sure snowy' locations.

Following these forecasts, in the Italian Apennines, the existing ski resorts will lose any economic viability due to their low altitude and given the snowmaking-related costs. On the other hand, in such a competitive sector, the areas located at more favourable altitudes will partly benefit from this trend, but just on the short period. In the medium-term, in fact, they will be damaged by negative effects mostly due to the loose in popularity of ski given the increasing costs related to the distance of available locations and maintenance expenses.

In our opinion, such complex framework requires to be tackled from a larger as possible perspective in order to build prospective scenarios which may consider the possibility of tuning new infrastruc-

Figure 4.9: The ski resort district 'Dolomiti superski' in the Italian Alps; the main ski slopes and their related infrastructures are highlighted including cableways, water and electricity networks.



tural interventions, such as the development of new higher ski district, with more radical choices including the abandon or the conversion of lower areas to different winter sport activities. In particular, scenarios will have to consider the climate-change trends, but also the raising of alternative types of winter sport activities in the tourists' interest (Doering & Hamberger, 1996). Such multiplicity in their behaviours is an opportunity which could be used to differentiate the offer by operating on a large scale context. This may also help in better managing the major topics of energy and water supplies which are the most impactful, both in terms of economic and environmental sustainability, when developing new infrastructures related with ski resort.

The model application in this framework would be eased by identifying a subjects that owns several resorts or an entity capable of operating on behalf of multiple partners. Both conditions are possible, for example, in the Emilia-Romagna area where some companies have the characteristics corresponding to this profile and there are Regional Authorities which can represent several stakeholders. Once the interlocutor will be found, the scenario design would be implemented, as said, on a vast area following the model workflow and taking into account the driving forces that this preliminary investigation has highlighted as the most effective in addressing the alternative futures of ski-tourism-related landscapes.

4.3 Matters of Scale

The present research has demonstrated the definite possibility of adopting the 'Sizing Landscapes Model' as a performative and negotiation format for a landscape-driven planning of infrastructural works, although there is still more ground to be covered to better understand the benefits and consequences of adopting such a workflow. In particular, the model applicability to different intervention scales will be further tested through the research's followup implementations, some of which have been briefly described in previous paragraphs. So far, the model has demonstrated its flexibility to the topic on condition that some basic requirements, concerning the developers' operation areas, exist.
In particular, by debating and collecting feedbacks from the companies involved in the model development, we understood the necessity of referring the 'scenario design' to an homogenous area in order to size landscape transformations in a specific context avoiding the risk of abstraction. By starting collaborations with companies, operating for example in the fields of energy production or urban waste management, whose intervention areas are scattered in several territories, together we realized the importance of focusing the alternative scenarios place by place. In fact, even though some factors of uncertainty are tied to general trends and phenomena, investigating their relationship with local conditions is imperative. Otherwise, we would fall in those same generalizations that feature quantitative and statistical approaches, in our opinion not effectively applicable in a long-term landscape-oriented perspective, especially within unstable and dynamic contexts where the number of data and uncertain variables is higher.
In conclusion, matters of scale may not represent a limitation to the model use since the territory involved by the landscape scenarios' design pertains to a coherent physical framework featured, and shaped, by readable interactions of site-specific and broader dynamics. Perhaps only at the end of several pilot implementations, showcasing the entire process from start to end with a list of measurable benefits, we will be able to prove the model effectiveness in working at different spatial and time scales. So far, the work has laid the basis for setting up infrastructure planning starting from landscape opportunities, rather than from its constrains; by this way the thesis proposes a model to assist decision-making process and provide developers with a tool aimed at addressing long-term strategies also by the means of short-term directions.

Figure 4.10: A ski slope building-site in the 'Cermis area' of the Italian Alps.

By collaborating with other disciplinary sectors, the research followups will investigate the model aptitude for being cross-referenced with quantitative analysis and thus opened up to updating and further refinement. Although this thesis might be considered as a first step in all these directions, it has demonstrated the convenience of overturning the attitude towards landscape in the common process of designing and planning infrastructures, promoting the scenario-based approach as a way of encompassing uncertainties, risks and prospective visions of infrastructure into the evolving boundaries of landscape.

List of Figures

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