



Scientific Journal of the Observatory of Mediterranean Basin.

Polis University / Ferrara University /

UNECE Center of excellence / Co-PLAN Institute.

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and planning towards new "repairing" and
"performative" landscapes**

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**SOURCE: Scientific journal of the Observatory of Mediterranean Basin,
Volume 3 / 2016, pp. 1-1**

ISSN: 2959-4081

ISBN: 978-9928-4459-1-9

PUBLISHED BY: POLIS-Press

DOI: 10.37199/o41003106

Evolving waterscapes by relying on instability / An operative approach to river systems' design and planning towards new "repairing" and "performative" landscapes

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58

Introduction

The layout of river systems, as we observe them nowadays, 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 have long struggled with seizing such features since morphodynamic imagery has radically changed our awareness of rivers' evolution as the result of overlapping forces acting at several levels.

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, the recurring operative approach to the topic seems to ground on a paradox. In fact, it deals with the misleading expectations to freeze or restore the "natural" functioning of the river ecosystems, while indeed they are inherently on-the-move. It seems that forces operating in this sense should be somehow balanced by the idea of an "authentic landscape" which is as reassuring as unhistorical. The concrete result of such a mindset is an increasing disjunction between technical developments and landscape outlooks: the first looking ahead, the second backwards. Unless we want to perpetuate such approach, we should attempt to conceive the landscape as a stratification of always new arrangements, layouts and usages.

In this perspective, our research contribution focuses on the "waterscape" topic working through an integrated

design approach based on the early combination of diverse expertises. This has produced a vast range of proposals aimed at matching infrastructural works with new landscaping procedures.

In both the applicative key studies presented in this article, environmental risk management (pollution and flood control) and tourism development act as strategic drivers, motivating landscape transformations.

Such method may find further and interesting applications in those territories, such as the Balkan Peninsula, which are now experiencing huge hydromorphological developments, due to the increasing demand of water or energy supply as well as the necessity of floods control. The speed at which this is happening threatens to reiterate a mere technical-oriented approach leaving out more systemic opportunities.

In this framework, blurring the boundaries between disciplines is a paramount concern to shift the viewpoint having a more holistic approach to the subject.

Furthermore, even though a spatial planning approach needs to be implemented in order to evaluate environmental cost-benefits of infrastructural works, the forthcoming landscape will be also the result of a cultural attitude towards the concepts of instability and change which mark the inner essence of river systems.

Inspiring morphodynamics

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

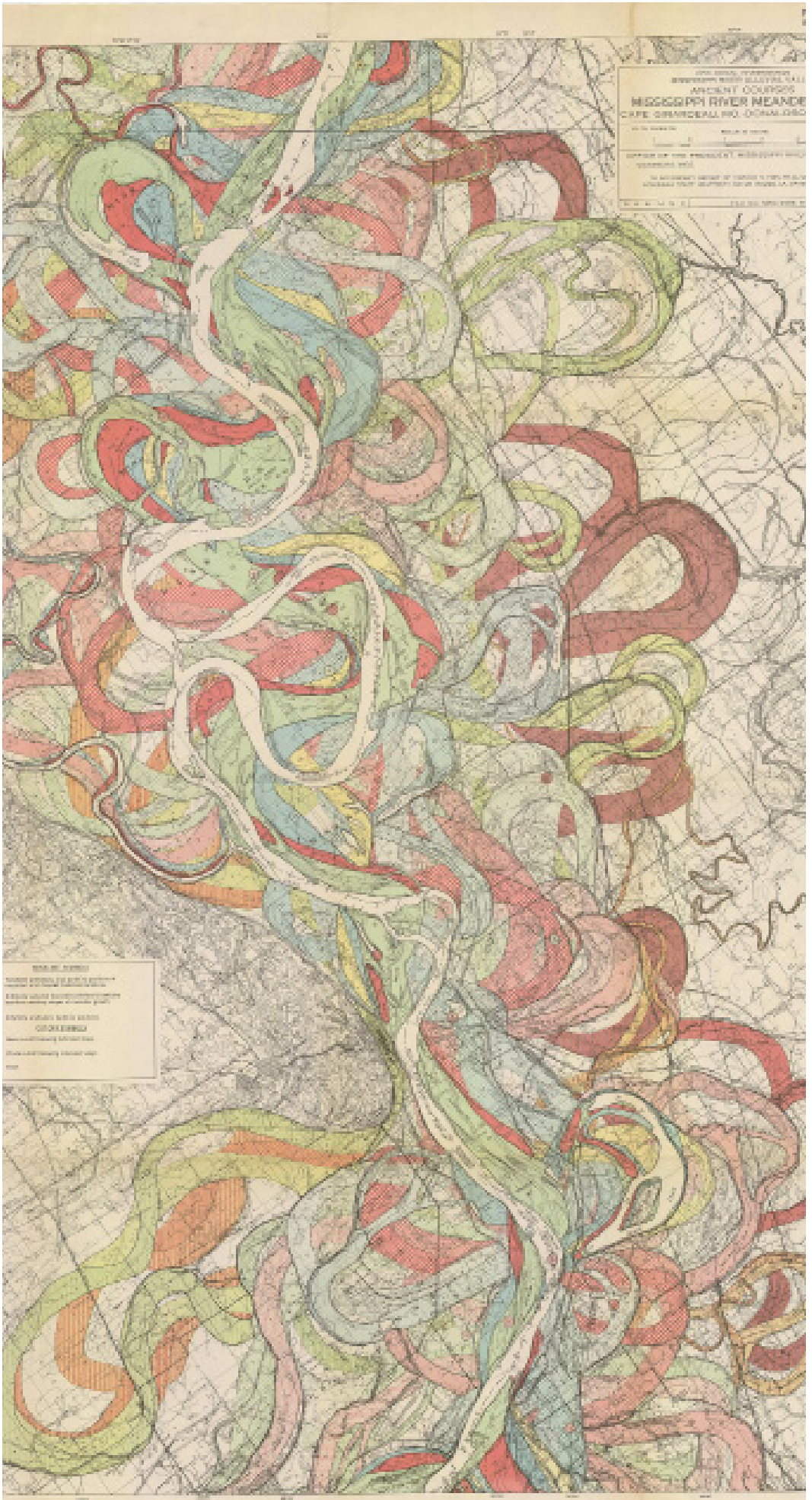


Fig1 / Geological Investigation of the Alluvial Valley of the Lower Mississippi River-Plate 22, Sheet no. 6 source / US Army Corps of Engineers

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 (fig.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 LiDAR¹ - has allowed a more accurate knowledge of rivers' dynamics increasing the awareness of their past and future impact on landscape morphology.

The LiDAR-derived digital elevation model of the Willamette River (fig.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 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 embankments, 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 somehow 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, the Sealine Research Centre (University of Ferrara) has 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

¹ / LiDAR (acronym for Light Detection and Ranging or Laser Imaging Detection and Ranging) is a remote sensing technique that allows to determine the distance of an object or of a surface using a laser pulse, in addition to determining the concentration of chemical species in the atmosphere and in the water.



Fig2 / LiDAR imagery by Daniel E. Coe. of the Willamette River source / Oregon Department of Geology and Mineral Industries

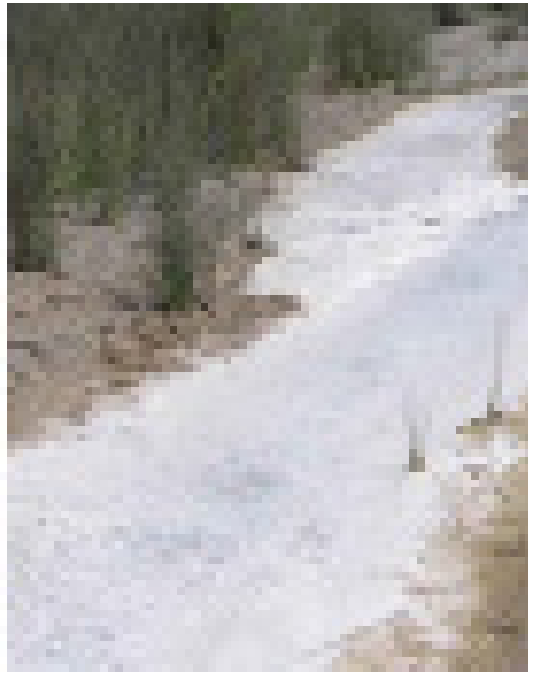


Fig3 / The Piscinas (left) and Naracauli rivers passing through the dunes before reaching the sea source / Sara Cuccu's Master Thesis

and geographers. This has produced a vast range of studies and proposals aimed at matching infrastructural works with new landscaping procedures (Emanuelli and Lobosco, 2015).

Our main objective is to investigate the way landscape devices may contribute to drive rivers' system transformation towards new modes of exploitation, fruition and relationship with the context. In the following paragraphs, we present two applicative key studies in the Sardinia region (Italy) developed by two master thesis within the Laboratory of Landscape Architecture at the University of Ferrara, Architecture Department.

The first project² 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 project³ 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": a case study

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 (fig.3) 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

2 / The Master thesis project is titled: "Peasaggi Disturbati. Costruzione di nuove opportunità per la risignificazione dell'ex zona mineraria d'Ingurtosu Naracauli Gennamari Sardegna". Candidate: Sara Cuccu. Supervisor: Luca Emanuelli. Co-supervisors: Roberta Fusari, Michele Bottarelli.

3 / The Master thesis project is titled: "Oltre mare. Verso l'interno della Sardegna, risorse e ospitalità del turismo alternativo alla costa. Candidate: Silvia Corgioli. Supervisors: Luca Emanuelli, Gianni Lobosco.

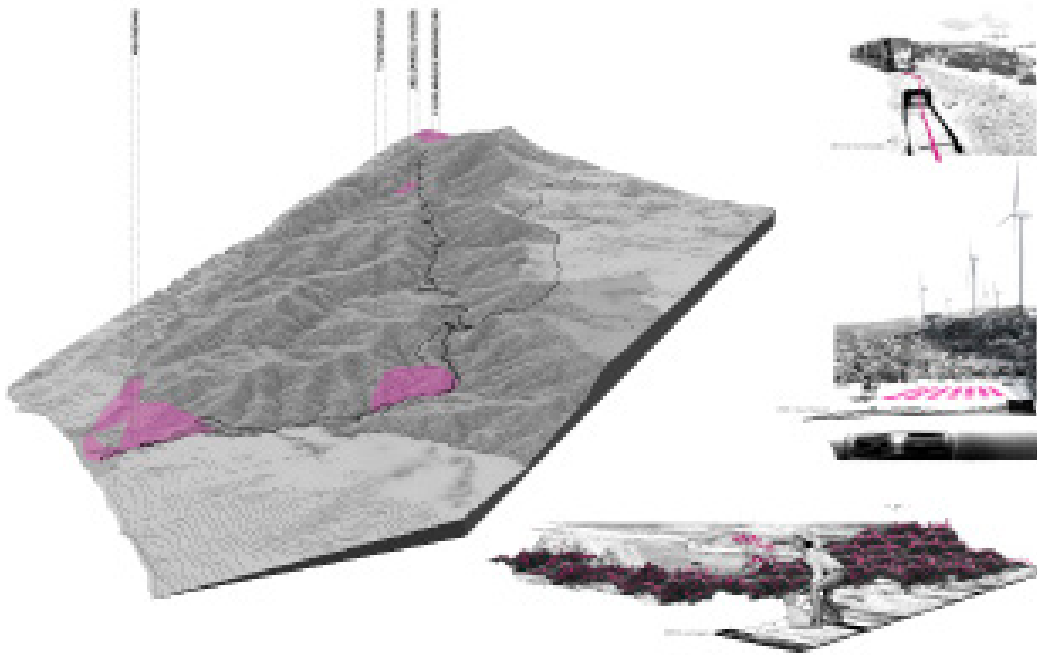


Fig4 / The expected risk assessment pinpointing priority remediation areas source / Sara Cuccu's Master Thesis

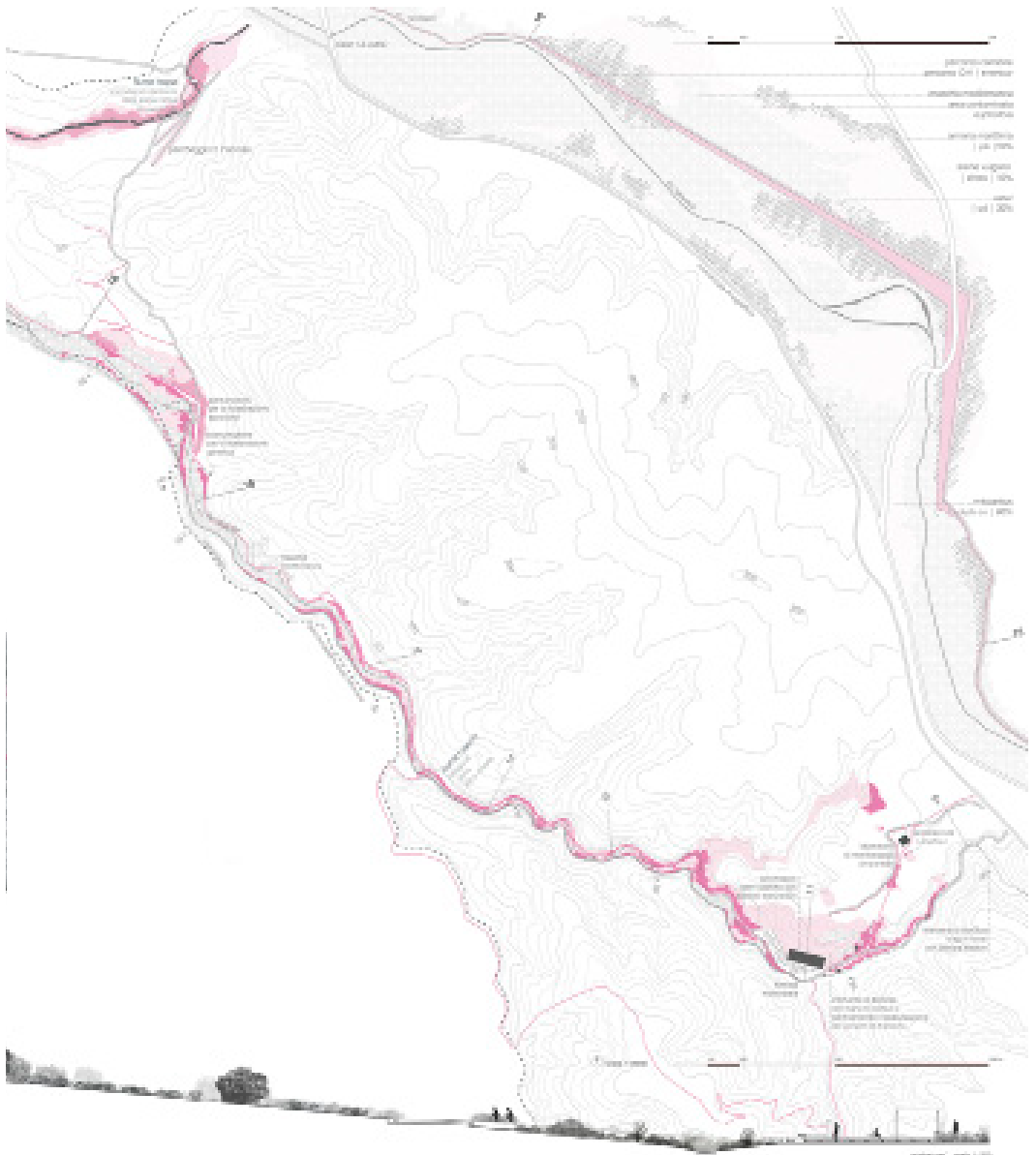


Fig4 / The phytoremediation "repairing landscape" along the Piscinas and the Naracauli rivers source / Sara Cuccu's Master Thesis



Fig6 / The Coghinas Rives basin placement among the the two main tourist destinations of northern Sardinia. source / Silvia Corgiolu's Master Thesis

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, 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 (fig.4). 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.

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 phytoremediation or the application of permeable reactive barriers (i.e. PRBs) aimed at preventing pollutants migration and therefore the contamination extent (fig.5).

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": a case study

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 backpackers or trekkers) on this island's section require to uncover and make operational those

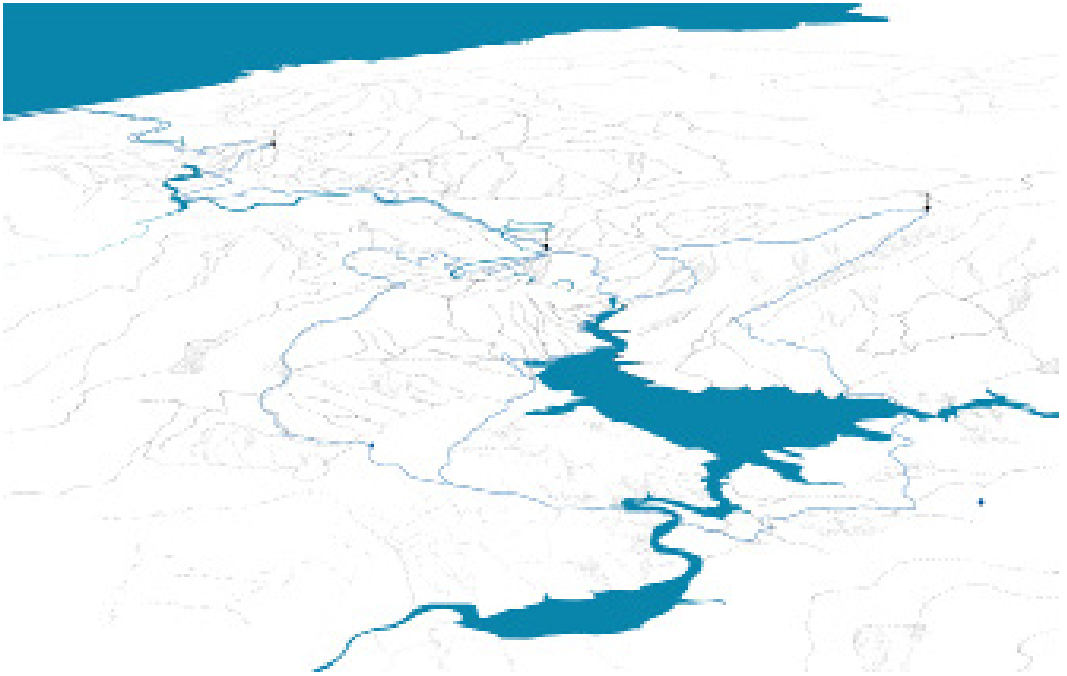


Fig7 / The project's alternative strategy to address the flood risk management on the valley source / Silvia Corgiolu's Master Thesis

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 (fig.6): 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, 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.

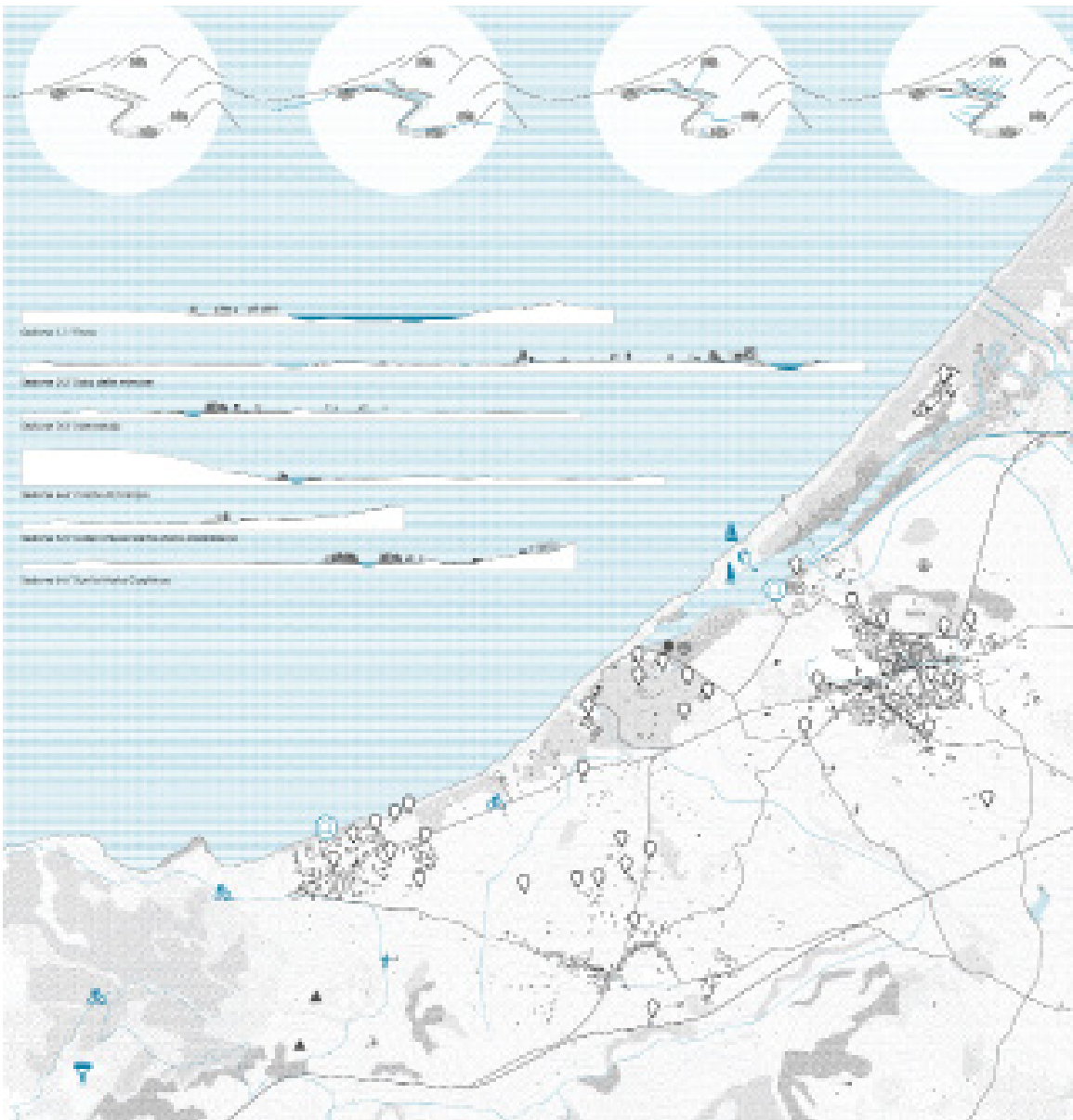
Beside such light infrastructural system, that mostly concerns the two lakes'

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.

In order to reach this goal, the project (fig.7) 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 activities, camping, etc.) compose a "performative landscape" that puts the river at the centre of a new touristic scenario (fig.8).

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.



Relying on instability

In the previous paragraphs, we have briefly discussed how morphodynamic representation has radically changed our awareness of river systems' evolution. Then, in order to avoid any bias at a design level, we have stated the importance to equate climate, geological and human alterations' impacts on rivers' landscapes and ecologies.

Finally, we have suggested that the recurring operative way in which such physical transformations are normally managed is still too sector-based and that the role of landscape design and planning is neglected.

We have shown Sealine's "Research through design" approach (Lenzholzer, Duchhart and Koh, 2013) to the waterscape topic, analysing in particular two applicative case-studies in which both environmental risk management and tourism development act as

strategic drivers motivating landscape transformations.

Both the presented project proposals are aimed at developing an original and contemporary interpretation of the "cultural landscapes" idea (Sauer, 1925) especially 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)

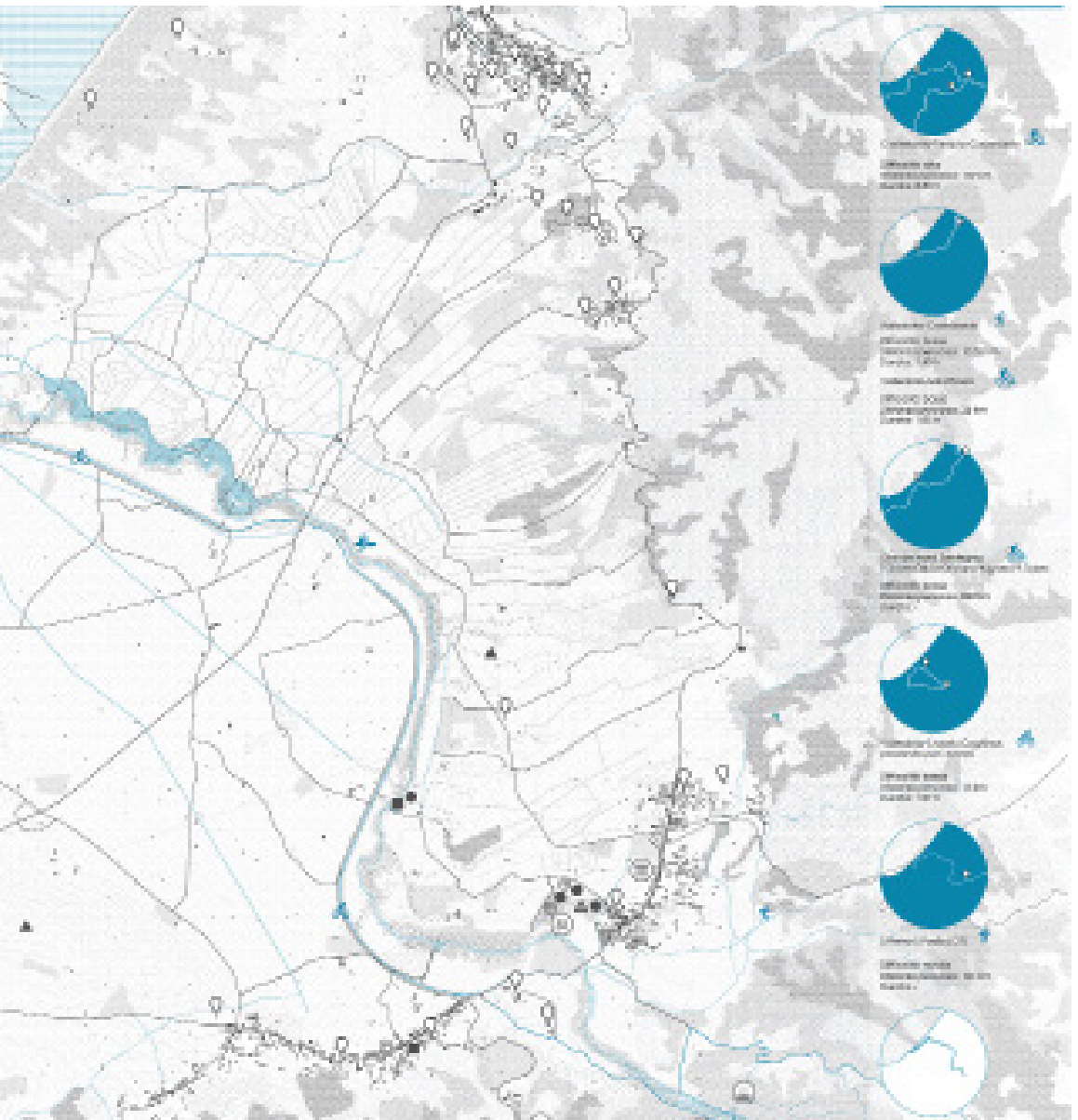


Fig8 / The "performative landscape" variations along the new Coghinas river banks
source / Silvia Corgiolu's Master Thesis

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.

In this perspective, our research contribution in the last few years has focused on what we consider essential to this purpose: to work on forthcoming landscapes, able to fit with contemporary culture and processes.

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 represents probably the most



relevant area in Europe where the conflict between 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 (fig.9) 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.

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

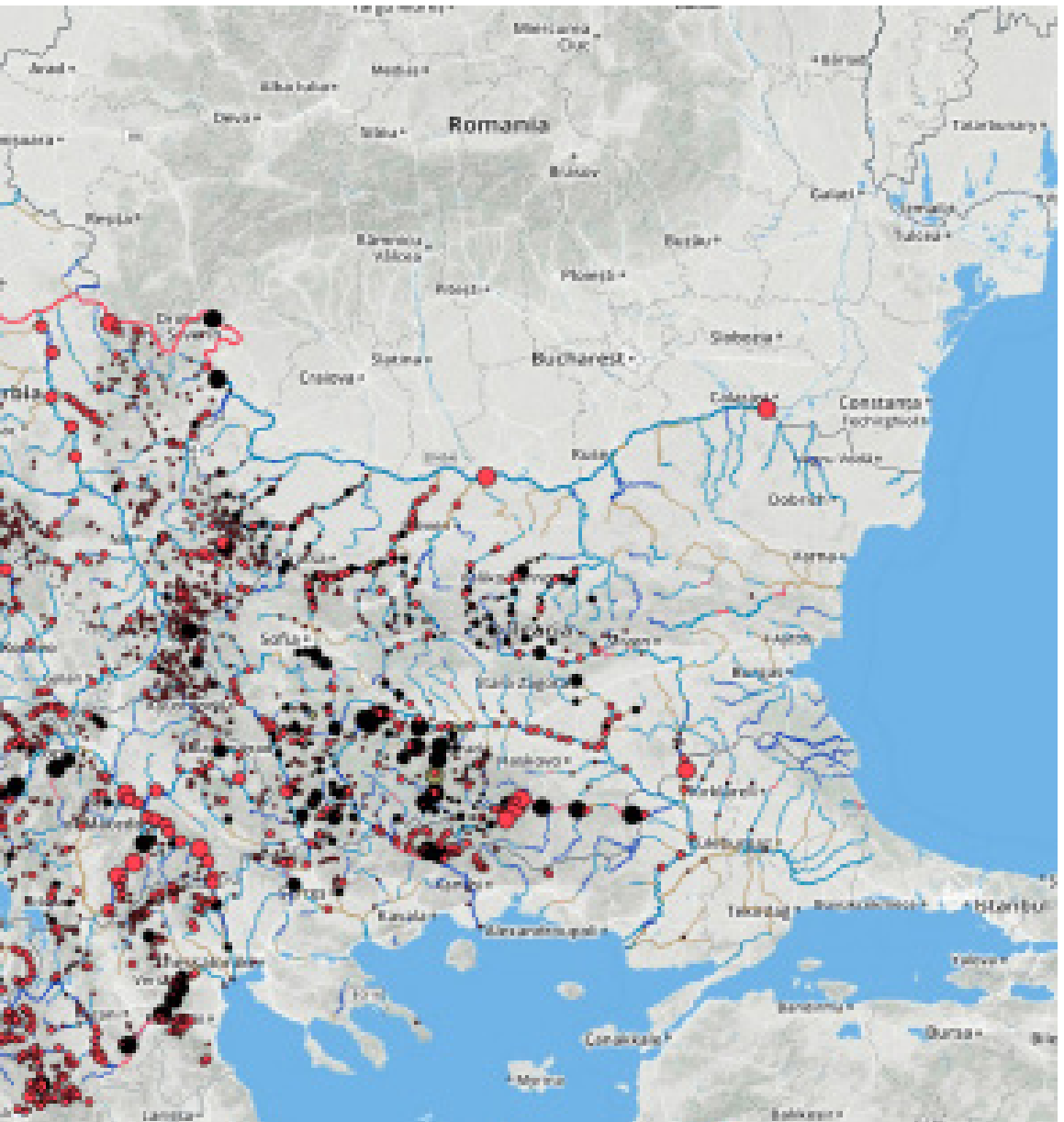


Fig9 / Existing (black), under construction (grey) and planned (red) hydropower plants of the Balkan Peninsula. source / Save the Blue Heart of Europe, www.balkanrivers.net

mark - as we tried to demonstrate - the inner essence of river systems.

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