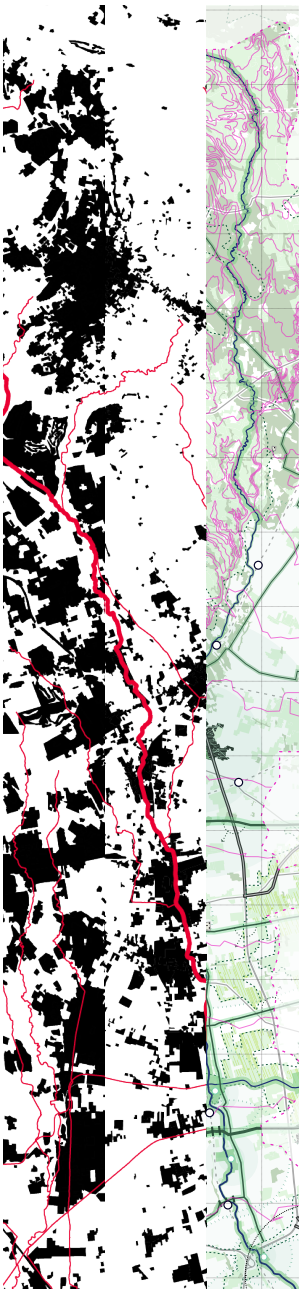
Re-Territorialization

A vision for Milan Urban Region



Reterritorialization:
A vision for Milan Urban region

Author:
Filippo Lafleur
Student number: 4920691
filippo-lafleur@hotmail.com

Supervisors:
First mentor:
dr. Arch. Taneha K. Bacchin, MArch., Msc
Second mentor:
dipl.ing. B. Hausleitner, MSc

P5 Report.
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Delft University of Technology (TUD)
Faculty of Architecture and the Built Environment
Department Urbanism
2628 BL Delft
Postbus 5
2600 AA Delft
The Netherlands

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Thanks to my family and Francesca for the infinite support from Italy.

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Introduction

In the light of environmental degradation, climate change, and the rise of particular spatial configurations of urbanizations, at the start of this academic journey, the broader aim was to understand the interplays and relations between processes of urbanization and environmental degradation through an analytical, conceptual and projective approach.

Under this lens, the graduation project brings forward important themes regarding urban - landscape planning and design fields in relation to complex systems (urban regions) and critical territories (environmental degradation and risk). This inquiry was led in the urban region of Milan, an extremely interesting case study characterised by critical and complex spatial conditions.

As I will explain more in depth in the first chapter (project field) of the document, these conditions have been visualized and related to each other's through the agency of mapping à la Corner.
This process of relational thinking conceives design as a medium of inquiry in socio-spatial transformations and it was crucial to understand complex relations between processes of urbanizations and environmental degradation.

After understanding a series of related fields and grounds, the document advances the main issue of landscape fragmentation and secondly of hydraulic risk, as the driving factors shaping a series of hypothesis, objectives and research questions. From this perspective the methodology advances the question of scales (transcalar design) and time (open ended, indeterminate design processes) as the core focus of the project.

Inspired by the legacy of landscape ecology and In counterdency with current urbanistic practices, the project embraces the design of landscape systems (corridors and patches) as both structurally and functionally performing elements at multiple scales.
Moreover, it addresses the modes of reactivation of active programms along these corridors and patches for the replenishment of ecosystem services and the introduction of nature based infrastructures for the mitigation of hydraulic risk.

Within this framework, the project explores the role of the urbanist in designing / reintroducing landscape, in its broader meaning, as a transcalar, multisectorial and multiscoping strategy, vital for the strategic and operational reprogramming of nature in urban regions.

The programmatic question of implementation has been explored through a design inquiry around the notions of open ended and indeterminate design processes.

Some research and design procedures are represented in the Apendix as supportive documents, which generated the rationalities of the design synthesis presented throughout.

"L'aspetto nuovo più clamoroso dell'urbanesimo padano è perciò l'imporsi dello sprawl, la campagna urbanizzata. Ma la città diffusa, sebbene derivi dalla " voglia di città" degli uomini, finisce per essere la città indifferente, il non luogo, per cui i legami che contano oggi sono diversi da quelli con il centro urbano, il cuore storico delle antiche e straordinarie città padane: sono sempre più i luoghi destinati alla fruizione della modernità (i nuovi luoghi sono i supermercati, la discoteca, l' autosalone, il casello dell' autostrada). Ciò che manca alla megalopoli è il senso dello spazio vivo e partecipato, della sua unità, della sua organicità",

"The most resounding aspect of the new 'Urbanesimo Padano' is the imposition of sprawl, an urbanized countryside. However, the città diffusa, although is a product of the human desire of city, it ends being the indifferent city, the non place, for this reasons the relations that counts today are different from the one with urban centres, the historical core of the ancient and extraordinaries cities of the Po river valley: they are progressively becoming the places of modernity (the new places are supermarkets, discoteques, automobile showroom,toolbooth). What is lacking to the Megalopoli is a participated an lived space, the sense of its unity, its organicity"

Eugenio Turri in La Megalopoli padana

0. Project Field

The project field chapter introduces a set of problematiques through visual and written mediums. Secondly, through relations between various fields and grounds it frames the main issue to be addressed (written and visual). Eventually, it advances a series of objectives, hypothesis, research quesitons and the underliyng metholds through which the project unfolds its projective dimension.

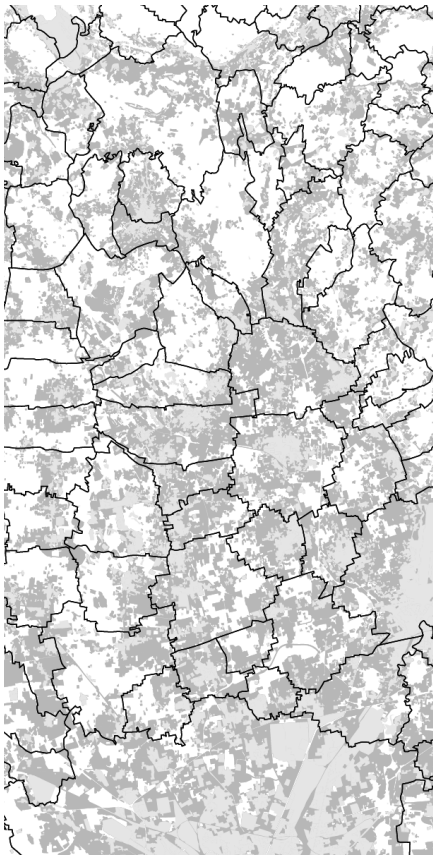


Figure:
Showing administrative fragmentation in milan urban region. Black, municipal borders, In light grey is portrayed urbanization untill 1954 and in dark grey more recent urbanization patterns.

0.1) Problem field

Problem of various nature are affecting the urban region of Milan. All these problems are interlinked and interdependent in various degrees.

Below a list and following a disclosure and visualizations of each of them.

A) Political
B) Environmental
C) Socio-spatial

A) Political / Governance

As an inherited spatial configuration (see appendix 3x3x3), the urban region of milan is defined by a politically fragmented territory and an undefined functionally / operative connected urban system.
The fragmentation materializes through land use engineering (municipalities) and few transborder jurisdictional entities. Opposite to the constructed management units, the urban system of Milan is still yet undefined, some urbanist says that the urban region of Milan entails more than 6 millions inhabitants (Brandolini, Turri).
The fragmented state (which is also true for the most part of the peninsula) has been inherited from the long and tumultuos history of distributed territorialization in the region, as explored in the research by design section 3x3x3 (see Appendix)

The dynamics generated by this condition are of crucial importance in relating governance to specific types of urbanization patterns along with the consequent environmental issues.

Indeed, there is a clear incapacity of small municipalities in transforming their territory according to the functional and operative dynamics of the urban region. The latter has more than 200 municipalities extending for more than 2.000 km2. the structural and functional interdependencies (bottom left figure) would suggest a territorial governance of these places, and however municipalities are still the main actors committed to unveil urban plans for their territory.

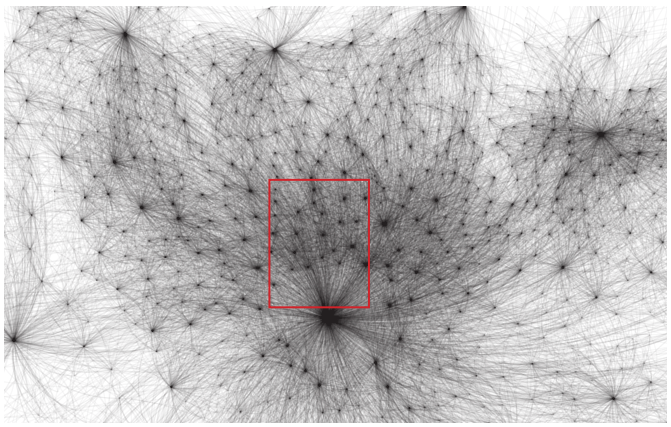


Figure:
Showing the functional interdependencies n the urban region of Milan. In red the borders, the geographical reference of the image in the upleft.
Source: Atlante dei territori post-metropolitani

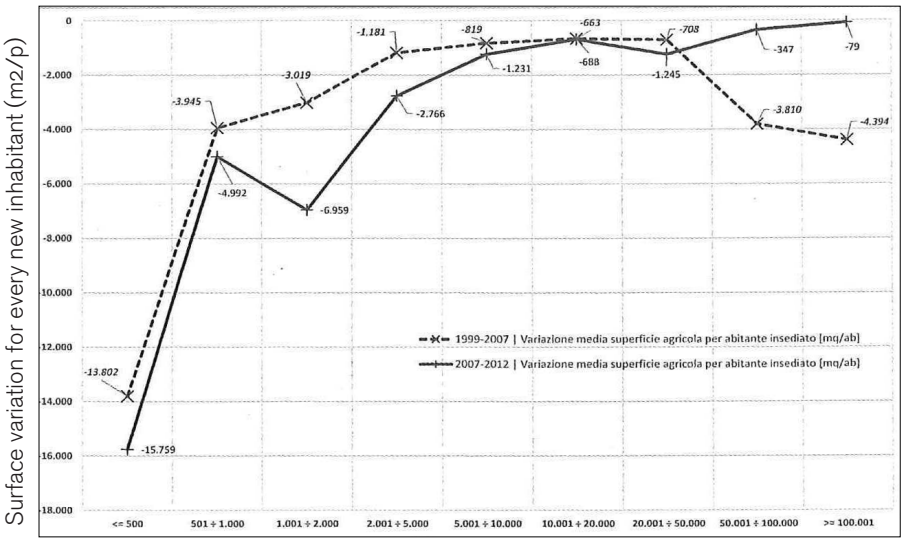
As previously mentioned, this political configuration it is inherited from the past, however, it has now been reinforced by a conservative view on territorial administration (Marescotti, 2014), too “static” over time to acknowledge the new “post-metropolitan” condition and its implications for land-use planning. As a consequence planning boundaries were never redesigned.

The specific processes underlying this urban expansion might better be understood as an incremental Regional growth guided by small (in size) and fragmented (in geographical terms) municipalities.
During the last 30 years the magnitude of land consumption, urban dispersion and soil sealing have been raising (figure on upleft).
As a matter of fact, this pattern of "territorial production" induced an incremental depletion of ecosystem services, in the following pages i will especially concentrate on the issues of landscape fragmentation and hydraulic risk.

Eventually, the issue of "*oneri di urbanizzazione" is* also a generator of multiple negative environmental dynamics. The latter is the tax revenue that municipalities gain when changing the local land use plan, e.g. from agricultural to built up areas.
Due to the financial shortages in which most municipalities lies which is also due to their small seizes, most of them are willing to give away more land for development (based on high increase in population, which are nevere verified) in order to restore their financial balance. It is again a cultural, economic and political issue, coming from an historical perspective leading to a dispersed urban horizons and soil sealing.
The behaviour of these political units in relation to environmental degradation is clear in the figure on the right.

"Ecologies, unlike buildings, do not respect borders. Instead they range across territories, and establish complex relations operating simultaneously at multiple scales, from microscopic to regional".

Stan Allen on Landscape Infrastructures in *Infrastructure as architecture, designing composite networks*, 2010



Municipalities classified according to number of inhabitants (p)

Figure:
Showing marginal soil consumption for each new inhabitant.
The graph shows a positive correlation between small municipalities and higher consumption of land per capita.
The dotted line indicates the period from 1999-2007; the continuos line from 2007-2012.
Moreover, it is clear from this graph the implications of smaller administrative units when condiering soil sealing
Source: Paolo Pileri in cosa c è sotto, based on DUSAF and ISTAT

B) Environmental:

Urban development = soil sealing = depletion of Ecosystem Services

The forementioned political issue generates structural consequences in the alteration of the environmental dynamics of the region. This particular type of urban development relentlessly transfor untouched grounds into seaed surface, which disrupts a variety of natural processes. This dynamic is also better described with the notion of Ecosystem services depletion.

The latter are the set of services which nature provide to human at no cost (MEA, 2008). Indeed, soil is a complex set of biotic and abiotic elements, which play a vital role in regulating the complex interactions between land water and air (Pileri 2013).

The disappearance of open soil comes along with a loss of carbon storage (250 ton Co2 for 1 Ha), potential food production (1 Ha potentially feed 6 people/Year) and water absorption (3,8 Mln litres of water). In the northern part of the metropolitan area of Milan. This territory is among the most sealed in Italy (Legambiente, 2014). Specifically within Seveso river catchment, once an untouched alluvial plain, now, 44% of its surfaces have been sealed (Conti, 2014), see figure on the page 15.

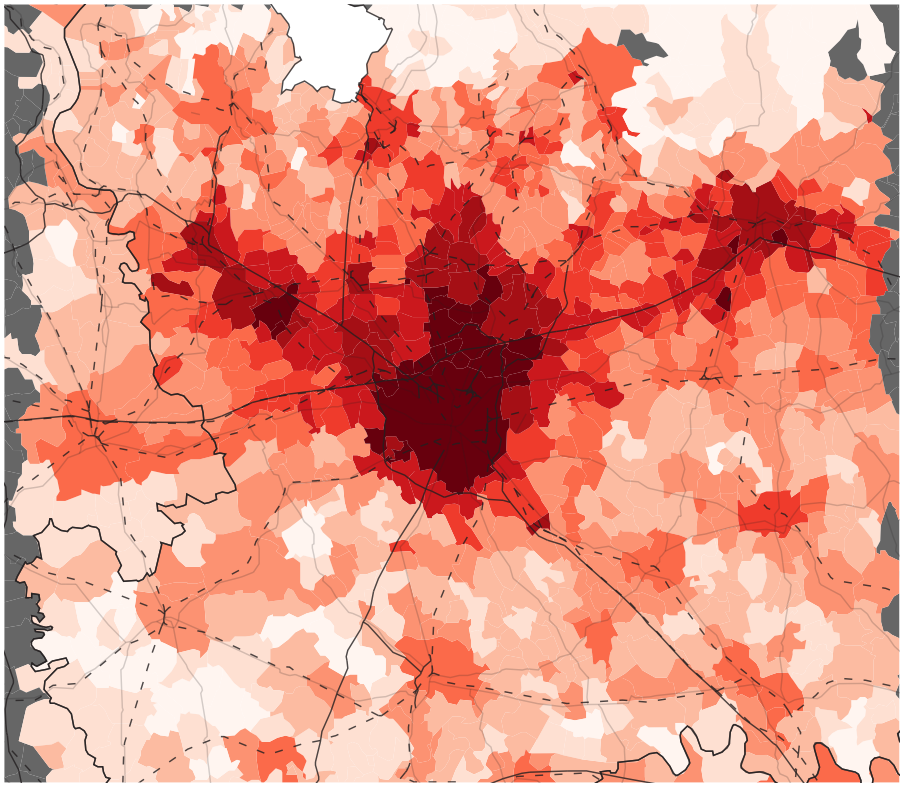


Figure
showing the percentage of sealed surfaces and the seveso river sub basin.
Image, source: Overlay made by auhor based on Atlante dei territori Postmetropolitani

lombardy region:
44.770 ha
of soil sealed between
1999 - 2012
(Pileri 2015)

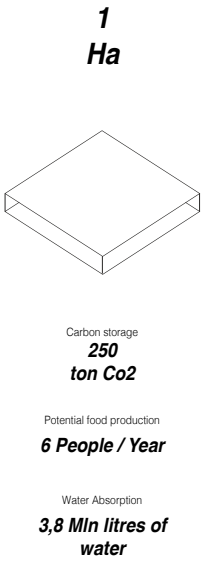


Figure
showing quantitative data of ecosystem services for one hectar of land.
Image made by Author based on Pileri, 2013 .

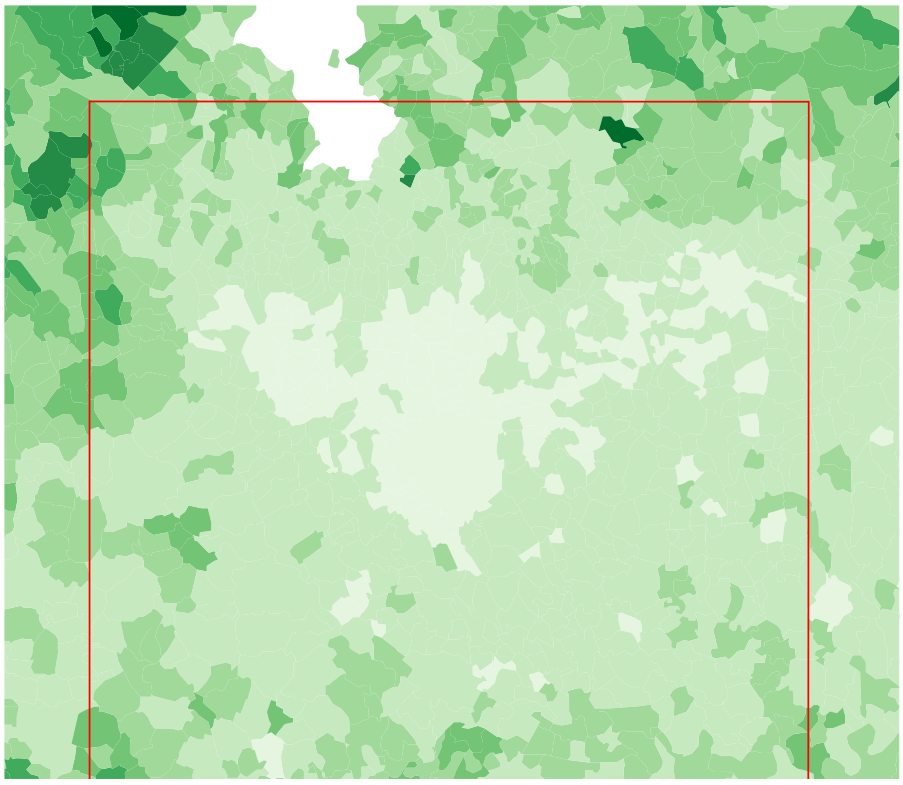
Urban development = soil sealing = depletion of ES = Landscape Fragmentation

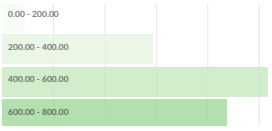
This imposition of specific dynamics of the anthropic domain on open soil, not only depletes the natural capital upon which it materializes, but also, almost irreversably fragment the landscape.

The latter is a complex system made of structural and functional interactions, and by fragmenting it, these interactions parlty cease to exist. The movement of species along with their operative function on patches stops to perform without connectivity of landscapes.

This disruption of continuity, is still yet to be taken into account in the urban development agenda. Indeed, atleast the italian context don't have the tools to deal with such transcalar processes. Regions and provinces should be dealing with such dynamics, however the only tool in their hand is the PTCP, territorial plan of provincial coordination, which brings forward ecological corridors and nature preservation as objectives but it lacks the legally binding mechanisms to superimpose such transformations and conservations to lower administrative units.

Anyhow, while the topic seems to have historycally been embraced only by conservation ecologist and life scientist, recently there has been a multisectorial emphasis on this processes (see the important EU document on the next page) and also urbanist and landscape architects recognize the importance of working in a certain direction, one that take into account defragmentation strategies and reactivation of landscape functions at multiple scales and for multiple benefits (Valsecchi, 2011).
The "ecological project" in the urbanism discipline, thus becomes central in bridging and relating certain questions and re-disclosing nature through projective design.





Number of Municipalities in each class.
White is the most fragmented while green is the most connected

Figure
showing the percentage of fragmentation in the landscape within the different municipalities. The drawing was made by using the software Fragstat, much used in landscape ecology, to understand the degree of non connectivity of green areas with multiple ecological implications. Moreover, it is clear to see the correlation betwen soil sealing and habitat fragmentation in the pictures showned in these two pages.Image, source: Atlante dei territori Postmetropolitani

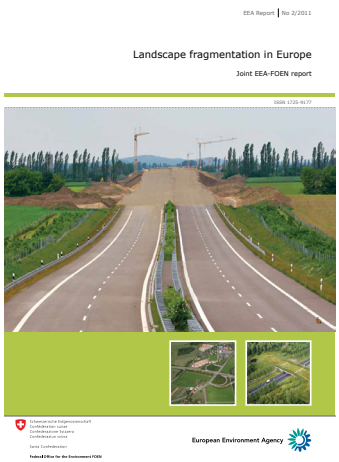
Urban development = soil sealing = depletion of ES = Landscape Fragmentation

As we can draw from one of the most recent and comprehensive publication on landscape fragmentation made by a collaboration between the Swiss Federal Office for the Environment (FOEN) and the European Environment Agency (EEA), processes of urbanizations and their manifestation in space are the most important cause of structurally and functionally fragmented landscapes.

The report paints a worriyng picture in which not only roads and circulation systems divide wildlife movement but also depletes and alterates landscape patches into sealed surfaces, as we previously saw, this is connected to an irriversible process of carbon / water cycle alteration.

<u>Landscape fragmentation: processes of change.</u>

From the outlook of ***landscape ecology***, these processes of landscape depletion and isolation include:
Fragmentation: (i.e. breaking up a larger/intact habitat into smaller dispersed patches)
Dissection: (i.e, splitting an intact habitat into two patches separated by a corridor)
Perforation: (i.e, creating holes within an essentially intact habitat)
Shrinkage: (i.e., the decreae in size of one or more habitats)
Attrition (i.e, the disappereance of one or more habitat patches)

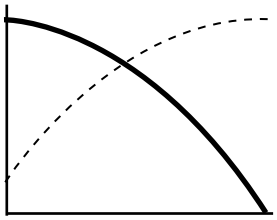


Landscape fragmentation in Europe (2011)

"andscapes are the setting for all human activities, providing a home to humans and all other life forms. Landscapes change constantly but in recent decades humans have often shaped them with little thought to the cumulative impacts and at a pace that is unprecedented. The value of landscapes is not yet fully reflected in decision making on transport infrastructure and urban development. Considerations such as biodiversity and landscape quality are often marginalised"...

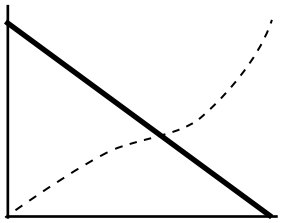
Fragmentation is not the only negative externality stemming from this political - spatial situation. Indeed processes such as: Urban Heat island effect, alteration of hydrological regime, depletion of Nitrogen loading and retention, and loss of biodiversity are all connected to specific patterns and processes of urbanizations.
Inspired by the legacy of Urban Ecology which seeks the theorization of the effects of urbanization on ecosystems, on the right as we can see in the figures, the environmental indicators show a negative correlation between ecological performance and the “anthropic” degree urbanization patterns.

Human Ecosystem functions



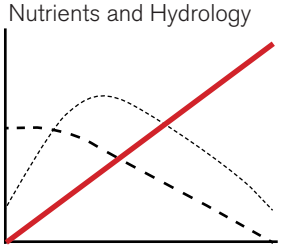
Human Resources input
Biological process rates

Climate and land cover



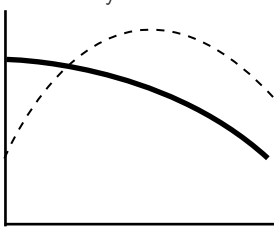
plant/soil cover per unit
Late afternoon temperatures

Nutrients and Hydrology



Runoff
Nitrogen retention

Biodiveristy



Native bird species
Synathropic spaces

Figure
showing a gradient of green areas in the urban region of Milan. From untouched space (prealps on the left) to a comlete alteration of landscape by humans on the right. Image made by author based in google earth.

B) Environmental: stormwater management

As we saw in the previous page specific territorial transofrmations have been impacting in various ways the ecological performace of the region. This "negative" relations are clearly visible in relation to the altered hydrological regime in the Seveso Sub-basin, in the North of Milan.

Here below it follows a more indepth investigation on the alteration of hydrological regime due to uncontrolled urbanization.

This investigation was usefull to understand the degrees of risk which have come along these transformations, nevertheless it provides interesting insights into the field of urban water management and its relation with landscapes.

The river Seveso sub basin within a total surface of 225 km2, urban areas account for more than 100 km2, in its most southern part, closer to the city centre of Milan, out of 36km2, 24km2 have been "urbanized" (67% of total surface is sealed),
(AIPO, 2011)

The capacity of drainage system in the seveso area is engineered for a rainstorm with a return period of 2 – 10 years, and can't deal anymore with the incremental water runoff due to relentless land consumption over the past 50 years (figure on the right). The average runoff is believed to be at 89 l/s/ha (AIPO, 2011), while the old regional normative was of 40 l/s/Ha, while the new one is set at 20 l/s/ha.
If we take the runoff generated by a storm events with a return period of 2-10 years by the microbasins located after the CSNO (compensation / deviation discharge canal) as we can see in the figure bottom left, within the municipalities of Paderno, Cusano, Cormano, Bresso and Cinisello Balsamo, the discharge is of 49m3/s and the threshold reach is of 30m3/s at the redefossi canal (figure bottom left) which is where the seveso has been "tombinato" buried underground.
The conflict and environmental risk is obvious and clear even for such a short return period.

Urban development = soil sealing = depletion of ES = runoff = Hydrogeological risk.

It is clear how the lost of infiltration capacity of the sandy soil underpinning these territories coupled with administrative fragmentation, have been incapable of constructing and managing over time the urban water management system.

All these quantitative data and the processes underliyng the generations of them are contributing to a major *risk of pluvial floods* in the Seveso sub basin. The risk is explored visually in the page on the right and in the next page.

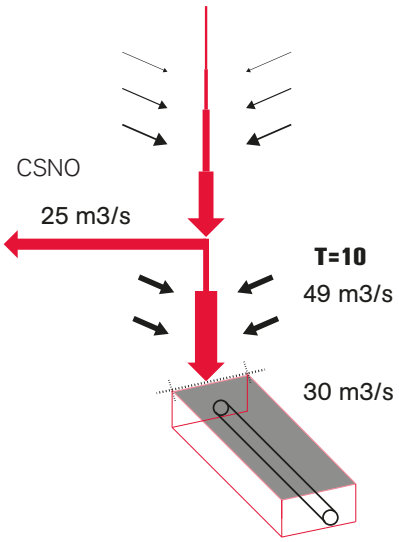
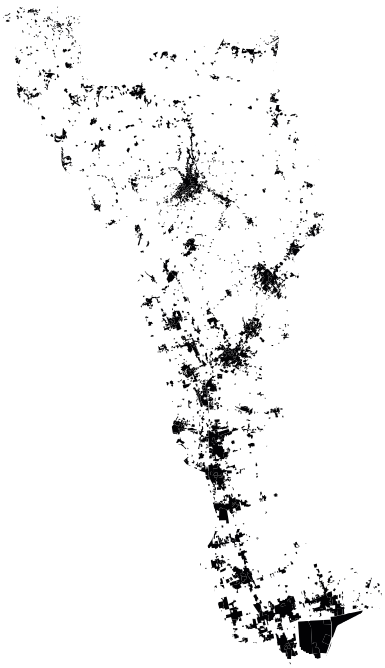


Figure
Showing a schematic representation of the sub-basin discharge mechanism. Especially, wants to highlight the part of the river downstream of CSNO which, being the most sealed, overload the Redefossi system (underground drainage) with a return period of 10 years. This schematization of flows and engineering interventions helped me to understand the specifc risk allocated in this altered watershed. It further let me to important considerations of location chioce.
Image made by author.

TIA Total Impervious Area

1954



2015

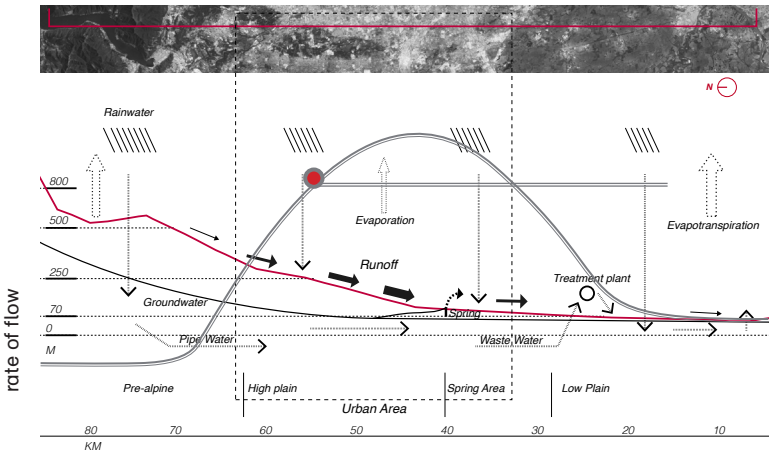
Figure left
shows the toral impervios areas in 1954

Figure right
shows the toral impervios areas in 2015, the implications for stormwater tunoff becomes quite clear.

89 l/s/ha
Average runoff of one hectare in the area

20 l/s/ha
New regional / landscape normative for water runoff in urban areas.

The alteration of hydrological regime due to uncontrolled urbanizations is here visualized trough a “cross referential drawing”: a conflict between the fixed Water capacity of the “linear” engineered drainage system and the scattered and incremental development (related to administrative fragmentation) of built up areas in the Hydrological units (sub-basin).



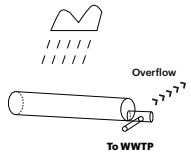
runoff

Figure

Showing an overlay of the urban region of milan from an aerial picture, coupled with a section, showing the topography and the water cycle altered by human settlements.
In addition to this, it shows the discharge curve (in grey) and the linear, fixed capacity of the urban drainage system (grey) and the tipping point (red), where inundations occurs.

Fixed System T:2-10

-Combined Sewer Overflow



1980 59 floods

2005 20 floods

Figure

Showing pluvial flood event in milan North (1965).

C) Socio - spatial: Green desert

Last but not least, the metropolitan area of milan is one of the lowest in Europe in terms of green areas per capita, as we can see in the graph at the bottom of the page.

This condition majorly Impacts the livability of the place not only in terms of public space fruition and lack of spatial qualities. As we can draw from a recent publication, *Spazi verdi da vivere*: *il verde fa bene alla salute,* made by a consotium led by IUAV University in Venive, the document is an extensive disclosure and collection of researches, which have been conducted worldwide, on the role of nature in providing health and visual aestethics and a please environment to people which live close to it.

As an opposite effect we can speculate on the non-livable conditions which this lack of distributed green areas generates in the metropolitan areas and the hardly quantifible effects on health and well being on the inhabitants.

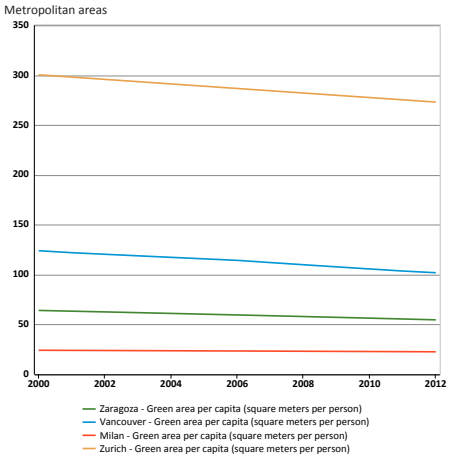


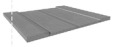
Figure
showing a graph odescribing an index related to green areas per capita in metropolitan region across the world. Although we have to contextualise the results (being Zurich in the alps for example) Milan is still at the bottom of the rankings.
Source: OECD 2015

Composite landscapes: Visualizing relational thinking

Elements of territorial production.

Diffuse / Dispersed / Discontinuos Urban Typologies

Concrete



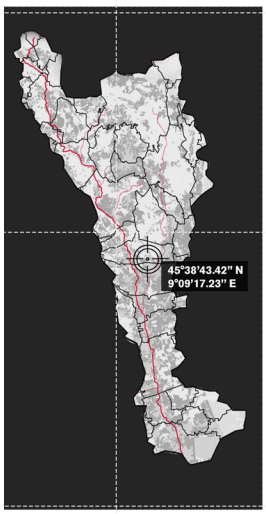
Water management infrastructure: Manhole

Water management infrastructure: subsurface drainage

Building permits

Municipalities

Scale issue: Administrative VS Landscape



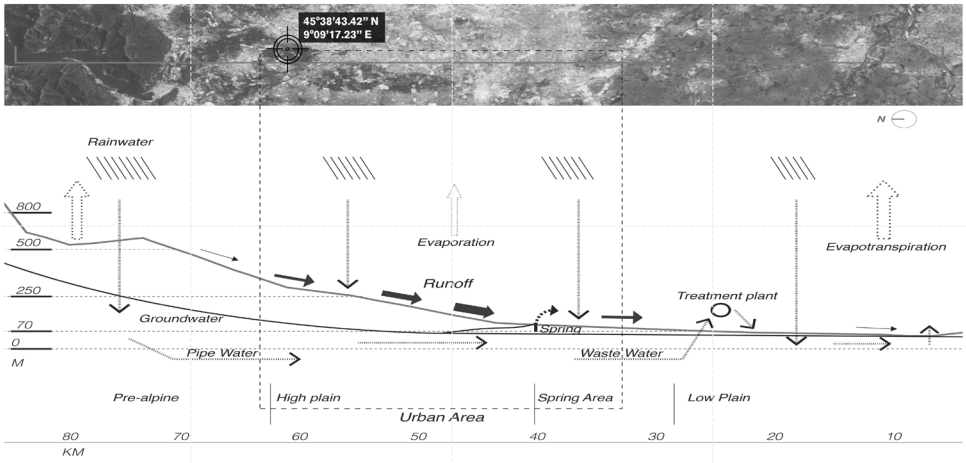
Urbanization 2015
Urbanization 1950
River Seveso
Natural and artifical hydrology

Composite Landscape

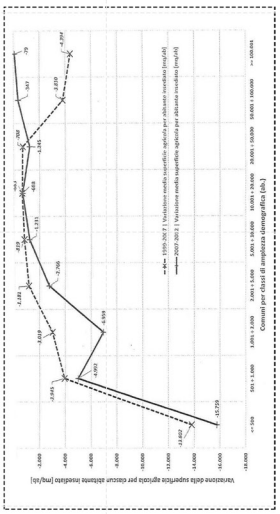
Landscape Fragmentation

Highest fragmentation
Medium fragmentation
Lowest fragmentation

An altered hydrological regime Section / plan



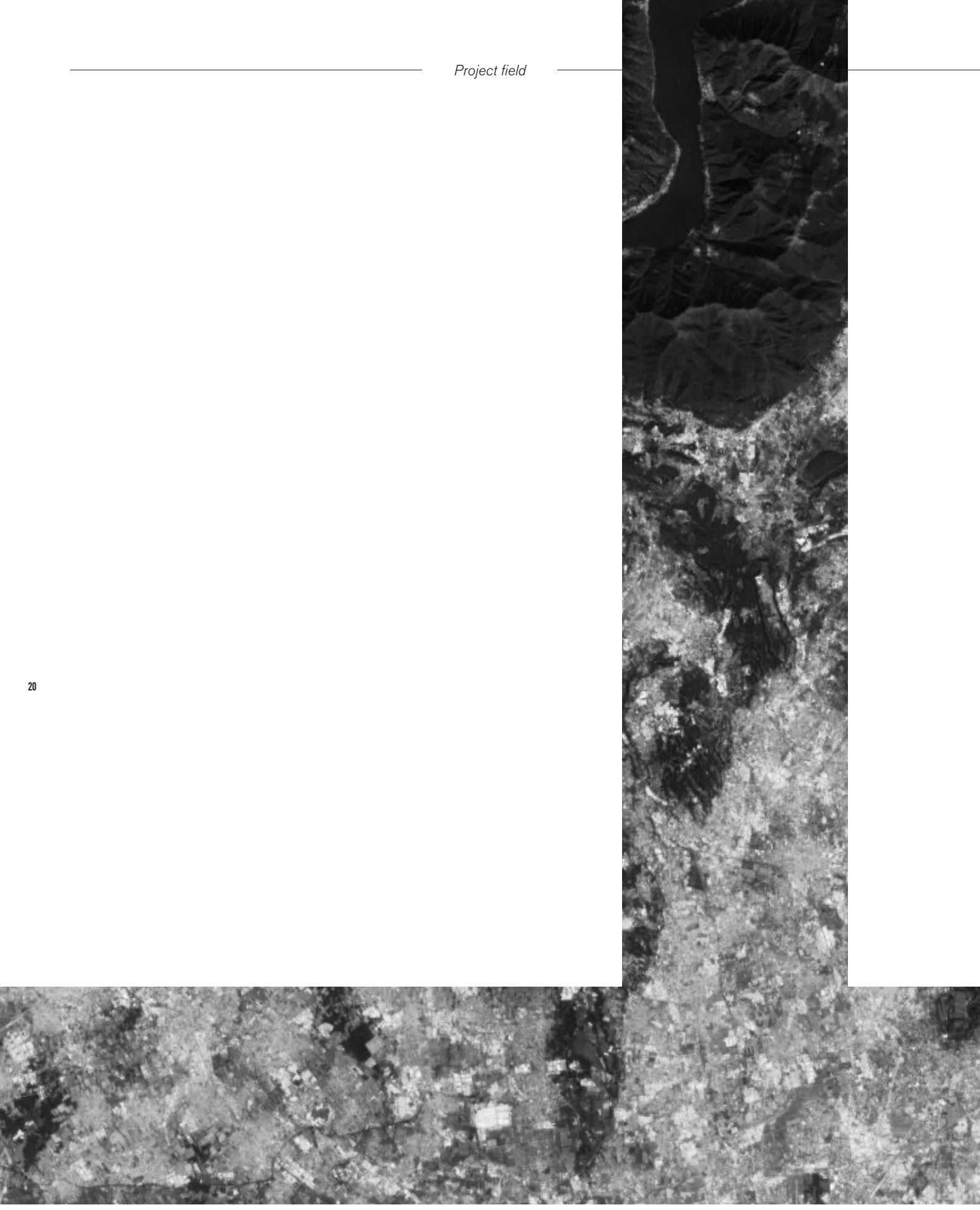
The role of municipalities



"I would claim that the relational system is just as important as the material realm, if not more so, because territory, in my conception, is the result of the production of actors. This is a fundamental idea expressed by Henri Lefebvre (1991 [1974]) in his The Production of Space..."

"Relationship, rather than space, is suggested to be at the conceptual core of territory, so that spatial and non-spatial territories can be seen as superimposed one onto the other and endowed with multiple connections, according to different scales and degrees of visibility".

Claude Raffestein in Space,
territory, territoriality, 2012



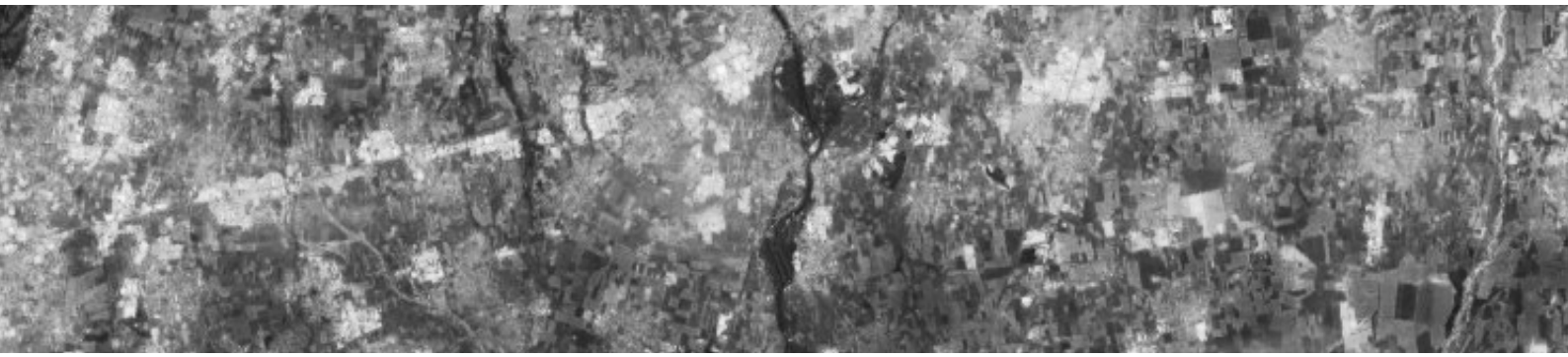
N

0.2 Problem statement:

The urban region of Milan is the most prosperous and economically rich area in Italy, it alone accounts for 20% of the national GDP (ISTAT, 2011). It is the physical representation and spatial outcome of a diachronic and tumultuous process of human occupation, starting in the "roman epoch".

This process of growth has contributed enormously and in various ways on the "wealth" and on the prosperity of the region, and of the state, however, due to the specific features and processes which have underlied this growth in the past 50 years and the current structural inability to govern the territory, several issues related to environmental degradation are affecting the region.

The main issues are related to the depletion of ecosystem services and specifically the fragmentation of landscapes and the risk of pluvial flooding.



Project field: toward a projective approach

In the following paragraph, in the light of the issues brought forward from the problem field and statement, the project advances a series of objectives, hypothesis, research questions and methods to underpin and develop an analytical, conceptual and projective approach.

0.3 Objectives

▪ The general objective is to to embrace a transcalar approach toward the understanding, planning and design of the urban landscape.

▪ To achieve flexibility in green – blue transcalar design by exploring the indeterminate and open ended dimension of the design process.

▪ To defragment the landscape through green –blue infrastructural design.

▪ To mitigate pluvial flood risk in the Seveso river basin.

0.4 Hypothesis

▪ Transcalar design of green-blue systems addresses the issue of landscape fragmentation through landscape connectivity.

▪ By exploring open ended and indeterminate processes the project increases inbuilt flexibility in the achievement of the objectives according to various contingencies.

Territorialism / De-territorialization

Throughout the project field and also further on in the projective part of the project, the spatial conditions at stake have been conceptualized through the lens of territoriality. I.e. a system of relations which defines the complex "imbroglio" of layers shaping and transforming territories.

Under this lens the project frames the field of spatial issues as a process of deterritorialization, i.e. a disconnection, loosing ties, between the natural processes (landscape), and occupational patterns. In this sense the disconnection between the river and its natural floodplain, an increasing engineering of territorial administration, of the water cycle and the incremental mariginalization / fragmentation of landscape patterns.

This process, is conceptually linked to the notion of *deterritorialization* (Deleuze, Guattari, 1972) as a powerful theorethical insight, which is, in this case adapted and concerned with the process of disconnection, between the natural and the human sphere, both geographical and cultural.

Overall, this condition raises an interesting question whether or not urban and landscape planning and design, as a discipline, shouldn't only be concerned with land use instruments for territorial development, but should conceive land / soil / and water as dynamic and interlinked entities **that should be planned and designed synergistically.**
A powerfull concept to change this trajectory is given by the notion of re-territorializaiton (deleuze and Guattari, 1987).
To regain the lost connection trhough a re-projection of new relations between the human and natural sphere through a systemic / transcalar urban and landscape planing and design.

0.5 Vision:
Re-territorialization

Thus the vision advocate for a transcalar projective approach in which natural and urban development are conceived synergistically, and mutually supporting instigating a new assemblage (delueze and Giattari, 1987) of human and non human relations.

"a way in which different human and non human actors and factors can interrelate, generate cross-factorial alliances, re-codify and re-territorialise space".

Jean Hiller on deleuze and Guattari.

"Territoriality as a system of relations is also a system of exchanges and, consequently, a system of flux of all sorts between exteriority (the physical environment) and alterity (the social environment)".

Claude Raffestein in Space, territory, territoriality, 2012

0.6 Research Question

Main research question:

▪ How to systematically design green – blue infrastructures at multiple scales?

Sub research questions:

▪ How can the exploration of indeterminate and open-ended design processes (the temporal dimension) add value to the process of designing green – blue infrastructure at multiple scales?

▪ How to program the transformation of the urban fabric with green – blue elements?
- How can this transformation adapt to various contingencies?

▪ How to define “fixed” and “dynamic” elements in transcalar design?

▪ How can the spatial manifestation of green – blue infrastructures help to reintroduce spatial qualities in the built environment?

0.7 Methodology

In this paragraph the core methodology and the design thinking / process approach are disclosed.
The core of the methodology mainly develops two key dimensions, fields, i.e. :

1) Scales and 2) Time

The methods used are mainly based on the theoretical / design insights and implications theorized by Formann and Godron in 1986, with their publication: Landscape Ecology. Subsequently, Formann in 1995 with Land Mosaics: The ecology of landscape and regions, Nevertheless on the methodology used by Bacchin in her recent PhD thesis: Performative nature, Urban Landscape infrastructure design in water sensitive cities, 2015.
These among others have influenced the methods used and to be used in the graduation year.

1) Scales

Crucial in the method to be unveiled is the concept of scales. The latter is important when dealing with landscape dynamics (Lter, 2015). Indeed, they determine the degree of heterogeneity, which we are able to see (Forman and Godron 1986).
The scales are mostly set by geomorphological boundaries, sujch as the river basin, the sub basin and the micro-basins. Topographic scales, could provide a strategic argument to plan across jurisdictions (Belanger 2010), and are believed to determine appropriate management units for integrative approaches (Ferreira et al 2008).

The system of landscape scales is crucial for the transcalar work and presents hybrid moments of analysis / synthesis coupled with a projective goal in every scale.
Last but not least the higher scale always inform the smaller scale with a design “input / agenda”.

Landscape.

Landscape Ecology:
Patches, Corridors and Matrix

As previously mentioned, the field and notion of Landscape ecology strongly influenced the guidance of the project since the beginning. It became particularly usefull in setting and influencing the methods and notions (vocabulary) to be used and provides the connective factor, the straegic link between ecological theories and infrastructural design (Bacchin, 2015).

The patches, which compose a “mosaic” are depicted analysed and projected at different scales. At the Macro scale they represent large patches of open spaces and regional parks and important nature based areas. At the Meso scale the full extent of the patches of the territory, i.e. local municipal green areas are visualized and compose the Landscape Infrastructure matrix areas to be reactivated.

The corridors provide strategic connection between patches in order to provide connectivity, which permits environmental function to perform (Ahern, 2015). The corridors (green and blue) will be the network link, to restore the fragmented environmental condition at stake. The latter will also function as the strategic link between scales.

Corridors will be represented by specific existing infrastructural axis of the mobility network. This method also introduced by Bacchin, 2015, follows a topographic and soil analysis.
The network hierarchy is given by the ecological relevance of the green patches to be connected. The actual projection, i.e. exploration and manifestation of the spatial transformations in the corridors and patches will be disclosed in chapter 5) genealogies and 6) Micro - nano chapter.

In this view two main products guide and unfold the design process through scales with potentials. Urban - landscape Syntax at the Macro scale and Landscape Infrastructure Matrix at the Meso scale.

The syntax, inpart portrays green - blue elements that set the objectives and prioritise environmental restoration of biophysical systems, specifically the spatial goal is landscape defragmentation, and secondly ecosystem services replenishment and reactivation. It seeks a restoration of the complex dynamics between, soil (carbon sequestation), air (air quality) and water (water quality and stormwater management) in the region sub basin. The “urban” elements (circulations / corridors and surfaces /

patches) projected at this scale serve as an ecological strategy to keep and preserve the integrity of the green - blue systems by attracting and accomodating urban demands.

The matrix (3.1) and the syntax (2.1) will embed the patches (retrofitted and existing green areas), and the corridors (existing and retrofitted / reactivated green and blue "linear" elements) meant as armatures for urban and landscape development, facilitating interactions between natural and human systems (Nljhius and Jauslin 2015) and perform from a stormwater management perspective.

Moreover, the matrix will serve as the representational and infrastructural backbone of a planning strategy (a mix of an opportunistic and offensive strategy à la Ahern), a vision, or a possible landscape configuration that it employs restoration, or reconstruction, to re-build landscape elements in previously disturbed or fragmented landscapes In order seek opportunistic and innovative functions in association with urban infrastructures (Ahern, 2007). This strategy is deployed through the Urban - Landscape Syntax projection at the Macro scale.

Eventually patches and corridors are also usefull to divide circulation systems (corridors) and surface reprograming (patches), this division it's made clear most of all in the two "key scales" the macro and the Meso. The division / representation and projective approach of macro patches and corridors, meso patches and corridors (of macro importance) and meso patches and corridors (of meso importance) have been a key interscalar step in the production of the project.

Geomorphology and soil

Crucial in the methodology is the understanding of pedological and geomorphological carachteristics in the area.
Specifically the topographic position index at various scale influences directly the operations to be made.
Nevertheless soil analysis will be crucial to understand natural performance of the territory.
Eventually, TPI and soil provide the basic "suitability" index for nature based infrastructures to perform and for the programm which can best be attacched to it.

2) The temporal dimension

Open ended and indeterminate design processes are explored as a way to add inbuilt flexibility to the transcalar design in order to cope with various contingencies. In this view, the project seek to explore the notion of *event* coupled with the underliyng notion of *space.*

Scenarios

The first method of exlporation of the notions just introduced is the scenarios exercise (4).
In the light of unpredictability and uncertain futures, the scenarios adopted from the Delta programme are visualized at the Meso scale through A Landscape Infrastructure matrix adaptation plan.

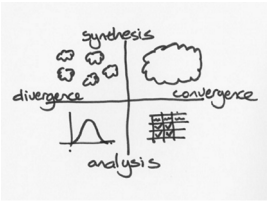
Genealogies (open ended - inderterminate design)

The project undertakes the exploration of the temporal dimension as a key step in the transcalar design, with the aim to seek adaptive and anticipatory operations for the implementation of green - blue elements at the runoff source units (Nano scale) according to various contingencies.

The *genealogies* (5) in this sense provide options of spatial tranformations in time according to the specific morphologies.
The genealogies at the nano scale not only have been produced according to patterns of spatial conditions, but also according to to the DUSAF classification of private built typologies.
Patterns of spatial conditions have been detached at the meso scale through a process of spatial synthesis based on dimensioning. The spatial genealogies are a key component of the project for their comprehensive and adaptive entity to link scales and explore indeteminacy.

Eventually the correlation between genealogies and scenarios are set next to each other in order to recombine events (scenarios) and shape (spatial adaptation) thus establishing the programmatic agenda according to various contingencies.

Design thinking



Tim Brown in Design Thinking, IDEO blog, 2008.

The underlying methodology of the graduation work stems from the process of integrative design thinking.

Design thinking refers to specific cognitive procedures that designers operate during the design process. Introduced by Herbert A. Simon in 1969 it refers to the ability of the designer to embrace a complex thinking process in which convergent and divergent thinking coexist and reinforce each other in a non – linear way.
As Tim Brown, CEO of successful business design company IDEO, puts it: “Design follows a series of divergent and convergent steps. During divergence we are creating choices and during convergence we are making choices.” Divergent thinking gives us the potential to imagine and to generate new possibilities, while convergent thinking takes decisions, focuses on specific goals and test / reflect on the design outcome (Queen, 2015).

As opposite to classical engineering techniques in which the focus is on problem solving, design focuses on problem framing and on the relations and interplays between parts. This process, of relational thinking, of synthesis between seemingly remote dynamics has also been engaged by progressive designers such as Pierre Belanger (Going Live: from States to Systems, Pamphlet Architecture Series 35, 2016) James Corner (The agency of mapping, in Landscape imagination, 1999.), and it is arguably been typical of the humanistic disciplines (Rizzi, 2007). Relational thinking gives us the ability to decodify the complexity of the multitude layers shaping territories and to project its recodification. It permits to seek and explore seemingly hidden interrelations between various spatial and social domains; the political and the spatial, the material, the immaterial, the empirical and the fictional, the surface and the subsurface, the biotic and the abiotic and most importantly the macro and nano scales…

Operatively, design thinking is deployed through the medium of mapping, thus informing the interplays between analysis and synthesis. This process unfolds as an interlocking action of separation and classification of elements and a moment of relation / synthesis between them.
Dealing with complex systems such as socio-ecological systems i.e. cities and territories, the ability to decompose, recompose, decodify and reframe problems and solutions becomes key.

Hence the project undertakes Design thinking through the agency of mapping in every scale. Each scale unfolds as a hybrid moment between Analysis and Synthesis in order to reach a specific Projection. More simply, every scale contains various mapping steps / exercises (visible as circles in the Methodology diagram in the next pages) some of them also informs (as an input) the consequent scale.

Integrative design thinking through mapping, Keywords:

Analysis:
Decodification, Disassembling, Selection, Separation, classification…
Synthesis:
Relational thinking, Interplays, Interlinks, Simplication…
Projection:
Re - Operationalization, Recodification, Reassembling, Re - materialization, Imagination…

Programming - Manifestation

The methodology as explained sets a sequence of scales to be researched and designed. Specifically the first part of the project aims at “setting” the operational system, i.e. programming “re-naturing” in Milan urban region, while the Micro-Nano scale wants to physically manifest and spatially materialize a specific outcome of the programming process.

"The term projective thus embraces the creative and speculative ambitions of representation - the drawings and often heuristic models that scientists, designers, and other use to help demonstrate and explain ideas. In many cases it is through the work of modeling, whether writing or drawing, that ecological ideas have continued to emerge and are clarified".

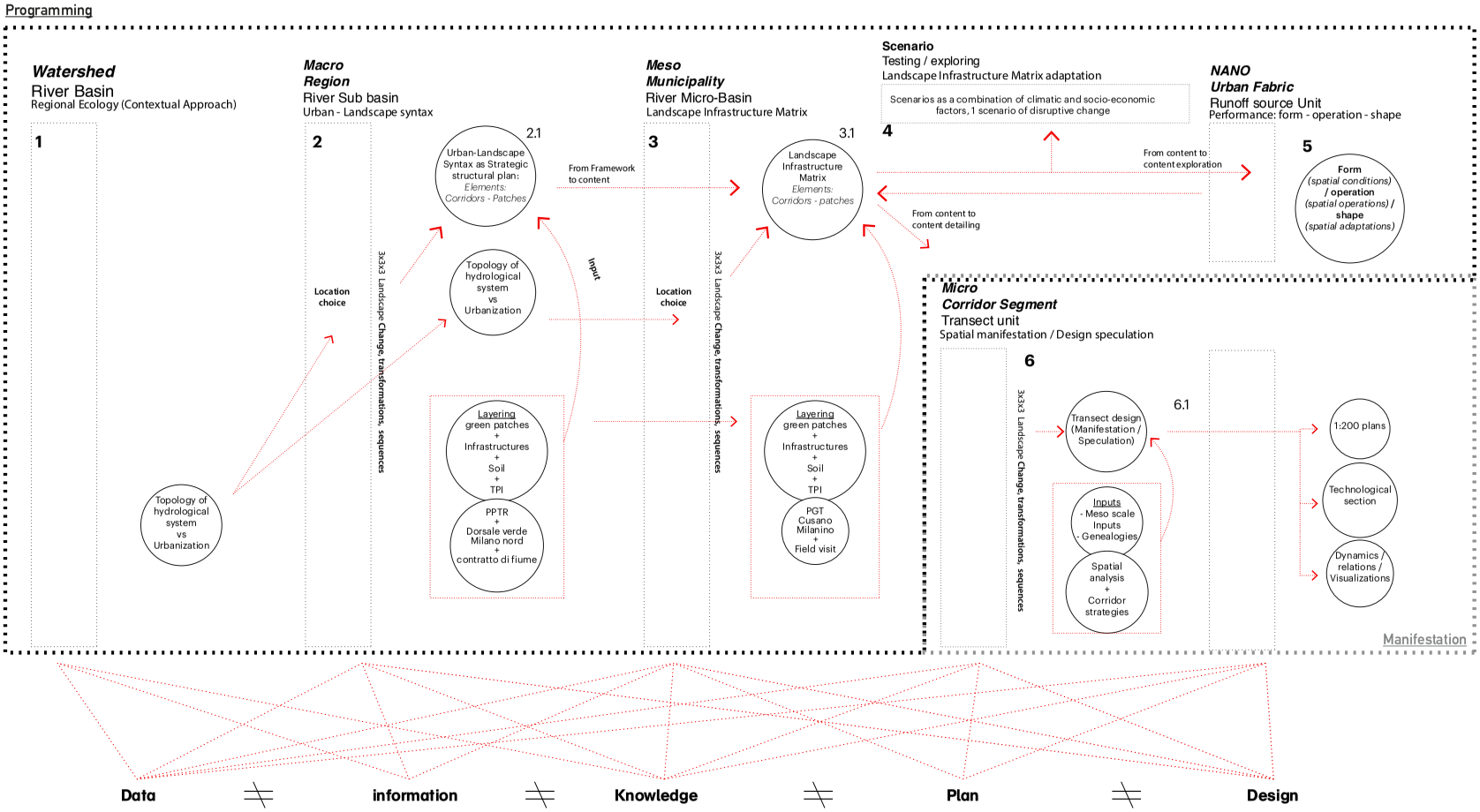
Chris Reed, Nina Marie Lister in Projective ecologies, 2014

"Through rendering visible multiple and sometimes disparate field conditions, mapping allows for an understanding of terrain as only the surface expression of a complex and dynamic imbroglio of social and natural processes. In visualizing these interrelationships and interactions, mapping itself participates in any future unfoldings. Thus, given the increased complexity and contentiousness that surrounds landscape and urbanism today, creative advances in mapping promise designers and planners greater efficacy in intervening in spatial and social processes".

"...Thus, the various cartographic procedures of selection, schematization and synthesis make the map already a project in the making. This is why mapping is never neutral, passive or without consequence; on the contrary, mapping is perhaps the most formative and creative act of any design process, first disclosing and then staging the conditions for the emergence of new realities".

James Corner in The Agency of mapping, in Landscape Imagination, 1999.

Method design process



Link between sub-research questions and methods

1) How can the exploration of indeterminate and open-ended design processes (the temporal dimension) add value to the process of designing green – blue infrastructure at multiple scales?

- *Design Method*: Divergent Thinking… Analysis + synthesis + projection
- *Core Exercise*: 4) Scenarios + 5) Genealogies
- *Page*: 98 - 125

2) How to program the transformation of the urban fabric with green – blue elements?

- *Design method*: Analysis + synthesis + projection
- *Core Exercise*: 5) Genealogies
- *Page*: 110 - 125, Genealogies Booklet, page: 0 -75

- How can this transformation adapt to various contingencies?

- *Design method*: Divergent / convergent thinking. projection of dynamic sequences of climate adaptive design at Micro scale.
- *Core exercise*: Genealogies booklet
- *Page*: 0 -75

3) How to define "fixed" and "dynamic" elements in the transcalar design?

- *Design Methods*: Projection
- *Core exercise*: 2.1) U-L syntax, 3-4) Meso = fixed Programmatic elements. 5) Nano = dynamic operative elements
- *Page*: (Fixed) 50 - 67, 81 -97, (Dynamic) Genealogies Booklet, page: 0 -75

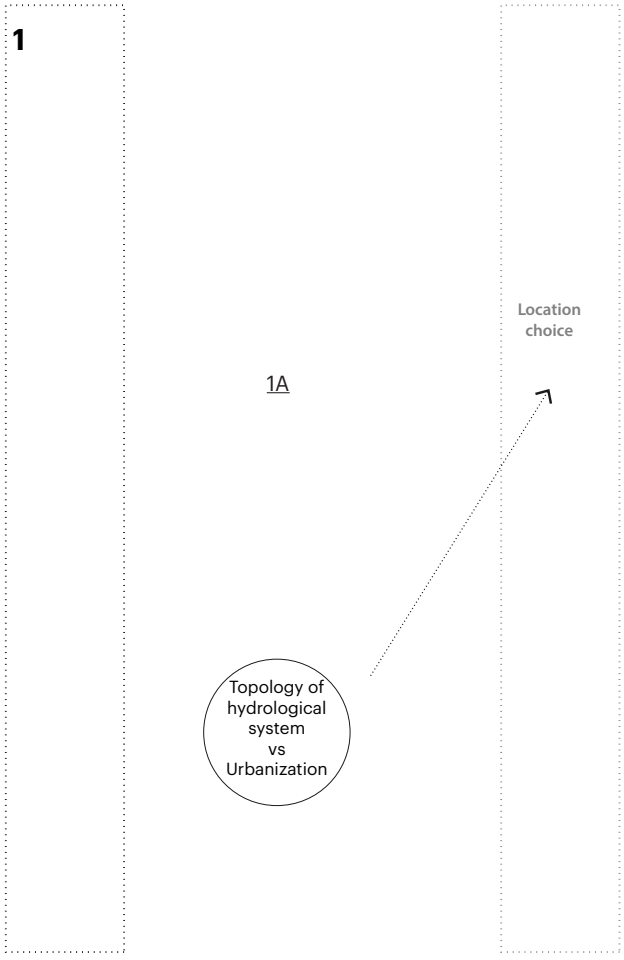
4) How can the spatial manifestation of green – blue infrastructures help to reintroduce spatial qualities in the built environment?

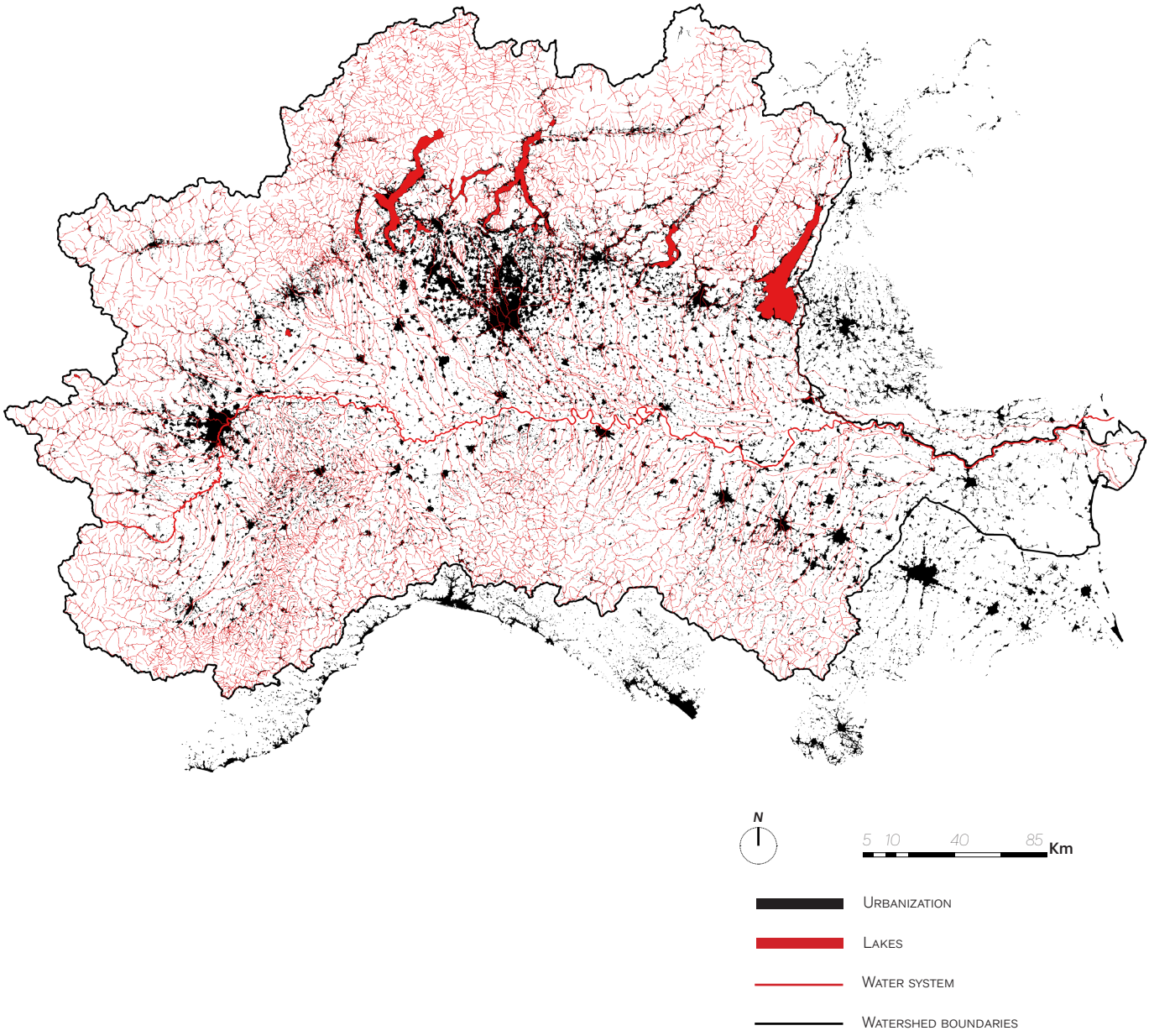
- *Design method*: Divergent / Convergent thinking Analysis + synthesis + projection
- *Core Exercise*: 6.1) visualizations / interactions / dynamics
- *Page*: 142 - 157

1. Watershed

The watershed, being the contextual scale served to inform the location of the consequent projections and manifestations scales.
This process of *information* and choice is disclosed in the next pages.

Watershed
River Basin
Regional Ecology (Contextual Approach)




N
5 10 40 85 Km
Urbanization
Lakes
Water system
Watershed boundaries

1A

As previously showed in the project field analysis, the magnitude of environmental degradation due to landscape fragmentation and hydraulic risk informed the process on focusing on the area just north of Milan.
While the project field was more focused on landscape fragmentation, the watershed contextual scale wants to underpinn further location choice with topological and relational analysis.

Understanding risk

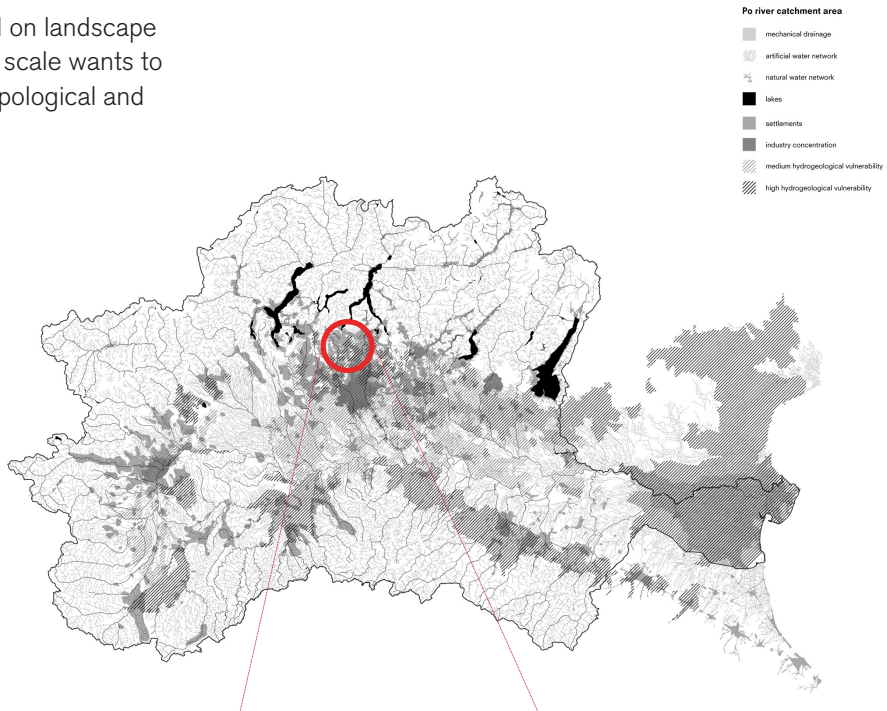


Figure
Showing the extent of the Po river basin,
ant the risk associated with hydraulic instability
of the territory,
source: Latitude Office

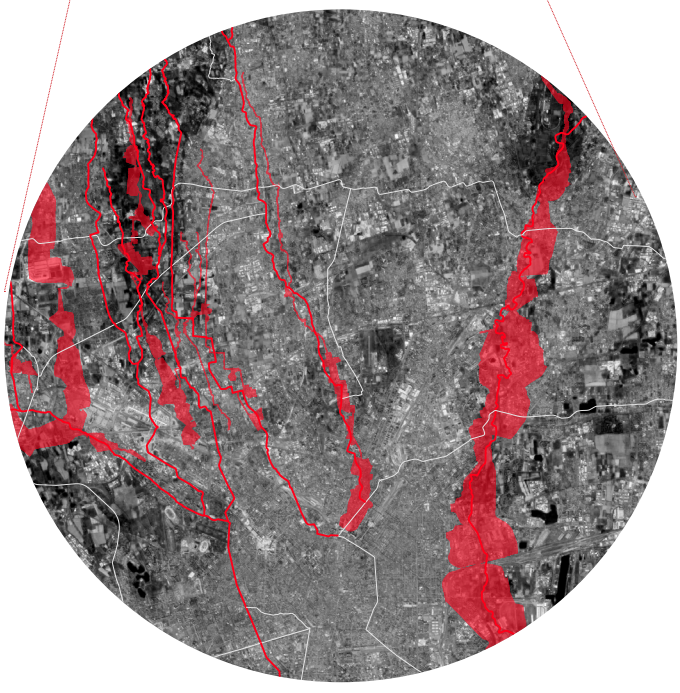
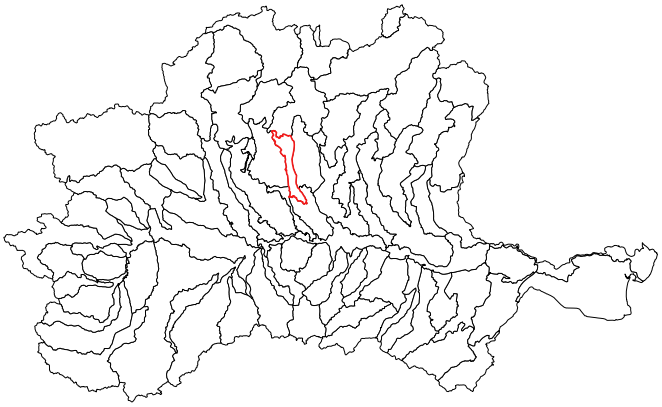


Figure
Showing the detailed hydraulic risk in the
metropolitan area north of Milan.
In particular the red shows the extent of the
most recent flooding.
Source, image made by Author.

71.000 km2

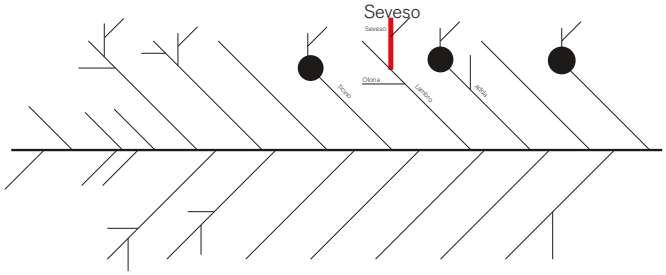
River basin



Figure

Showing the extent of the Po river basin, and its sub basins, in red the sub-basin of the seveso river.
Source: image made by Author

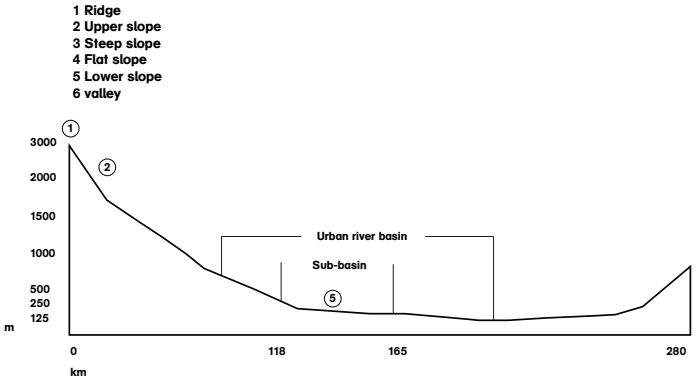
Topology



Figure

Showing the topology of the hydrological system in the river basin. In black are shown, schematically, the alpine lakes carachterizing the prealpine regions in Italy.
Source: image made by Author

TPI



Figure

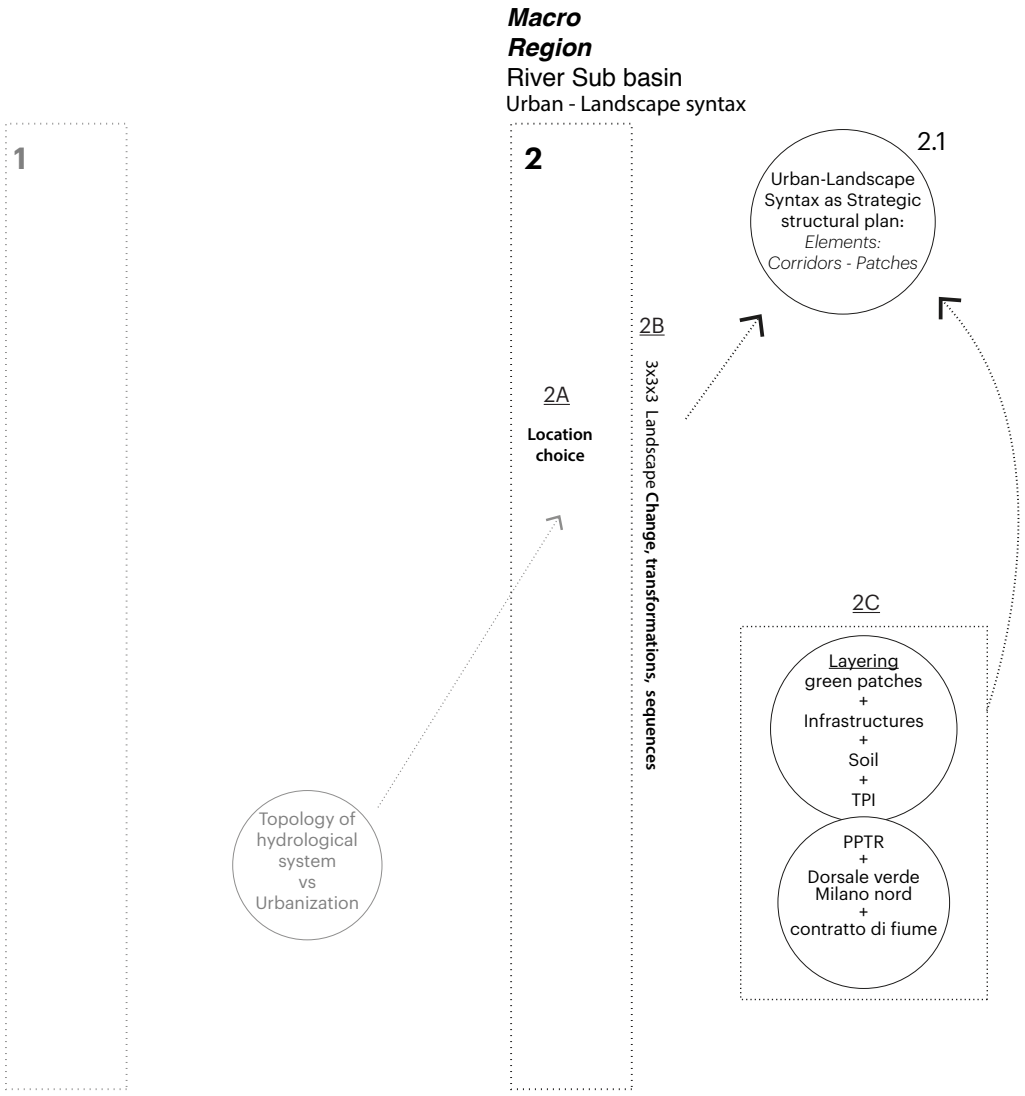
Showing the Topographic space index of the Po watershed, from the alps to the appennines. Moreover it shows the geomorphological condition of lower slope (5) of the sub-basin.
Source: image made by Author

2. Macro scale

Objective:
Urban - Landscape Syntax as the projective medium through which a series of temporal and spatial questions are synthetized - analyzed and reassembled. As the product which deploy landscape connectivity and sets macro objective for environmental performance of the region sub-basin.

Following, in this chapter, a reconstruction of the design process which brought to the objective. A disclosure of each step of the methodology, following the diagrammatic section here below.

Methodology Section

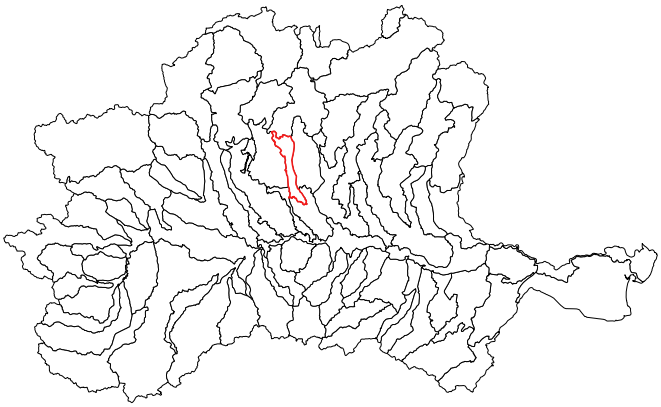


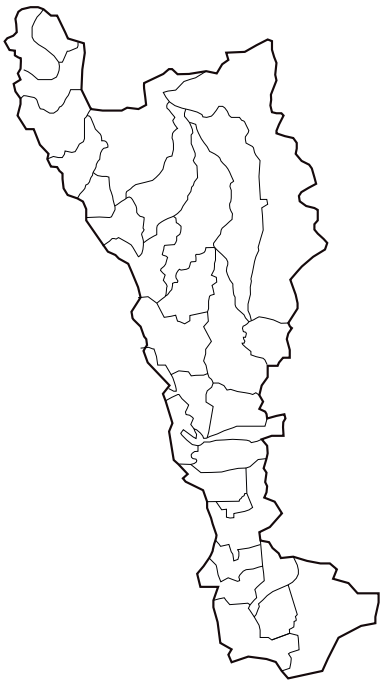
2A: Location choice

River basin

River Sub-basin

226 km2





Figure

Showing the hydrological sub basin of the river Seveso.

Image made by Author based on DUSAF

2B: 3x3x3 change, transformations, sequences.

The 3x3x3 exercise as part of the delta Intervention graduation studio required an understanding of the territory in a diachronic and multi-layers manner.

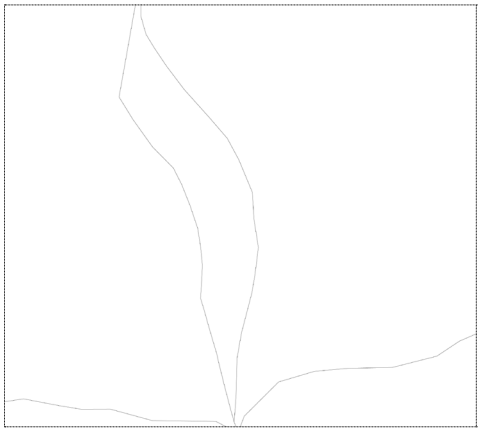
This process of tracing different layers of development boosted a series of consideration on the territorial formation of this area.

First it served to frame the problem field mapping exercise by understanding the magnitude of change in specific moment of human occupations. For example it informed the visualization of the distributed modes of territorializaiton in the region starting from the roman epoch, and the great advance of urbanization after world war II.

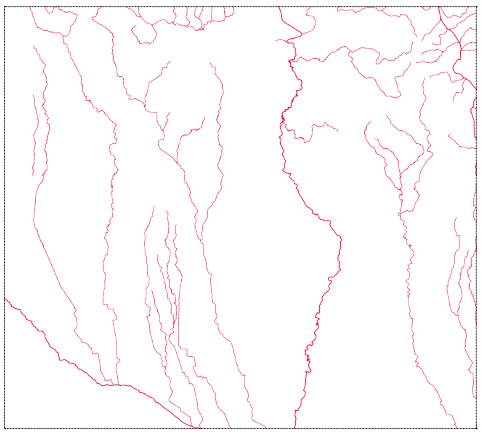
Secondly it sets the base for a visualization of small scale transformations that are repeted and aggregated at this large scale. In this sense the visualizations on the next page served to synthetize some of the key land use change as staging of surface sequences in order to understand that the repetition and aggregation / distribution of such processes on Macro scale is what define part of these territories.
In this sense it visualizes change from a *landscape ecology* perspective: "Change is the dynamics or alteration in spatial pattern and functioning over time" (Olson et all, 1996).

Last but not least, it irrigates the projective design with sensibility.
In this sense the projection (2.1) is always conceived as the next sequence suiting a much longer process of territorial formation.

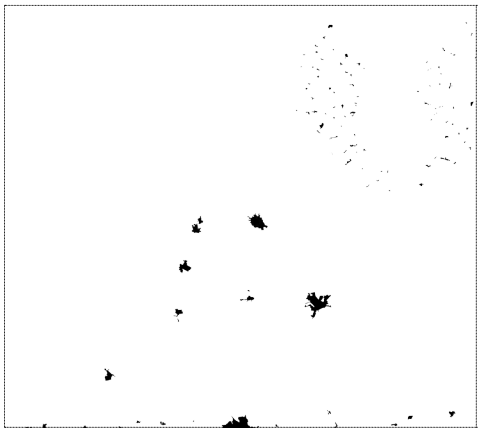
Roman Age



Infrastructure

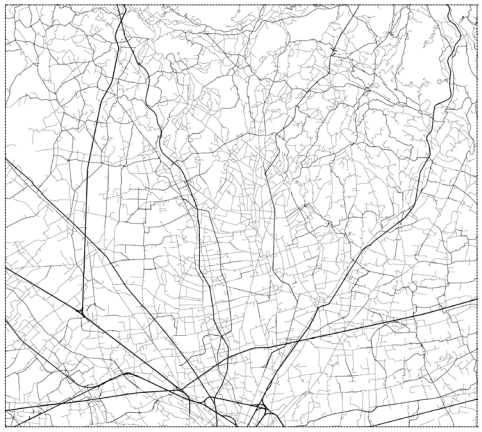


Landscape

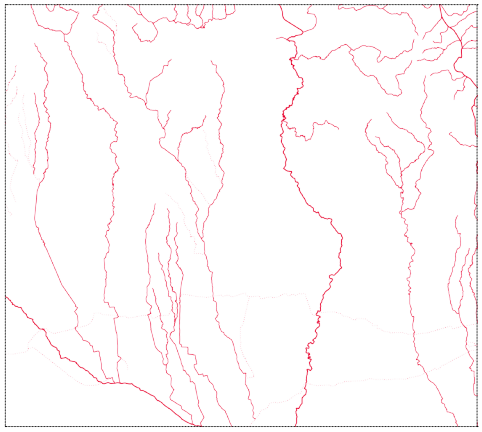


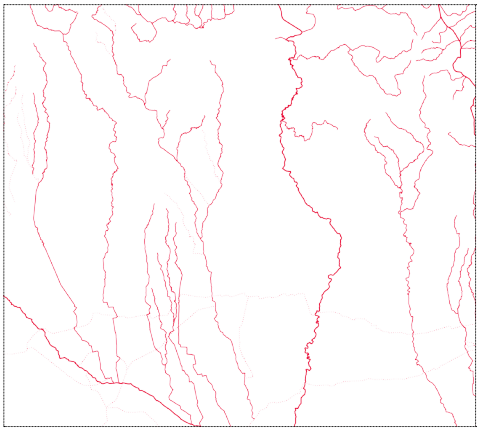
Occupation

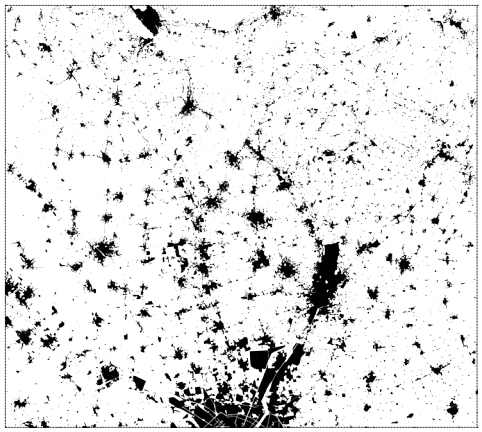
1954

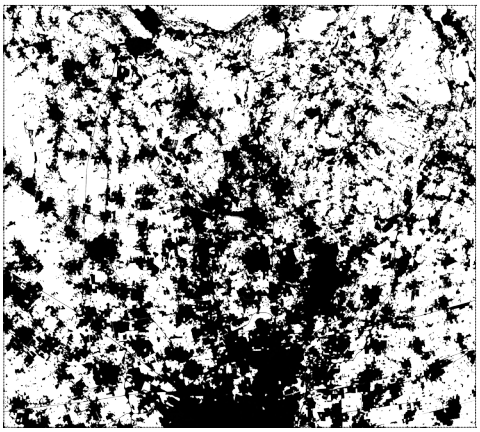


2016







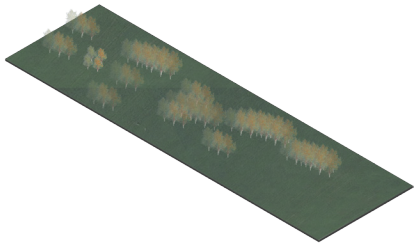


Green patches:
Land use change, staging surface sequences in time.

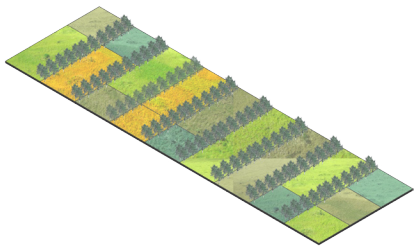
The sequences of transformation visualizes key territorial tranformation at a Nano scale. It also inform the analytical process of territorial tranformation with understanding. Moreover by synthetizing land use change sequences in a spatial and transcalar way, the material and geometrical disruptions over time is visualized.

From the outlook of a landscape ecology perspective, these sequences of transofrmation (change) inform the spatial dimension of the dynamics which cause landscape depletion and isolation over time.
These processes include:
Fragmentation: (i.e. breaking up a larger/intact habitat into smaller dispersed patches)
Dissection: (i.e, splitting an intact habitat into two patches separated by a corridor)
Perforation: (i.e, creating holes within an essentially intact habitat)
Shrinkage: (i.e., the decreae in size of one or more habitats)
Attrition (i.e, the disappereance of one or more habitat patches)

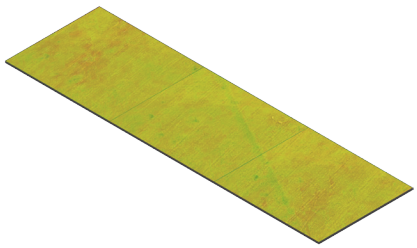
These land use change sequences always end with the actual spatial condition, and the problematique beyond that condition. By tracing and redrawing these sequences it starts a process of inquiry toward the imagination of the next sequence of green patches.



Brughiera (moorland)
Native Landscape



1700
Parcelation (subdivision)
Re-Arrangement
Policulture



2016
Monocultures
Landscape "Banalization"
Landscape Vegetation Subtraction

Ecosystem Services Depletion

From green patch to corridor:
Land use change, staging surface sequences in time.

The sequences of transformation visualizes key territorial tranformation at a Nano scale. It also inform the analytical process of territorial tranformation with understanding. Moreover by synthetizing land use change sequences in a spatial and transcalar way, the material and geometrical disruptions over time is visualized.

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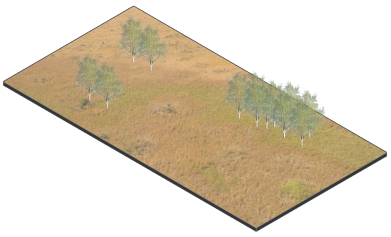
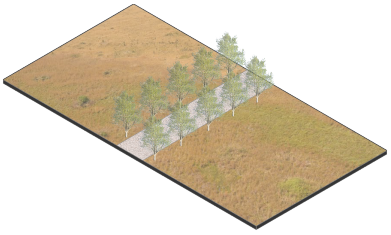
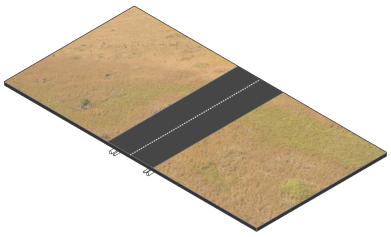


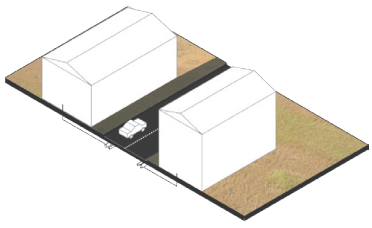
Territory:
Native landscape



Landscape Subdivision
Landscape Addition



Landscape Subtraction
Landscape Fragmentation

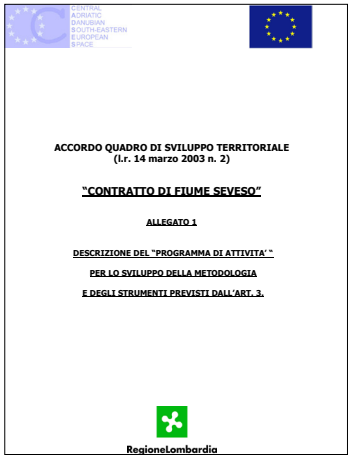


Soil Sealing

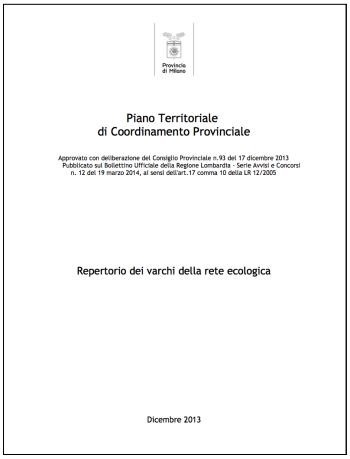
Dissection - Fragmentation - degradation - lack of spatial qualities

2C Layering

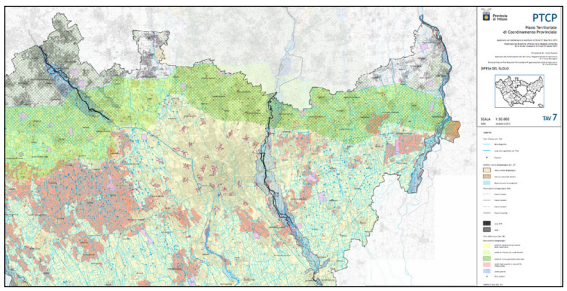
Objectives / Process: documents used
Building upon existing programmes and plans.
The layering section is the key part of the projective dimension of each scale and it shows the process of layering and relations between elements that underpinned the projection (2.1)



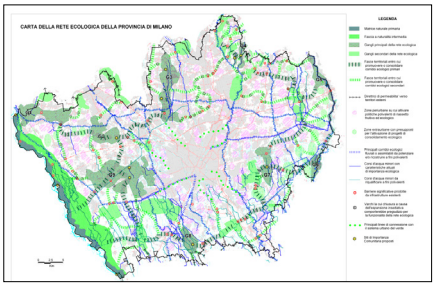
"Contratto di fiume"
Fluvial contract



Territorial plan of the province of Milan, *ecological networks.*



Soil defense and environmental zones province of MIlan



Ecological networks and environmental protected areas in the province of Milan

Pedemontana Highway in the north of Milan. Public work to be finished in 2020

Contratto di Fiume :

The most important tool to endorse for its strategic ability to build institutional capacity, and guide territorial trnaformations to mitigate hydraulic risk.
It is also an important tool due to the fact that it is one of the few government mechanisms to plan and think beyond municipal boundaries.

"Nel febbraio 2004 la Regione Lombardia ha avviato con soggetti pubblici e privati un'attività di concertazione e integrazione di politiche per la tutela e valorizzazione delle risorse idriche e la salvaguardia dal rischio idraulico per il T. Seveso, in quanto il relativo bacino idrografico presenta gravi problematiche di sicurezza idraulica e una pesante compromissione della qualità delle acque e dell'ambiente circostante.

E' stato quindi promosso il "Contratto di Fiume Seveso", Che è diretto alla realizzazione di un programma di attività ed interventi che interessano l'ambito connesso al corso d'acqua. Gli obiettivi di seguito specificati, per rilevanza e complessità, necessitano un approccio integrato su area vasta e sono:
a) la riduzione dell'inquinamento delle acque.
b) la riduzione del rischio idraulico.
c) la riqualificazione dei sistemi ambientali e paesistici, dei sistemi insediativi afferenti ai corridoi fluviali.
I soggetti sottoscrittori si impegnano a sviluppare o ri-orientare le politiche ambientali per concorrere a connettere gli spazi aperti residuali in una rete verde, al fine di realizzare un corridoio ecologico N-S quale elemento strutturante di una rete ecologica di bacino; promuovere, per questa rete, funzioni ecologiche, fruitive, di mitigazione del rischio idraulico e del rischio di inquinamento; promuovere la rinaturalizzazione delle fasce prossime ai sistemi infrastrutturali lineari.
d) condivisione delle informazioni e diffusione della cultura dell'acqua.
Il Contratto è promosso dalla Regione Lombardia e stipulato con: Amministrazioni Comunali , Amministrazioni Provinciali di Milano e Como, Ambiti Territoriali Ottimali (ATO) di Milano (Città e Provincia) e di Como, ARPA Lombardia, Autorità di Bacino del fiume Po, Agenzia Interregionale per il Po (AIPO), Ufficio Scolastico Regionale Per la Lombardia, Parco regionale Spina Verde di Como, Parco regionale Nord Milano, Parco regionale delle Groane, Parco regionale Agricolo Sud Milano, PLIS Grugnotorto-Villoresi, PLIS della Brughiera Briantea".

From contratto di fiume, Regione Lombardia

2C Layering

Objectives / Process: layers
Toward Urban - Landscape Syntax...

Objective = Landscape connectivity

Geomorphology

TPI

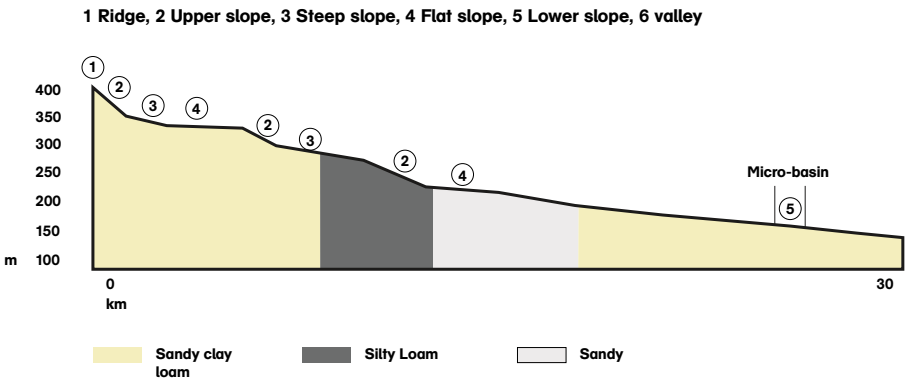
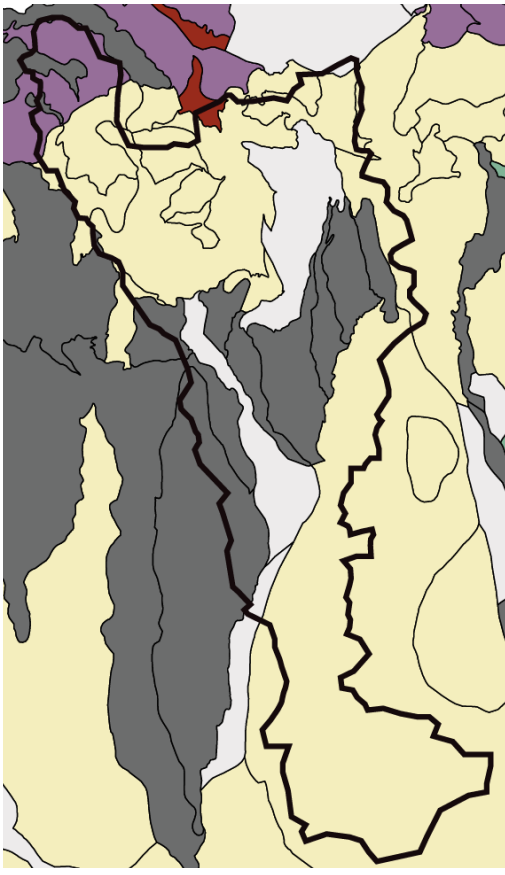
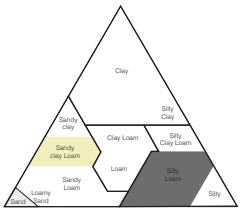


Figure 6.9,3
Showing the topology of the hydrological system of the Seveso, in red are shown compensation and deviation canals, such as the historical villoresi canal and CSNO.
Image made by author

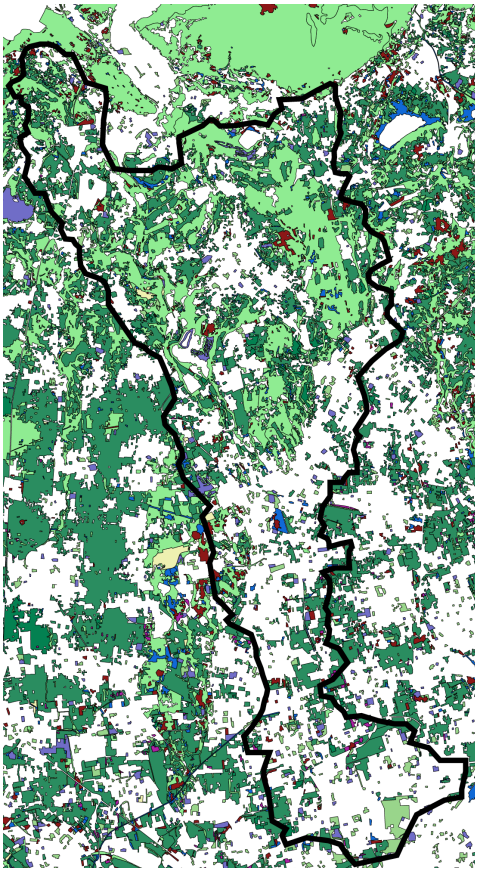
Soil Analysis





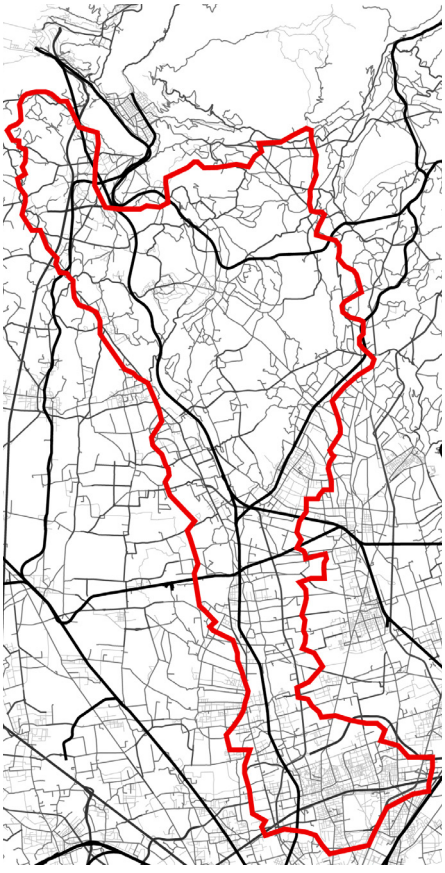
Showing soil structure sceheme with the soil specific of the area,
Image made by author based on USDA.

Green patches



- Agriculture
- Fields
- Natural vegetation
- Woods
- Urban green
- sport areas
- Biomass production
- Orchard

Mobility network



- Highways
- Primary road (tangenziali)
- Secondary road
- Tertiary road
- Railway system

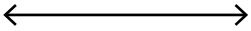
2C Layering

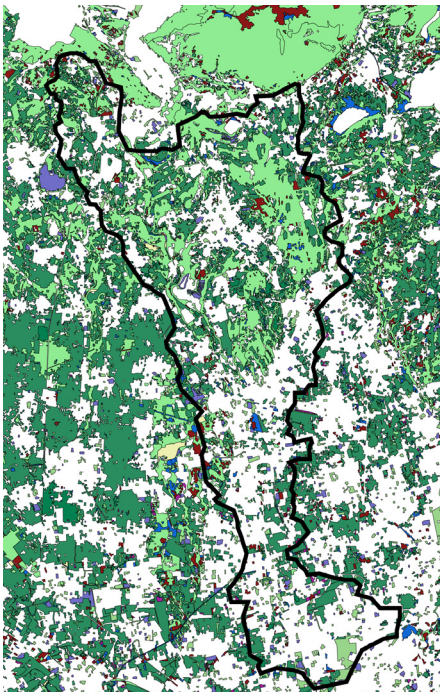
Objectives / process: Hierarchy definition.
Toward Urban - Landscape Syntax.

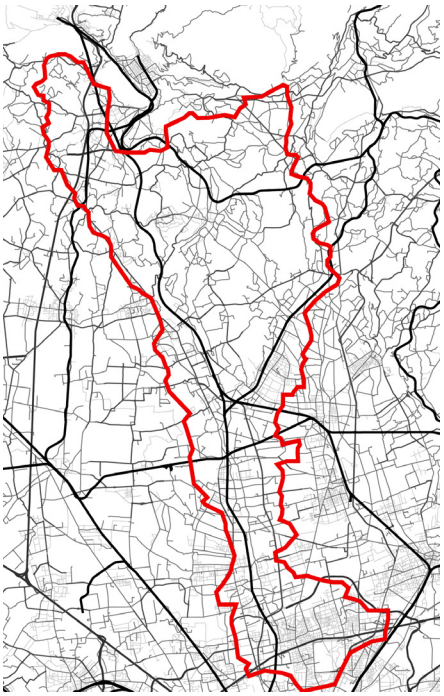
Objective = Landscape connectivity

Patches

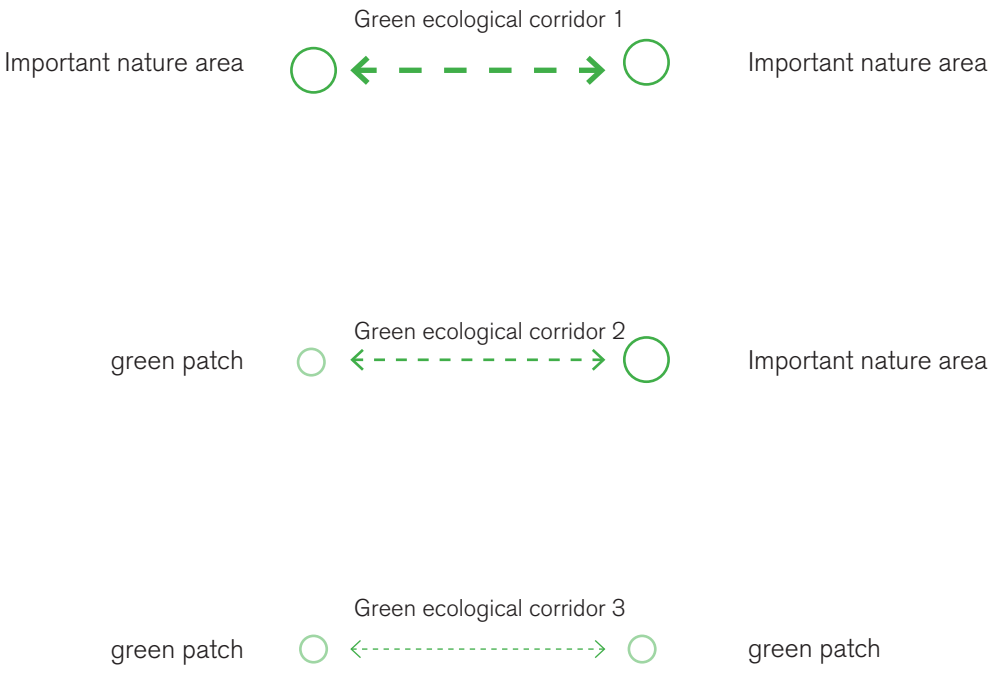
Corridors to retrofitt





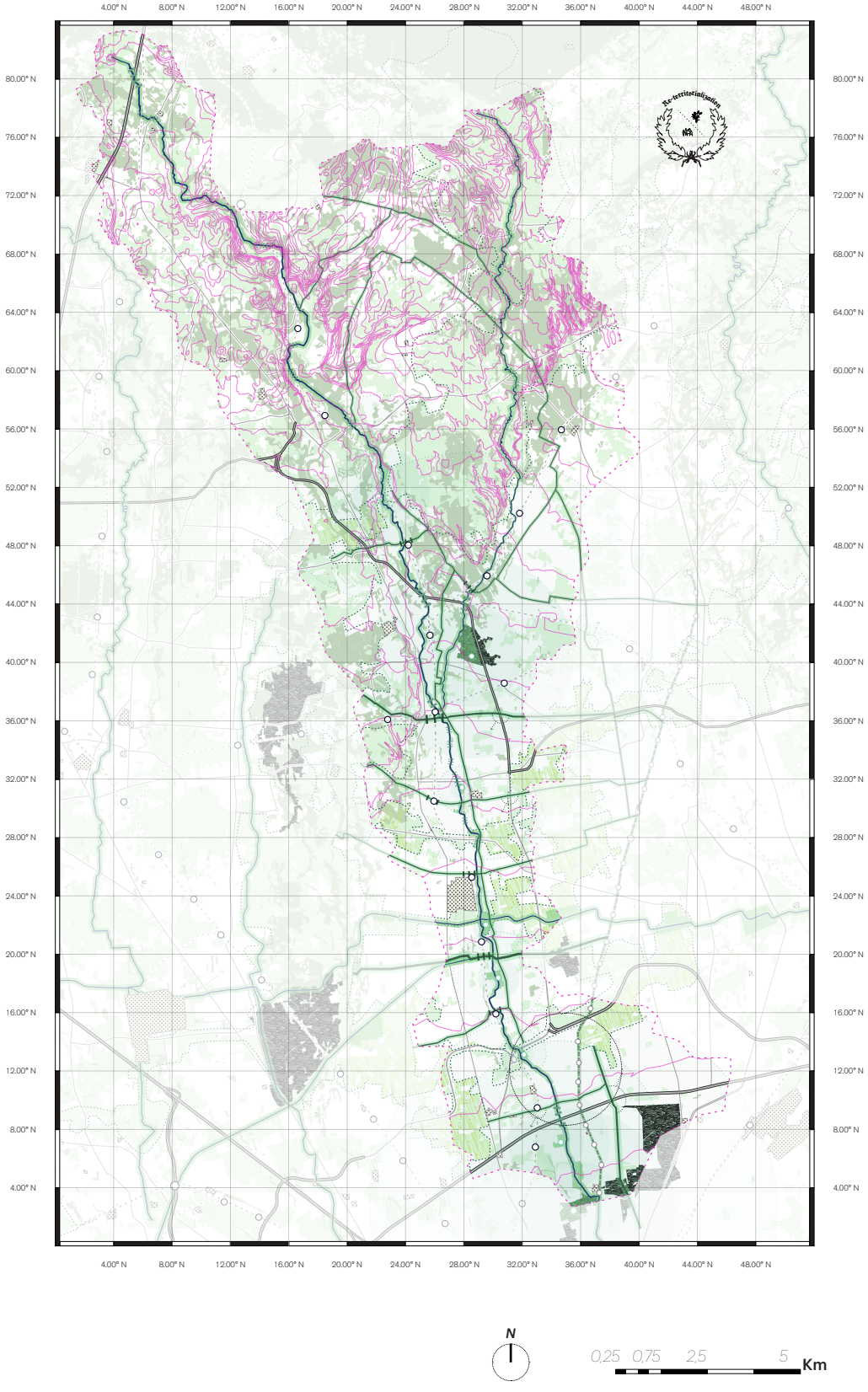


Corridors hierarchy definition



2.1 Urban / Landscape Syntax

- Circulation systems and Surface programming

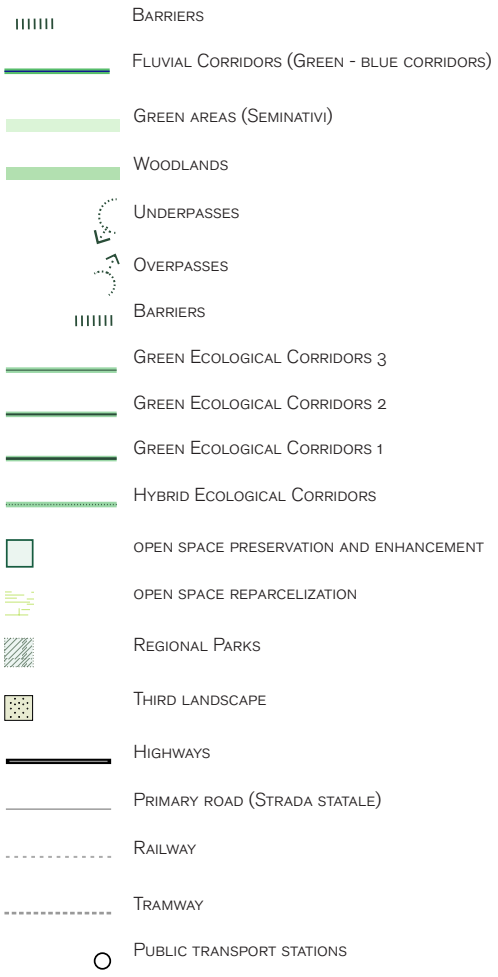


Objectives:

Landscape De-Fragmentation
Hydraulic risk mitigation
Ecosystem services reactivation
Toward Zero Soil consumption
Urban Regeneration and renewal
A new project for the countryside

Administrative tools:

- Contratto di fiume
- PPTR



The urban / landscape syntax at the macro scale mainly steer 4 dynamics:

- It physically links the urban landscape, by maximizing connectivity and circulation.

- It channels and accomodate active programms along and within these circulation corridors.
For instance, they establish a stromwater strategy that slows runoff form the impervious areas and unload the pressure of the combined sewer system.

- It frames and preserve large spaces of open landscape both by guiding the reprogramming of open spaces as well as by attracting / accomodating urbanity along the compact settlements elements.

- It sets the spatial base for the multitude of operations and programmes to be activated in the future.

The projection is a multiplication of several projective elements and as i will later show the different elements / images for this territory reinforce and irrigate each other with potentials.

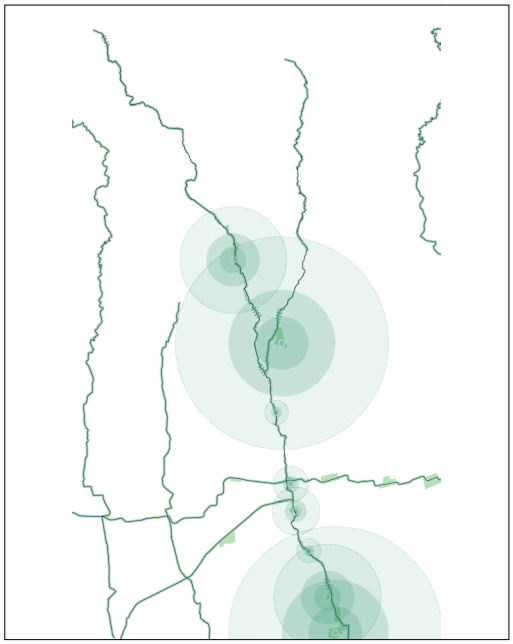
Therefore, the Syntax could also be read separately for bureocratic and regulatory porpuses.
In order to disentangle the complexity in the next pages the Urban - Landscape Syntax is portrayed in its full complexity. First a separation into Corridors and patches is visualized and consequently each of the elements of the syntax is declinated and disclosed with specific objectives, tools and strategies.

In the declination section, each elements contain a diagramm of values in 3 domains: green - blue (natural), mobility (circulation) and socio - economic (spatial qualities).
The extent of the indexed has been given as a parametrization of the implication of the objectives and strategies whether the implementation would be achieved in its full potential.

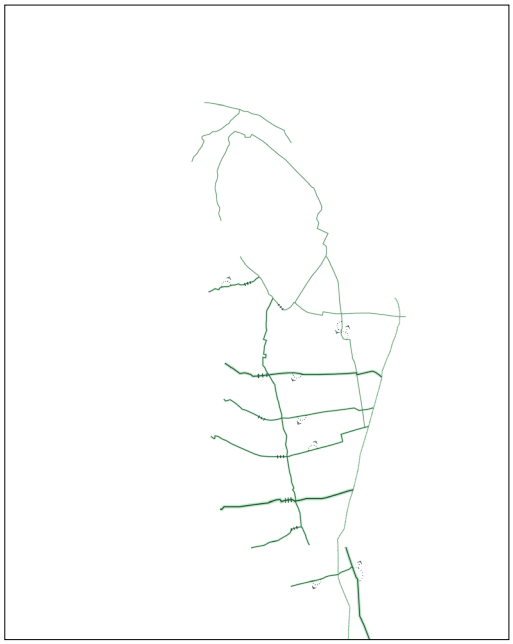
Images / Elements

Five interlocking elements irrigate the territory with new potentials by providing new pathways and services.

The different elements defines programmatic and strategic political actions. Moreover they delineate and chanel economic investments in the region.
These images / elements work both in coexistence, reinforcing one another, but also they could operate individually by defining implementation tools, i.e. the “software” (define rules, policies and strategies) for the urban landscape syntax deployment.



Fluvial Regional Corridor)

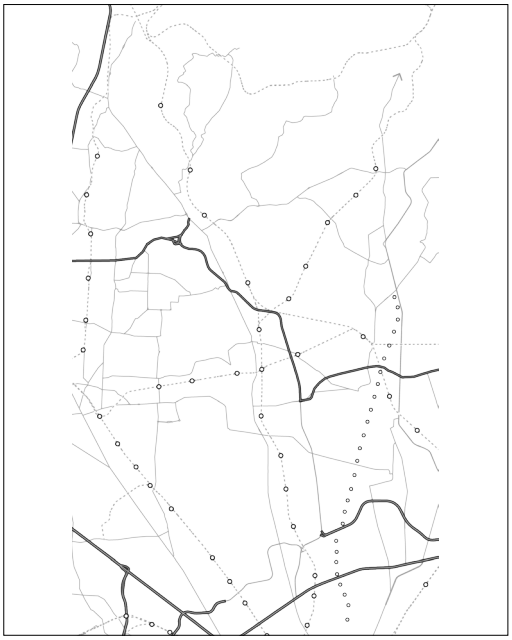


Ecological Regional corridor

Open space connection

Regional Parks

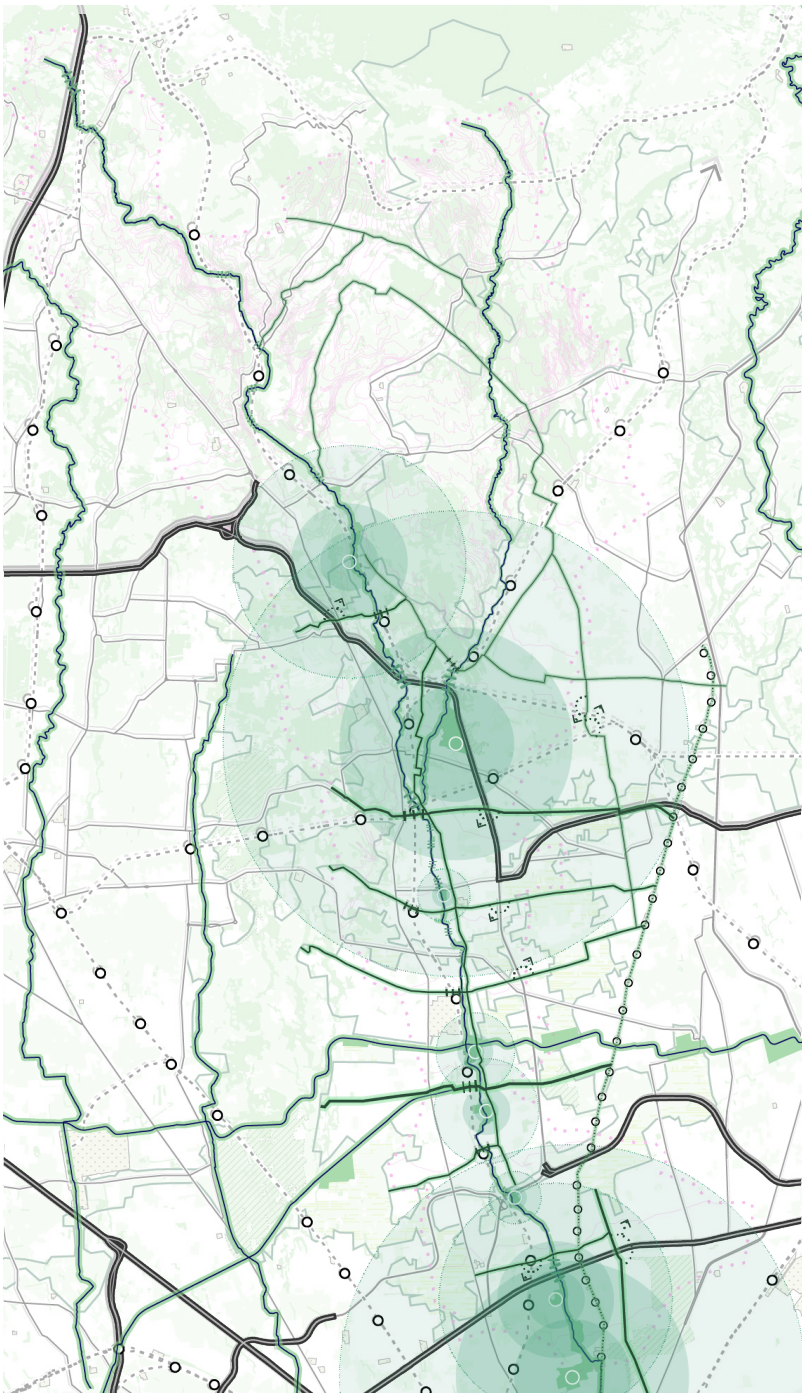
Third Landscape system



Compact Settlements and circulation systems

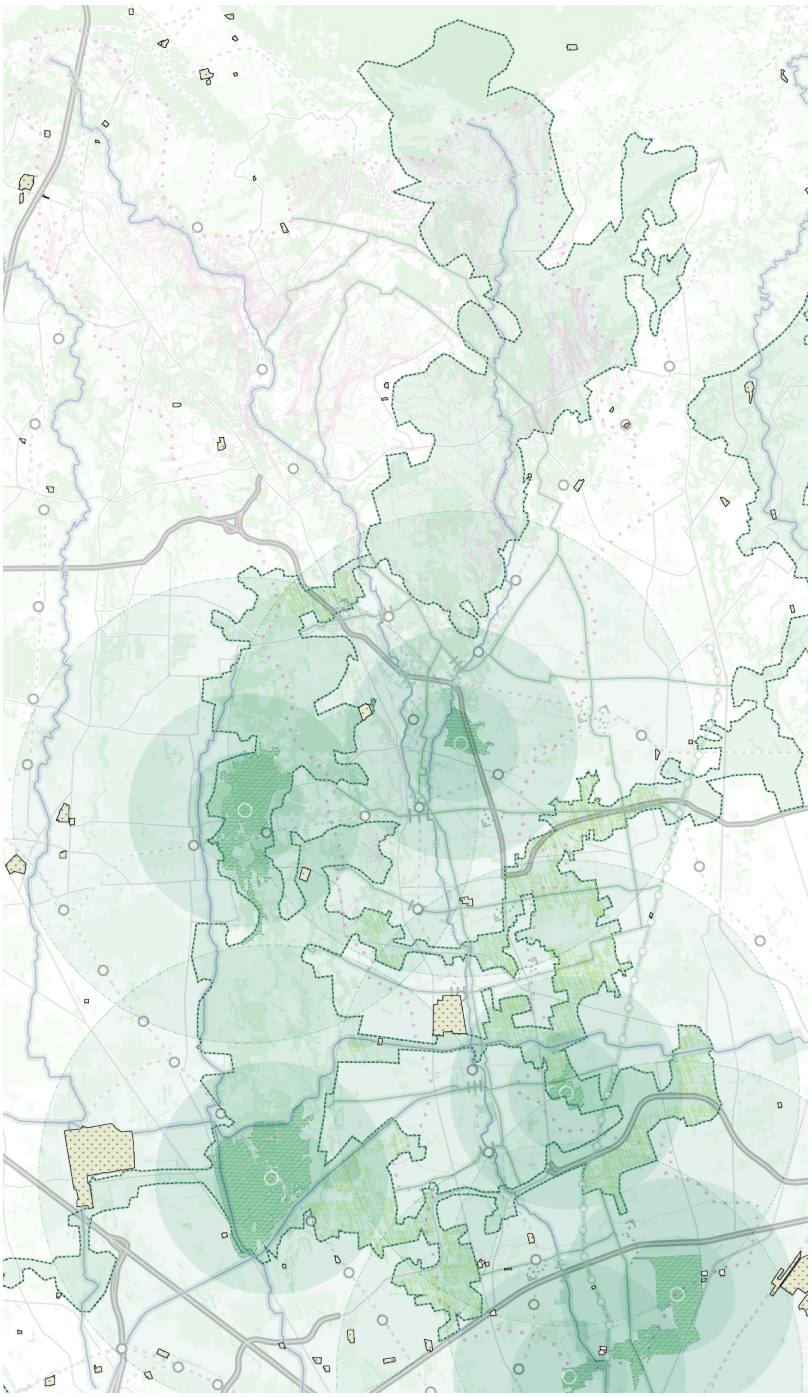
Macro scale Corridors

- Circulation systems

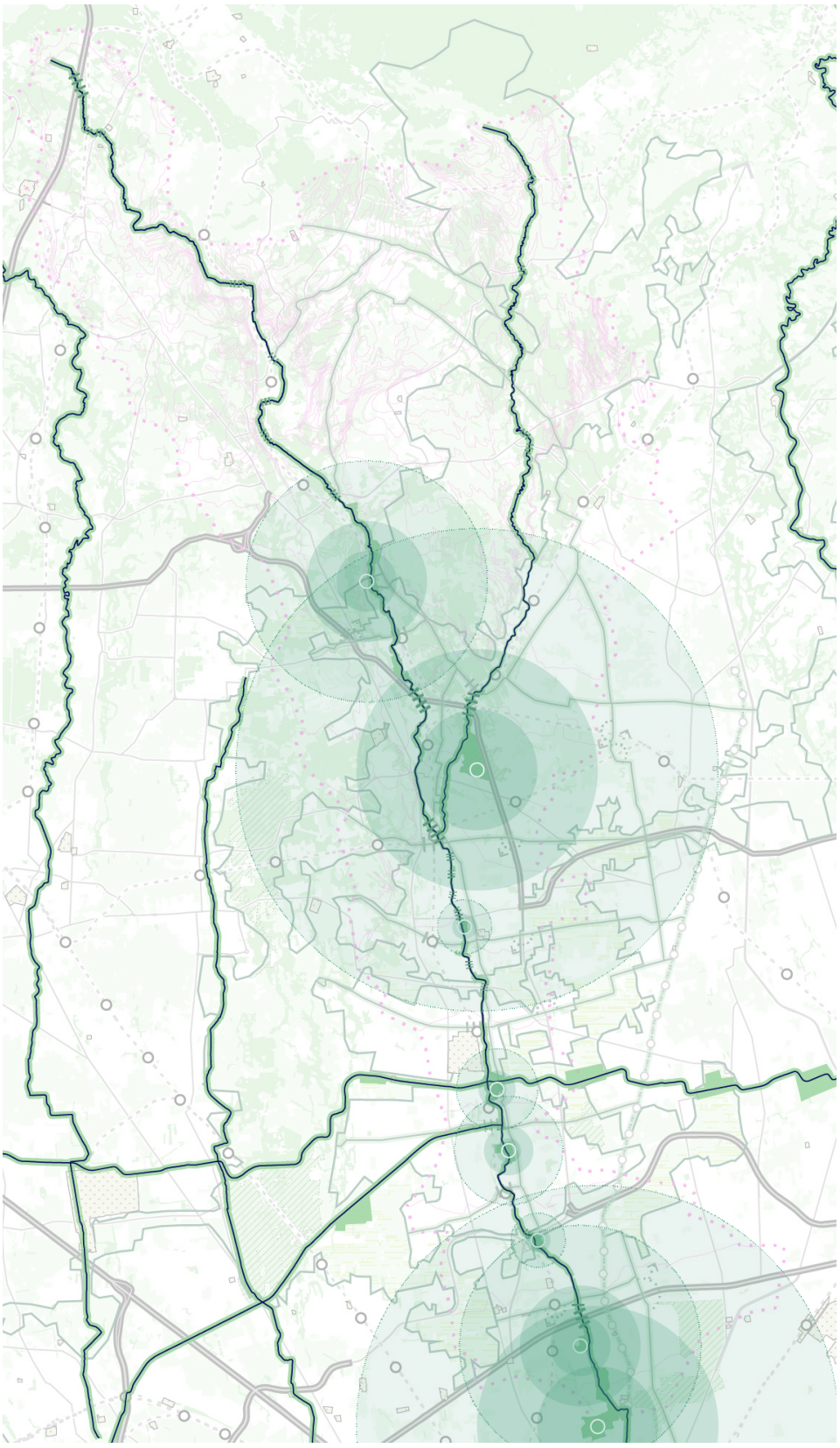


Macro scale Patches

- Surface programming



Fluvial corridors



Index

Objectives:

- landscape connectivity
- Restoration of ecological qualities, the river as a riparian habitat corridor
- The river as a social space
- The river as a mobility corridor

Spatial strategies:

Subtraction:
- Water bed cleaning

Addition:
- Replantation strategy
- "Trail based mobility"
- Physical Accessibility
- Public equipment and new programms

Administrative tools:

- Contratto di fiume (provides the governance tools to bring stakeholders together and inform of the multiple benefits for all of them)
- Piano Paesaggistico Territoriale Regionale (sets llegally binding rules and the governance mechanisms to implement and facilitate spatial strategies,)

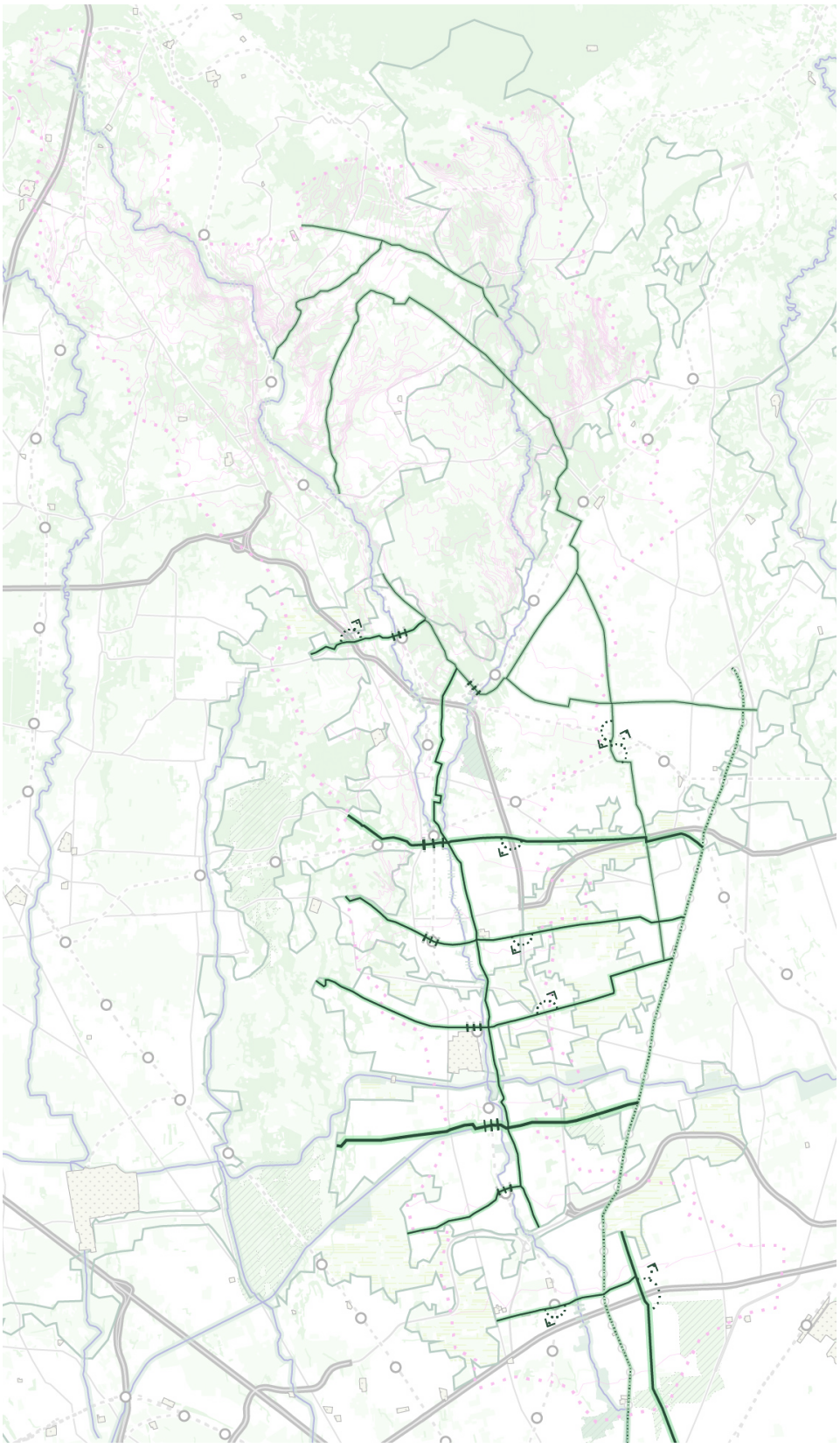
Legend

Service Buffer Area

Barriers

Fluvial Corridors (Green - blue corridors)

Green regional corridors



Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Landscape connectivity
- Stormwater infrastrastructures
- Coexistence of green - blue infrastructures / mobility / socio economic spaces

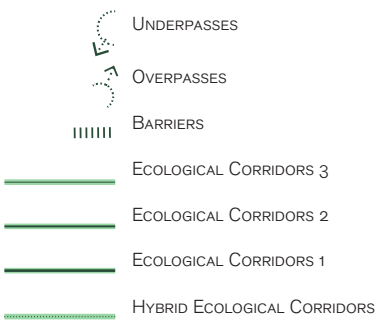
Spatial strategies:

- Addition:
Water sensitive urban design
Ecological viaduct or underpasses
Re-vegetation

- Subtraction
Impervious areas

Administrative tools, policies:
- Impervious areas fees
- 30 - 50 kmh road
- Local population involvement (co-development)

Legend



Open space Connection

Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Open space preservation
- De-fragmentation
- Ecosystem services reactivation (biodiversity, impollination etc...)

Spatial strategies:

- Addition:

Re-parcelization
Re-vegetation
Rotational crops surface programms

- Subtraction:

landworks

Administrative tools, policies:
- incentives for peri urban agriculture
- Subsides for regenerative agriculture mechanisms
- Promote public / private / collective partnership on the model of elderlie's allotment gardens
- Legally binding mechanisms on zero greenfield development
- Promote and develop adaptive management such as horticulture and sylviculture.

Framing and definition of large open landscape, thus provides circulation of fauna and instigate ecological contamination of complex biotic systems
.
Moreover it establish a new landscape suface systems in which rotational stragies for the replenishment of biogeochemical flows are foreseen.

This structural element of the urban landscape syntax proposes an alternative vision for the countryside, an open space in which the land its not merely let in the hand of the market, producing a disertification of species and loss of biodiversity (Magnaghi, 2012), instead wants to propose a model in which the biological replenishment of natural resources is considered crucial for added value agricultural products and to the human well being as well as for biodiverity.

An agriculture that more than just food, produces “landscape” / “paesaggio” that enables employment and valorize territorial peculiarities.

Eventually the reorganization of the spaces belonging to agroforestry with multisectorial functions have a high impact on the fruition of these territories by local inhabitants. This intelinks is not only physical but most of all is a cultural and metabolic interplay.

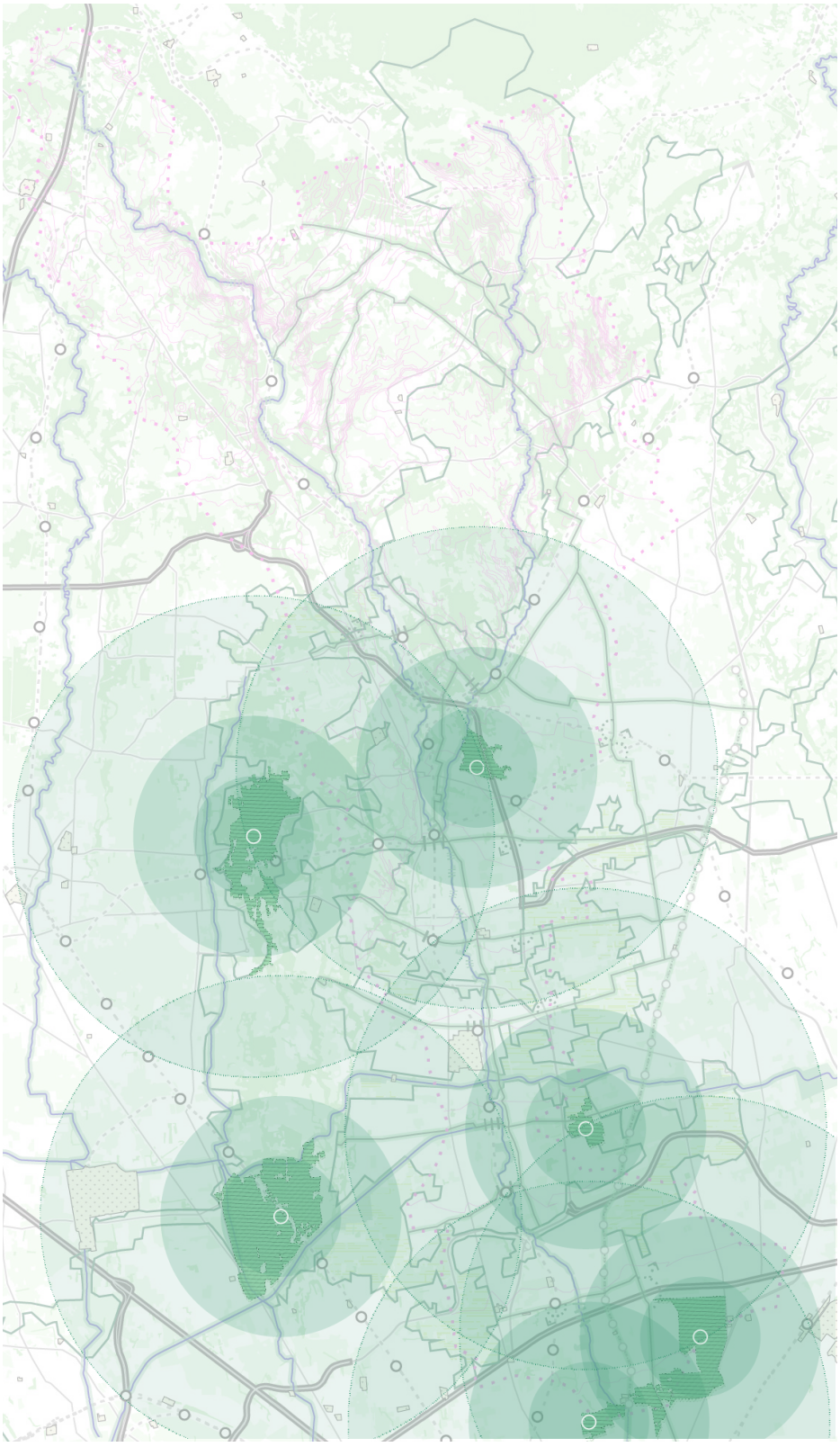
Legend

OPEN SPACE PRESERVATION AND ENHANCEMENT

NEW PRODUCTIVE, SOCIO-ECOLOGICAL LANDSCAPE

HABITAT CORRIDOR / SPECIES MOVEMENT

Regional Parks



Index

Objectives

- Open space preservation
- Regional parks as multifunctional accessible places

Spatial strategies:

- Addition:

Re-vegetation
Public equipment
Leisure and recreation trails

Administrative tools, policies:

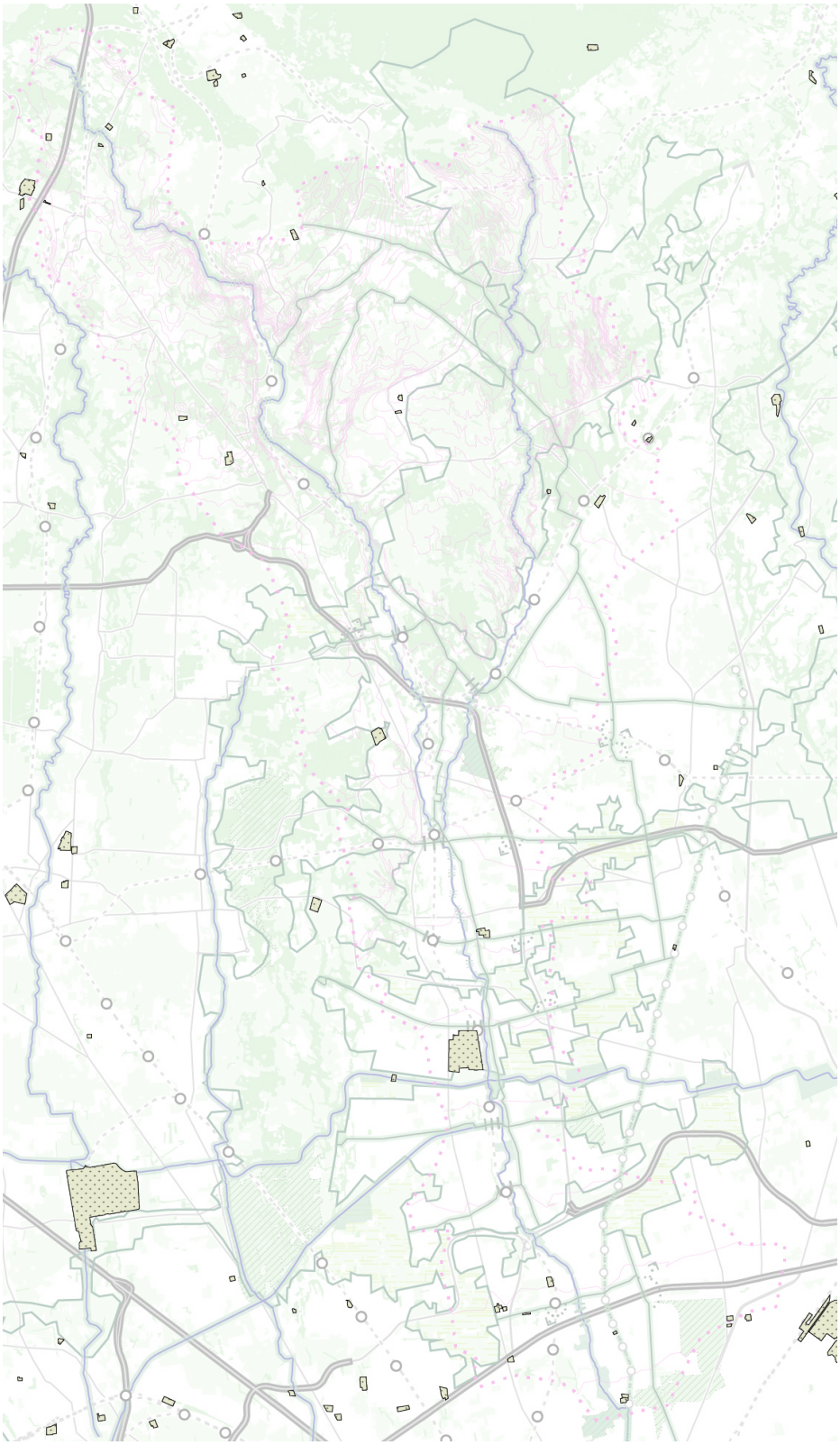
- environmental governance of park authorities
- Nature based inititatives, socio - educaitonal

Legend

Service Buffer Area

Regional Parks

Opportunities for the Third Landscape



Index

Objectives

- Regeneration of the third landscape
- Hydraulic invariability / compensation
- New nature based areas

Spatial strategies:

- Addition:

Re-vegetation
Public equipment
Leisure and recreation trails
Water Sensitive design (Retention / compensation)
Urbanizations (decentralized) , public services

- Subtraction:

De-paving

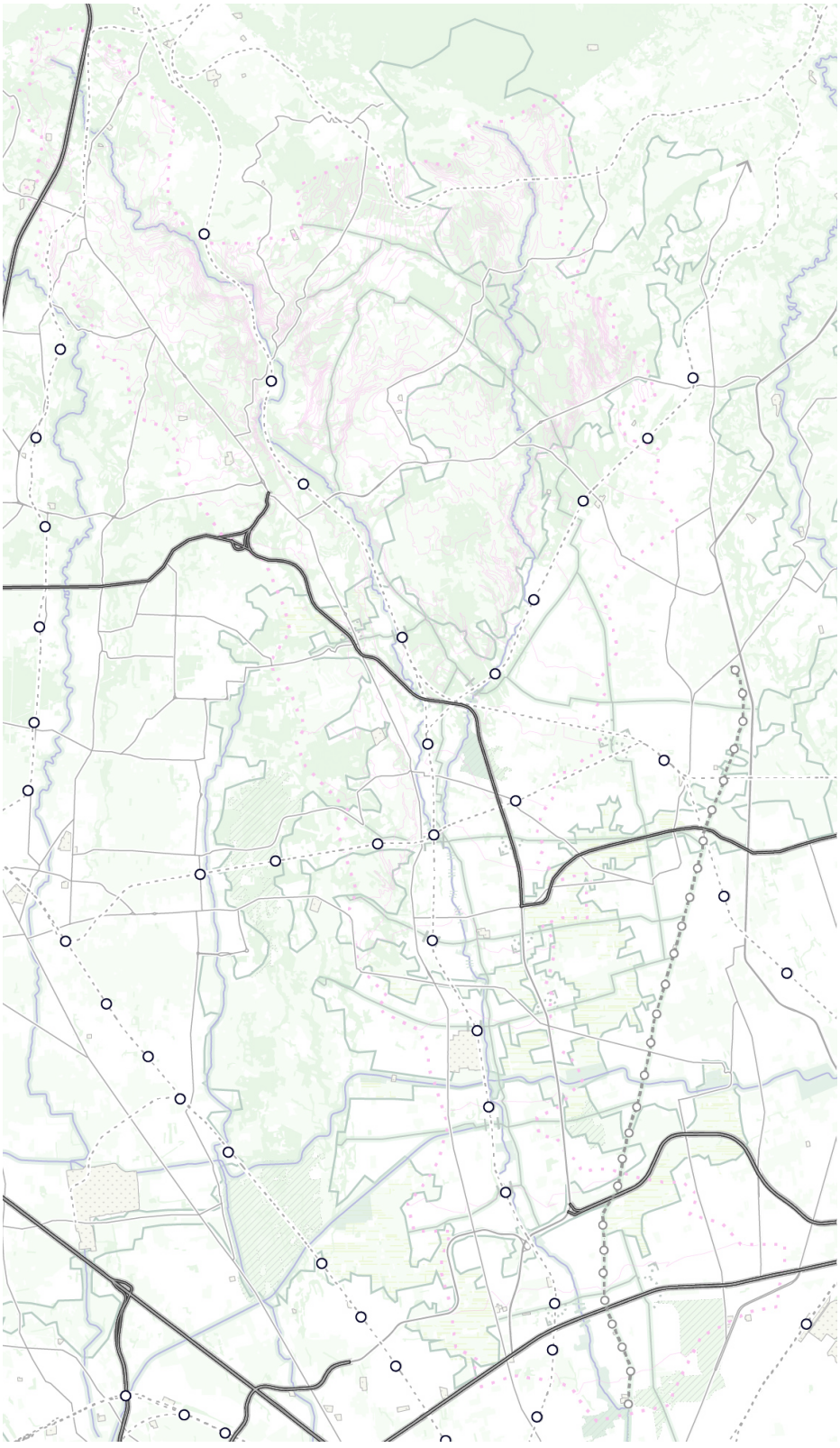
Administrative tools, policies:

- legally binding mechanisms for hydraulic invariability / compensation
- Buiyng / leasing these patches of land on behalf of public authorities.

Legend

Brownfield redevelopment

Compact settlements



Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Intermodal regional transport
- Transit Oriented Development
- Accomodation of "urban" demand

Spatial strategies:

- Addition:

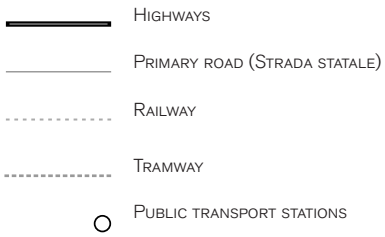
Densification
Infilling along transit nodes

Administrative tools, policies:

- Impose change in local land use plans (PGT)
- Incentives for restoration and floor addition / infilling
- Transfer of Development rights in proximity to these areas

The intensification of these spaces, deliniates boundaries in which, urban development along with logistical and teritiray economies should be positioned.
The strategy aims at redirecting flows of capital accumulation in these specific locations due to their proximity to intermodal / multiscalar networks and transnational corridors. As a couter ecological strategy, compact stettlements preserve the integrity and size of the performative green - blue system.

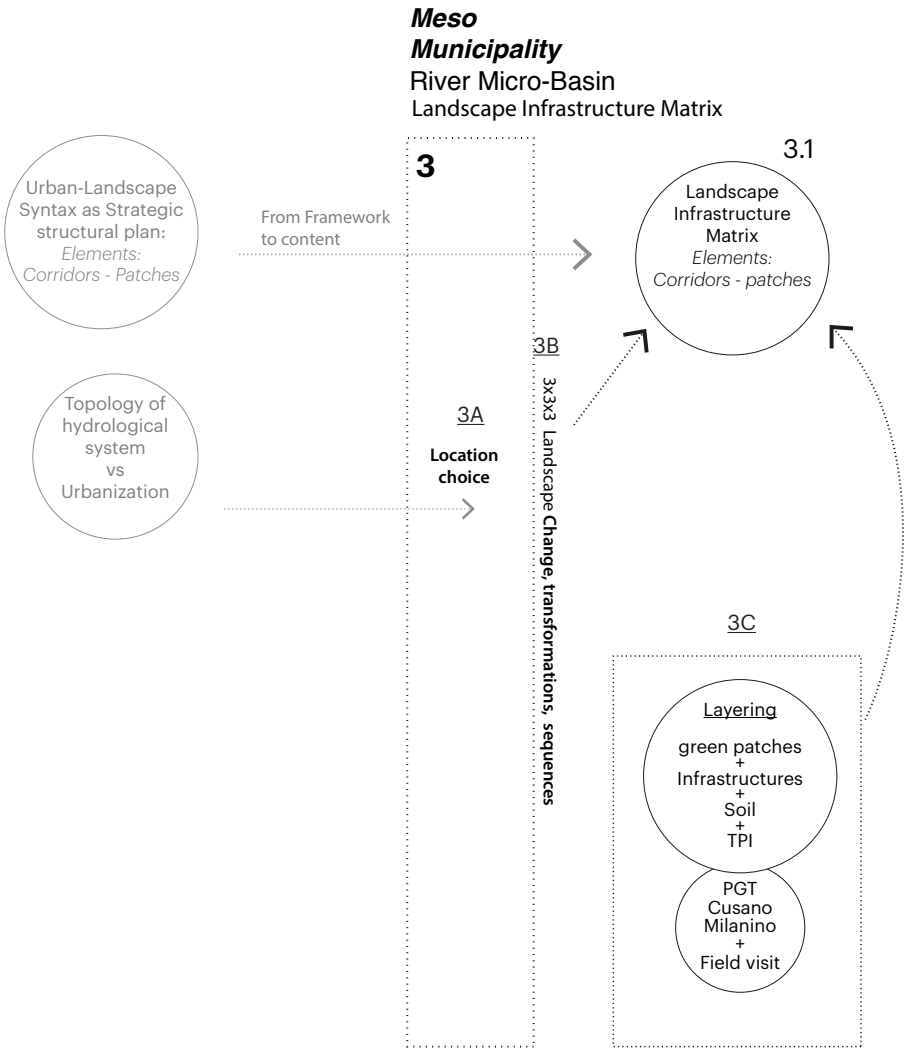
Legend



3. Meso scale

Objective:
Landscape Infrastructure Matrix as the projective medium through which the Macro scale syntax coupled with the full system (regional and local) of corridors and patches is visualized. The infrastructural matrix of Macro and Meso landscape systems for defragmentation, replenishment of ecosystem services and mitigation of hydraulic risk.

Following, in this chapter, a reconstruction of the design process which brought to the objective.
A disclosure of each step of the methodology, following the diagrammatic section here below.



3A: From Macro to meso, location choice

The microbasins within the river seveso sub-basin in the hydrographic context of Lambro-olona-Seveso, are 21. According to their geomorphological, occupational and infrastructural characteristics could be divided in three main categories (AIPO, 2011). The first two are located upstream the CSNO (compensation canal which is activated in the case of increased discharge) and characterized by modest and steeper slopes and a modest and low degree of urbanization. The increased water runoff discharged into the river Seveso due to the increased sealing of soil, causing floods, is believed to be addressed, according to current plans of an intermunicipal agreement led by the Agency for the Po Valley, with a doubled reach of the CSNO, from 60m3/s to 120 m3/s.

However, the mostly urbanized, conflictual part is located downstream of the CSNO, where a chaotic mix of infrastructural elements, terrain vague, peripheral conditions, heterogeneous spatial typologies seems to co-exist in a unique metropolitan chaos.
Therefore, i decided to take as the Meso scale projective goal the Microbasins with high urbanization rate, population density and interesting spatial conditions.
Microbasin 18, in the municipalities of Cusano Milanino and Paderno Dugnano.

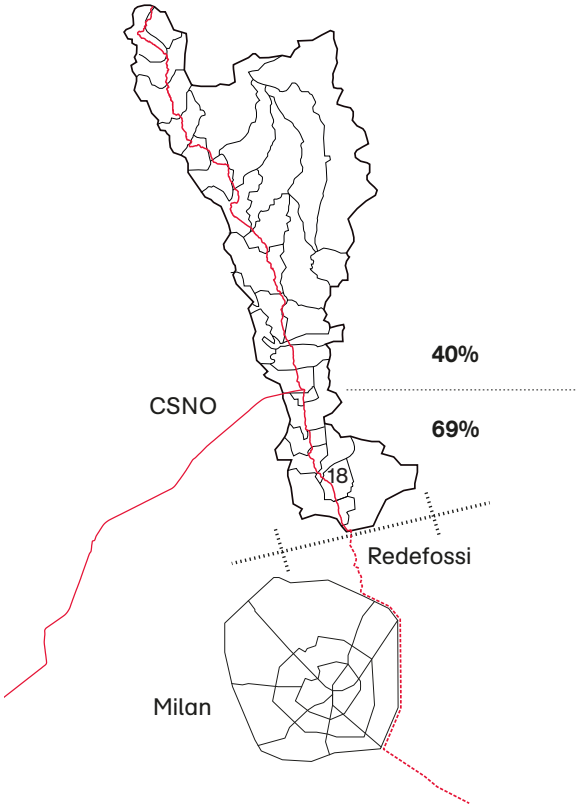


Figure
Showing the sub basin of the river seveso, its micro basins and the redefossi canal, the underground space where the river seveso flows under the city centre of Milan. Moreover it shows the percentage of built up areas in the the different sections of the basin, before and after the compensation discharge canal CSNO.
Image made by author.

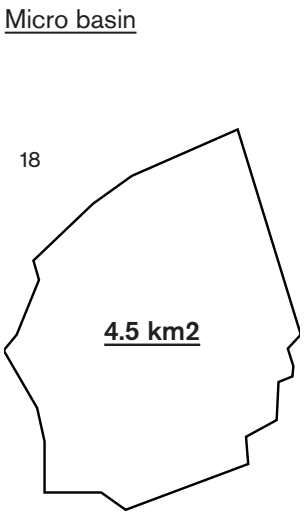


Figure
Showing the micro basin number 18. This hydrological unit scale across two municipalities, i.e. Cusano Milanino and Paderno Dugnano.
Image made by Author based on DUSAF

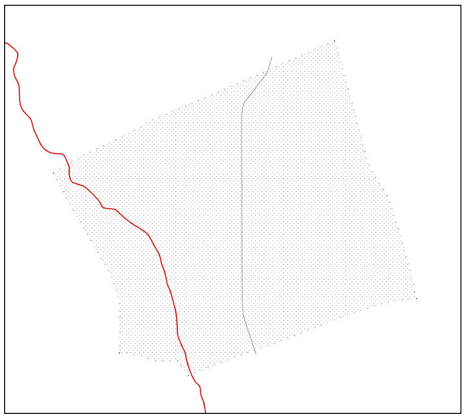
3B: 3x3x3 change, transformations, sequences.

The 3x3x3 exercise as part of the delta Intervention graduation studio required an understanding of the territory in a diachronic and multi-layers manner.

This process of tracing different layers of development boosted a series of consideration on the territorial formation of this area.

I this scale it informed through visualization the historical territorializaiton in the micro basin starting from the roman epoch, and the great advance of urbanization after world war II.

Secondly it sets the base for a visualization of small scale transformations that are repeted and aggregated in this meso scale. In this sense the visualizations on the next page served to synthetize some of the key land use change as staging of surface / subsurface sequences in order to understand that the repetition and aggregation /



Roman age

1722

1954

1980

distribution of such processes on the meso scale is what define part of this micro basin.
In this sense it visualizes change from a *landscape ecology* perspective:
"Change is the dynamics or alteration in spatial pattern and functioning over time" (Olson et all, 1996).

Last but not least, it irrigates the projective design with sensibility. In this sense the projection (3.1) is always conceived as the next sequence suiting a much longer process of territorial formation.

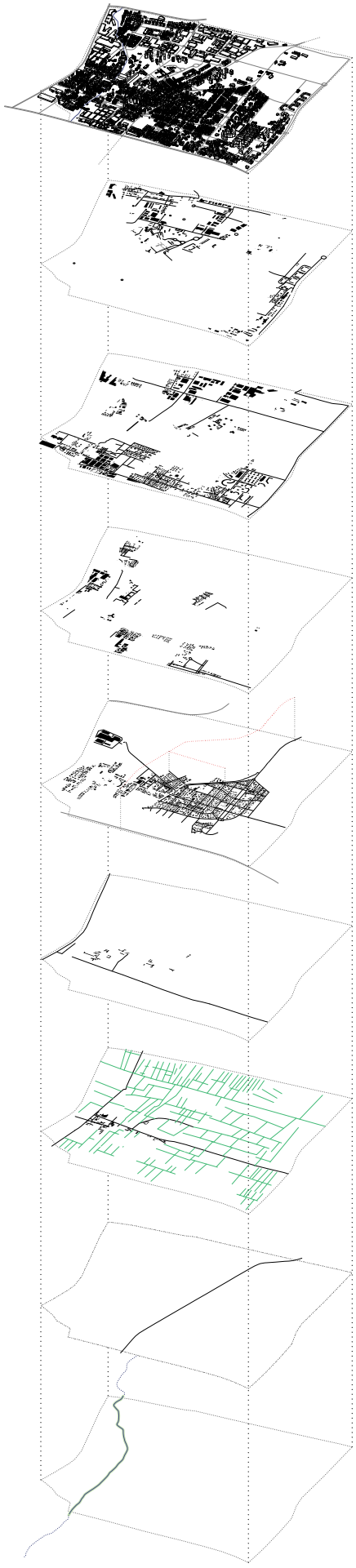
1880

1950

2015

Stratification

Mapping the evolution of this area in a diachronic manner make us able to frame the contemporary spatial configuration similar to a process of sedimentation. In this sense the area is best understood as the stratification of different processes of human occupation in time.
This exercise was extremely usefull to culturally and spatially being sensitive to the projected transformations according to history.



2016

1980

1955

1950

1920

1842

1722

Romans

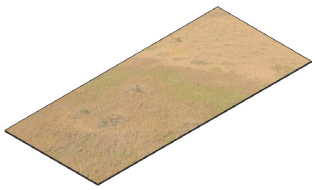
Paleolithic

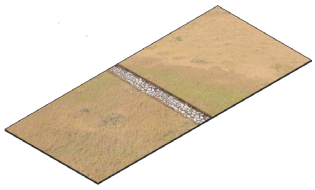
From green patch to local corridor:
Land use change, staging surface sequences in time.

The sequences of transformation visualizes key territorial tranformation at a Nano scale. It also inform the analytical process of territorial tranformation with understanding. Moreover by synthetizing land use change sequences in a spatial and transcalar way, the material and geometrical disruptions over time is visualized.

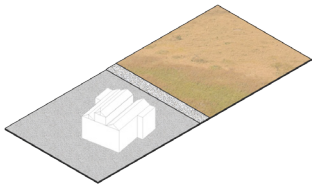
From the outlook of a landscape ecology perspective, these sequences of transofrmation (change) inform the spatial dimension of the dynamics which cause landscape depletion and isolation over time.
These processes include:
Fragmentation: (i.e. breaking up a larger/intact habitat into smaller dispersed patches)
Dissection: (i.e, splitting an intact habitat into two patches separated by a corridor)
Perforation: (i.e, creating holes within an essentially intact habitat)
Shrinkage: (i.e., the decreae in size of one or more habitats)
Attrition (i.e, the disappereance of one or more habitat patches)

These land use change sequences always end with the actual spatial condition, and the problematique beyond that condition. By tracing and redrawing these sequences it starts a process of inquiry toward the imagination of the next sequence of green patches.

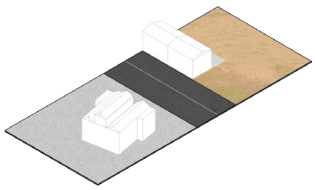




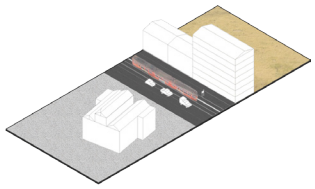
Graft



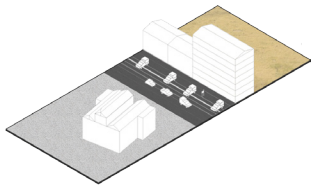
Occupation



Fragmentation



Sealing



Degradation

Dissection - Fragmentation - attrition- degradation - lack of spatial qualities

3C Layering
Field visit, site picture.

The field visit informed the project with interesting insights on the spatial qualities and conditions that underly these territories.

The sensorial moments of being lost into this “imbroglio” of different constructed and natural elements made me appreciate the heterogenous nature of the place, materialized through different built up typologies (which i consider a quality), and a series of public space designs, as a matter of fact it informed the further design agenda with the idea of reintroducing and reprojecting elements of continuity.

Vegetal and nature and non nature based infrastructural systems to reproject the contiguity of these places became crucial in visiting the Micro basin.These elements which wants to sew up the urban fabric with new constructed vegetal and infrastructural systems are disclosed and exlored in the genealogies (5) and Micro-Nano chapter (6).

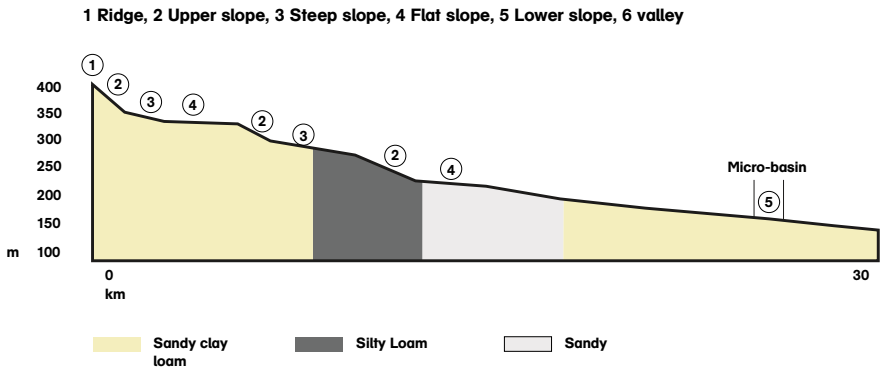
3C Layering

Objectives / Process: layers
Toward Landscape Infrastructure matrix.
The layering section is the key part of the projective dimension of each scale and it shows the process of layering and relations between elements that underpinned the projection (3.1)

Input from Urban - Landscape Syntax

Zoom in on the Urban landscape syntax projection in the Micro basin.
The macro elements sets the base for a full representation of patches and corridors in the micro basin.
The addition of local corridors and patches came from the synthesis and projections of the layer described here below and on the right.

TPI *Topographic Position Index*

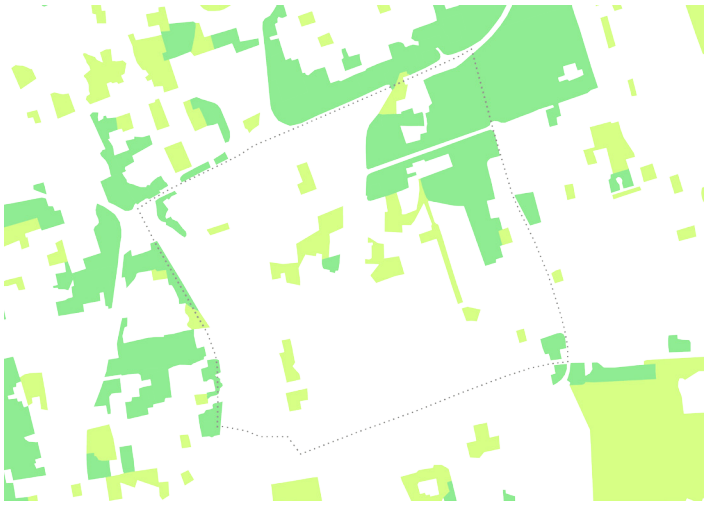


Limitation in discharge due to flat slope.
Soil condition: Sandy clay loam, good for water infiltration.

Mobility network *(Corridors to be retrofitted)*

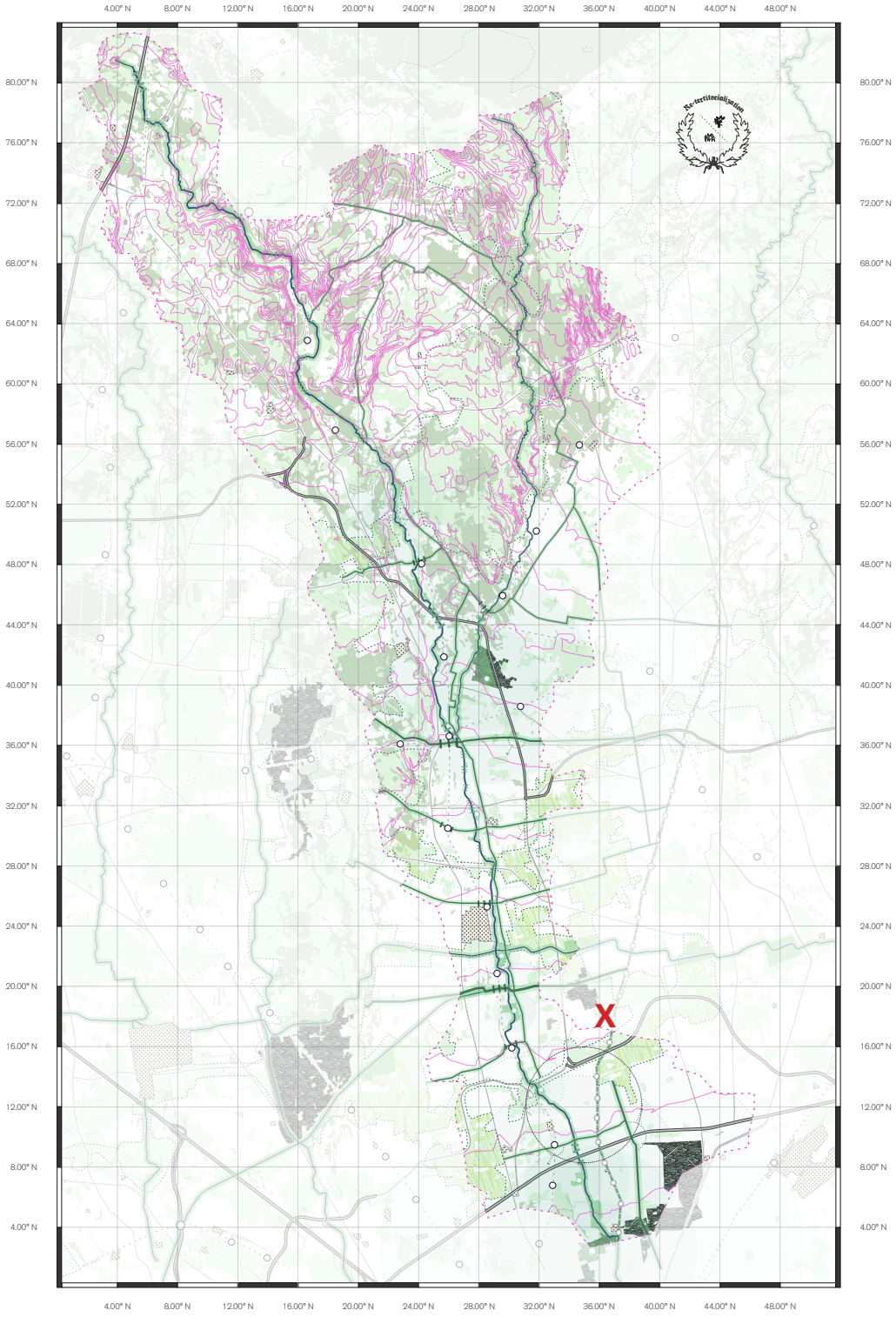
Highways
Primary road (tangenziali)
Secondary road
Tertiary road
Railway system

Green patches *(Patches to be connected)*

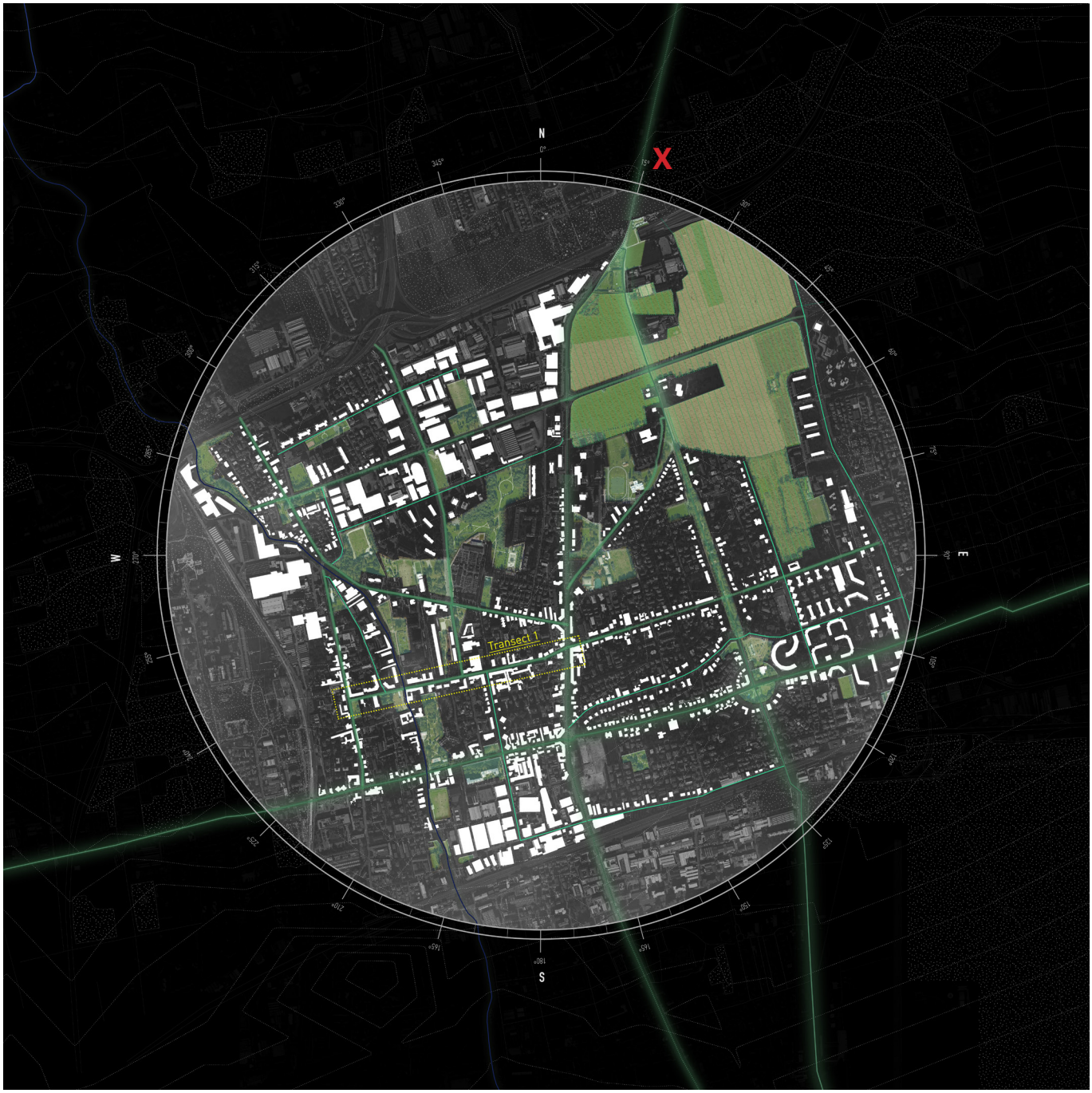


Woods
Urban green

Macro: Urban - Landscape syntax



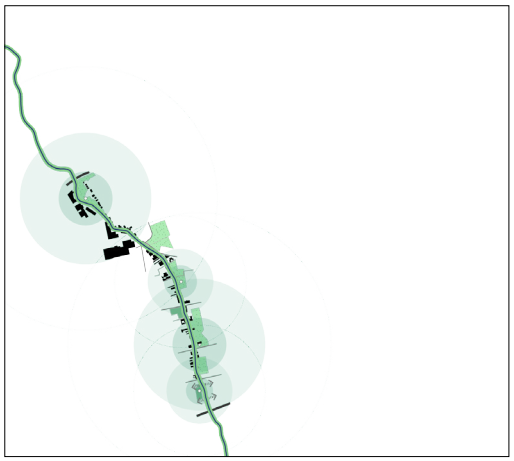
3.1 Meso: Landscape Infrastructure Matrix



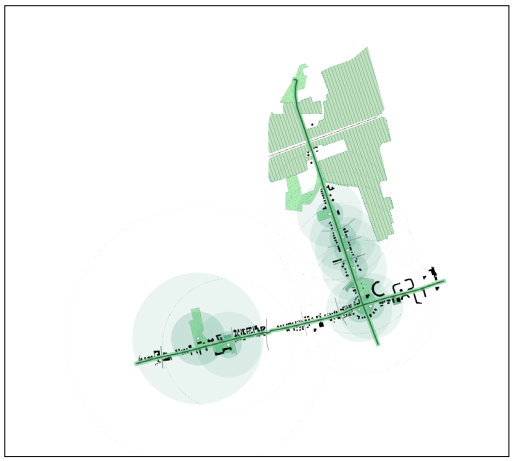
- Municipal Green areas influence
- Fluvial corridor
- Green regional corridor
- Hybrid corridor
- Local green corridor
- Contours line (1meter)
- Micro basin border
- Municipal green areas
- Open space patch

Matrix elements declination

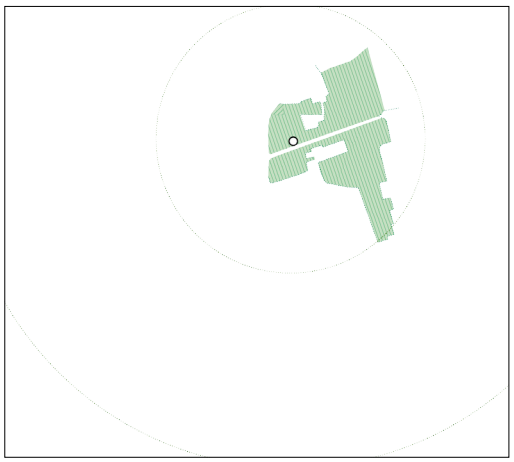
Corridors and patches



Fluvial Regional Corridor



Green Regional corridor



Open Space Regional patch

Municipal green areas

Hybrid corridor

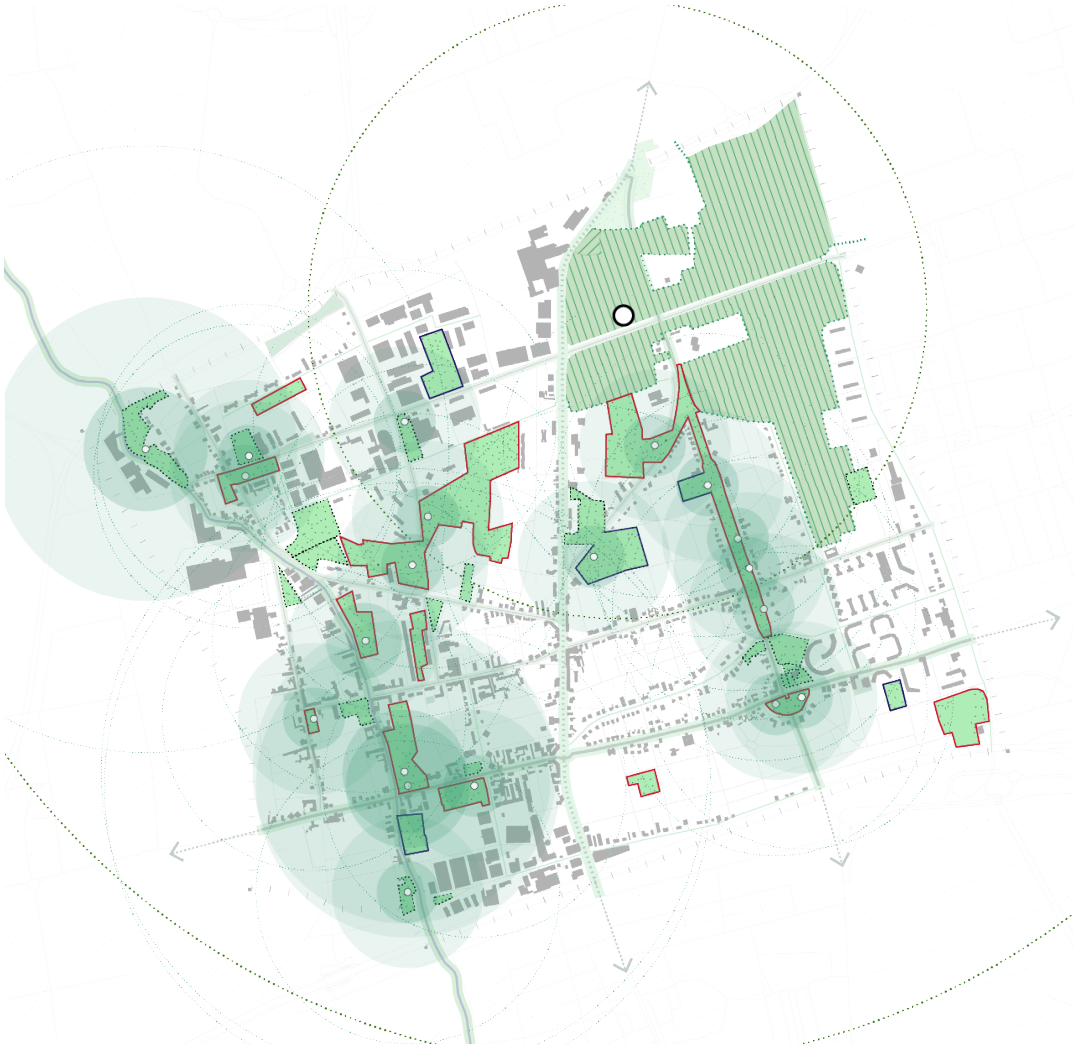
Green Local corridor

Meso scale Corridors

- Circulation systems

Meso scale Patches

- Surface programming



Fluvial corridor

Index

Green-Blue

Mobility

Socio-Economic

Objectives:

- landscape connectivity
- Restoration of ecological qualities, the river as a riparian habitat corridor
- The river as a social space
- The river as a mobility corridor
- Enhance accessibility and permeability
- water quality

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 113, or in their full extent in the genealogies booklet form page 12- 17.

Administrative tools:

- Contratto di fiume (provides the governance tools to bring stakeholders together and inform of the multiple benefits for all of them)
- Piano Paesaggistico Territoriale Regionale (sets llegally binding rules and the governance mechanisms to implement and facilitate spatial strategies,)

Green regional corridors

Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Landscape connectivity
- Stormwater infrastrastructures
- Coexistence of green - blue infrastructures / mobility / socio economic spaces

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 114 - 119, or in their full extent in the genealogies booklet form page 18 - 43.

Administrative tools, policies:
- Impervious areas fees
- 30 - 50 kmh road
- Local population involvement (co-development)

Hybrid corridors

Hybrid corridor

Municipal green areas

Open space patch

Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Landscape connectivity
- Stormwater infrastrastructures
- Coexistence of green - blue infrastructures / mobility / socio economic spaces
- Accomodate potential urban growth and nature

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 114 - 119, or in their full extent in the genealogies booklet form page 18 - 43.

Administrative tools, policies:
- Impervious areas fees
- 30 - 50 kmh road
- Local population involvement (co-development)

Green local corridors

Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Landscape connectivity
- Stormwater infrastrastructures
- Coexistence of green - blue infrastructures / mobility / socio economic spaces

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 114 - 119, or in their full extent in the genealogies booklet form page 18 - 43.

Administrative tools, policies:
- Impervious areas fees
- 30 - 50 kmh road
- Local population involvement (co-development)

Regional Patch

Green areas influence

Open space patch

Index

Green-Blue

Mobility

Socio-Economic

Objectives

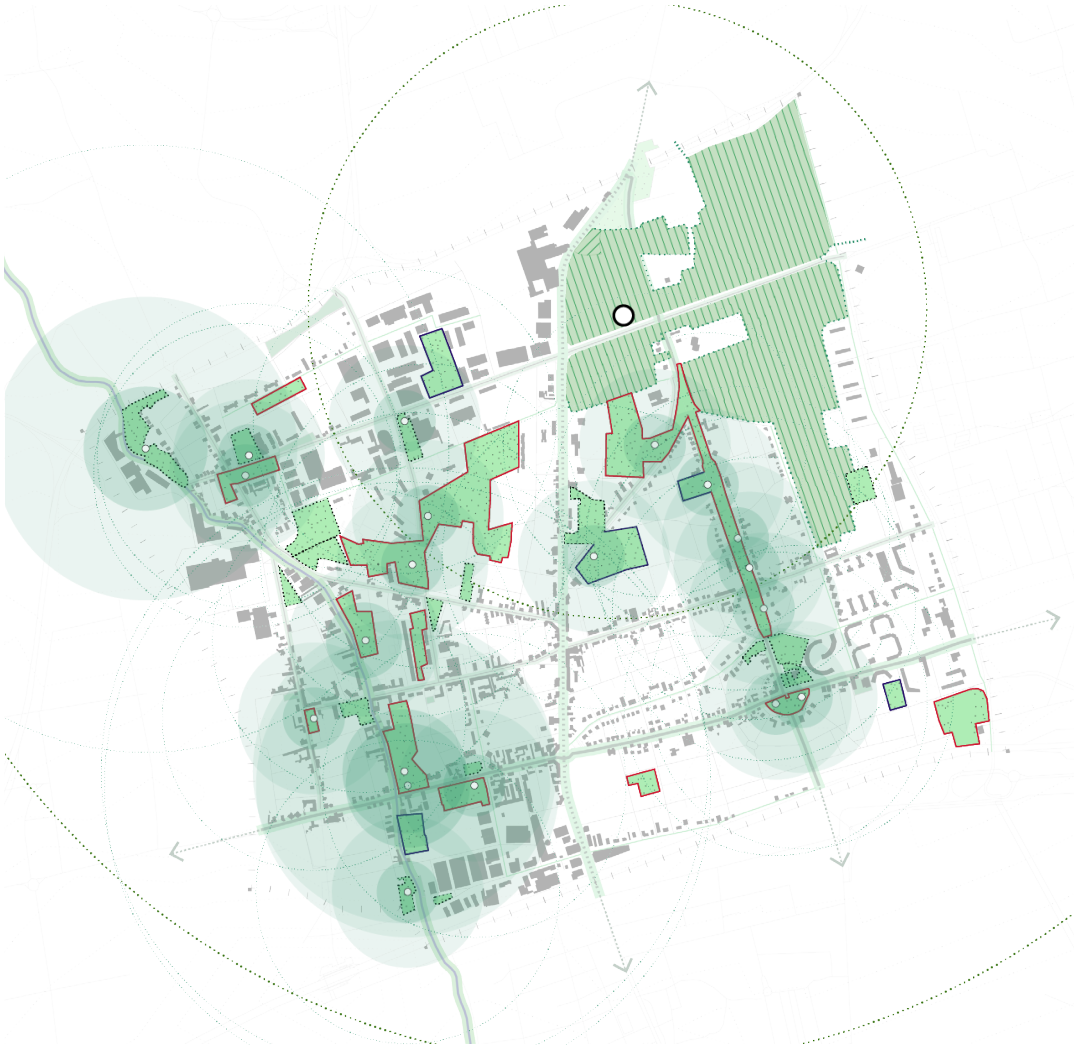
- Open space preservation
- De-fragmentation
- Ecosystem services reactivation (biodiversity, impollination etc...)

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 120 - 121, or in their full extent in the genealogies booklet form page 44 - 47.

Administrative tools, policies:
- incentives for peri urban agriculture
- Subsides for regenerative agriculture mechanisms
- Promote public / private / collective partnership on the model of elderlie's allotment gardens
- Legally binding mechanisms on zero greenfield development
- Promote and develop adaptive management such as horticulture and sylviculture.

Municpal green areas



Municipal Green areas influence

Municipal green areas

Index

Green-Blue

Mobility

Socio-Economic

Objectives

- Communal space activation
- Ecosystem services reactivation (biodiversity, impollination etc...)
- Socio- educational places

Spatial operations:

the spatial operations are showcased in the genealogies chapter, page 122 - 123, or in their full extent in the genealogies booklet form page 48 - 53.

Administrative tools, policies:
- subsides to the management of municipal green ares
- Promote projects and activities with a high impact from a environmental and socio-educational outlook

Designing with time (4-5)

As a key turn in the design process of the graduation project, the exploration of the open ended and indeterminate dimension is disclosed in the next two chapters (4-5).
This exercise wants to open up various possiblities for the operational reprogramming of green - blue systems at the Meso Micro and Nano scale.

Indeed, so far the research project investigated the projection of landscape systems through various scales. but it hasn't defined the operational and spatial adaptation of forms according to new shapes and possible contingencies. In order to understand the dynamicity of certain projections, this section unfolds as an exploration of the multiple possible dimension of the project in which the obejctives at Macro scale could be reached in various ways and with various spatial operations.

Specifically, two have been the key steps, speculating on the temporal dimension: scenarios (4) and genealogies (5). The temporal dimension is regarded as a progressive design exercise in order to explore socio-ecological dynamics in time in complex urban systems.

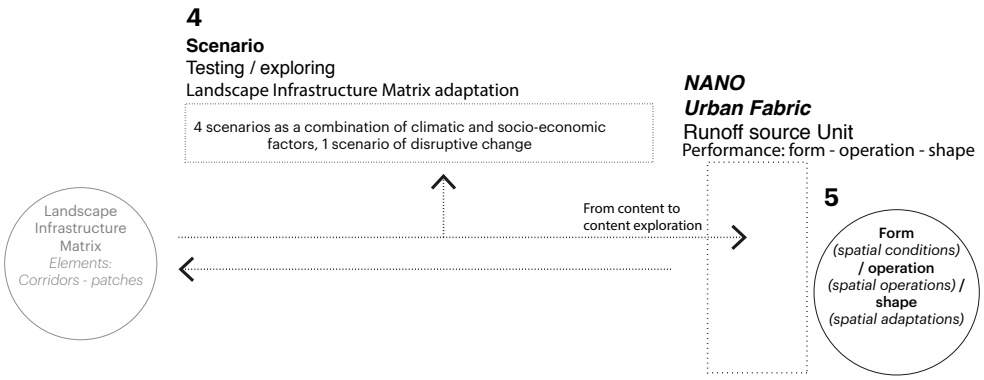
Under this lens projecting multiple options of spatial operations in time and different scenarios of spatial configurations made the temporal, adaptive and indeterminate dimension of the project alive.

Open endeddness and indeterminacy have been two keywords of recent progressive landscape architects, such as Chris Reed and james Corner in order to describe the dynamicity of ecological configurations in time. Their interest is to explore the adaptability, i.e. multiple possible configurations in order to deal with future and changing dynamics in both small and large scale infrastructural and landscape based projects.
Following the same approach, here the concept is specifically applied to the spatial anticipation by mutiple spatial configurations using scenario making as a tool, as well as multiple spatial operations to change patterns of similar segments (genes) in the Landscape Infrastructure Matrix to build flexiblity in the operational reprogramming of nature in the urban fabric.

4. Scenarios

Exploring Landscape Infrastructure Matrix adaptation in order to speculate on potential future configurations. Each scenario is described further in each section by projecting the reactivation of segments and pieces of corridors and patches (of the Landscape Infrastructure Matrix) according to a spatial speculation coming from the general setting of the scenario. I.e. socio-economic and climatic contingencies

Methodology



Scenarios:
Testing Landscape infrastructure matrix adaptation

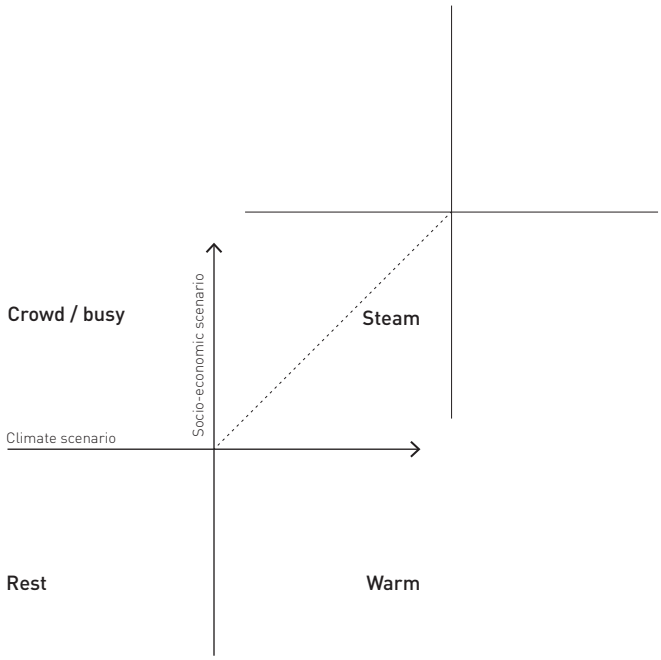


Figure
The 4 scenarios undertaken in the research are adapted from LANDS and delta scenarios.
Source: JPI Urban Europe Green/Blue Cities, TUDelft 2015.

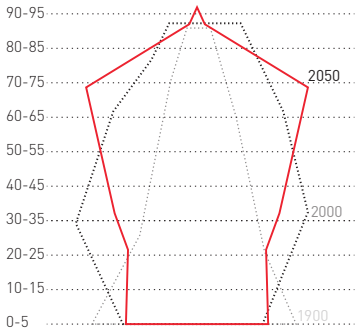


Figure:
The diagramm shows the evolution of demographics trends in Italy, despite the changes foreseen in each of the different scenarios, this visualization sets the macrotrend of an aging population.
Particular attention is thus given to the elderly.
Source: ISTAT, 2015

The importance of scenarios:

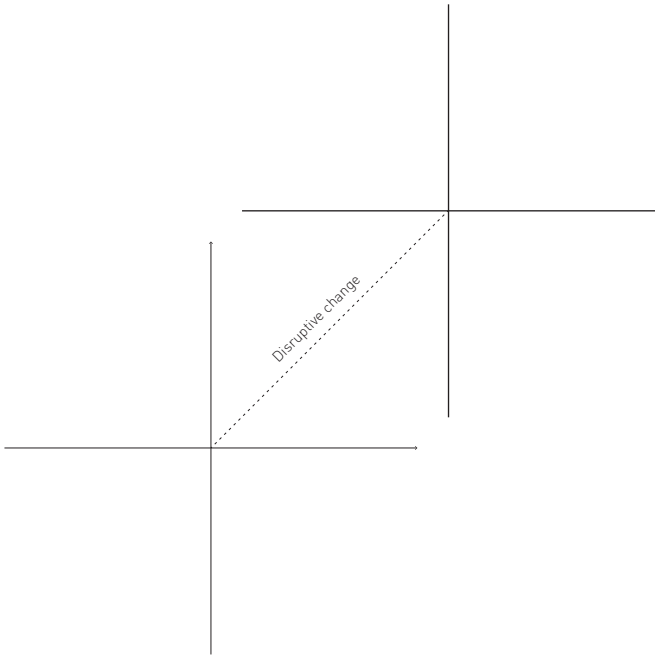
Multiple futures, multiple narratives.

The scenario exercise is usefull to explore possible futures, more or less likely to happen. Although the research project clearly advocate for a specific vision, the one of re-territorialization, a new culture of habitation in this specifc territory made of multiple benefits between natural and human systems. Eventually it allows to explore the multifacated dimension that the project might be dealing with.

Explanation of the scenarios:

The scenarios looks at possible futures ahead and are based on the integration of macro trends in the socio-economic domain and climate studies made by a consortium of scientists led by the dutch government (http://edepot.wur.nl/314825).
In order to attune it to my specific location, some of the trends have been taken for granted while others have been re-researched and tailored to the specificities that comes from the impact of climate change in the northern italian context. Several documents forecasted changes such as the studies conducted by the advanced institute for environmental studies ISPRA (http://www.isprambiente.gov.it/files/pubblicazioni/statoambiente/SA_58_15.pdf) and by the Mediterrenean Centre for Climate Change (http://www.climatrentino.it/binary/pat_climatrentino/GUALDI.pdf).

In the scenarios, the socio-economic / climate conditions are set by the study while the physical representation wants to represent a multitude of possible spatial transformations which can also be seen “strategies of anticipation / compensation / mitigation / adaptation” to reinforce or weakens some of the forecasted dynamics.

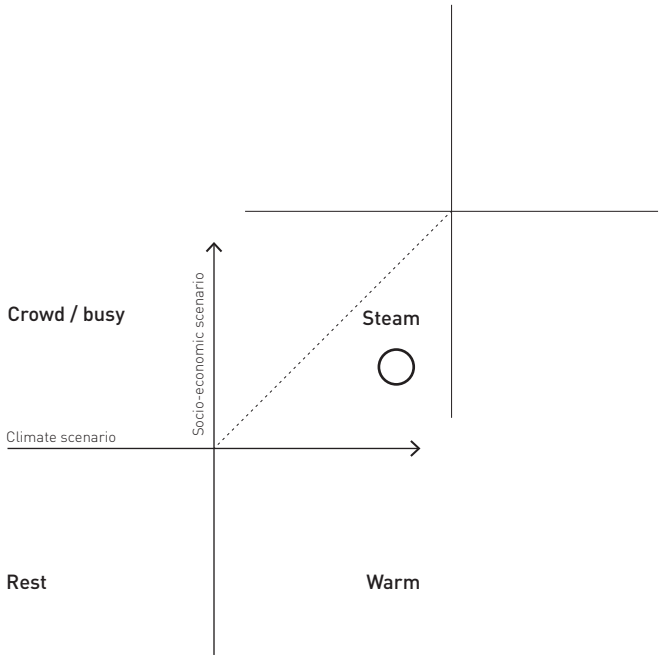


Disruptive change:

Automated vehicles / mobility revolution. This scenario investigates the potential spatial outcome and implications in technological advancement and implementation of automotive technologies and widespread rising culture of shared mobility.

As extensively researched recently, we are in the brink of disruptive changes in the automotive sector, self driving cars can indeed bring an unprecedented change since the conbustion engine in late 19th century.

More than the technological and social implications themselves the scenario investigates the spatial implications of such change. Under this lens it materialize some researches unveiled that explain how
Parking could be reduced by almost 90%, and the suburbs of cities which now rely mostly on cars could free up to one third of the land for other porpuses Dallegro, 2014).
The Mckinsey report predict that this revolution will be incremental and sets the target for full “automotive mainstreaming “ around the year 2040 - 2050 (Davis, 2015; Bertoncello, Wee, 2015).



Steam:

General considearations

- None or moderate increase in the number of inhabitants.
- Increase in private capital investment in the built environment.
- Increase in average temperatures, dryer summer, rising winter precipitation.
- High tech solutions.
- Increase in infrastructures and utility.
- Production is outsourced and automatized.

Values:

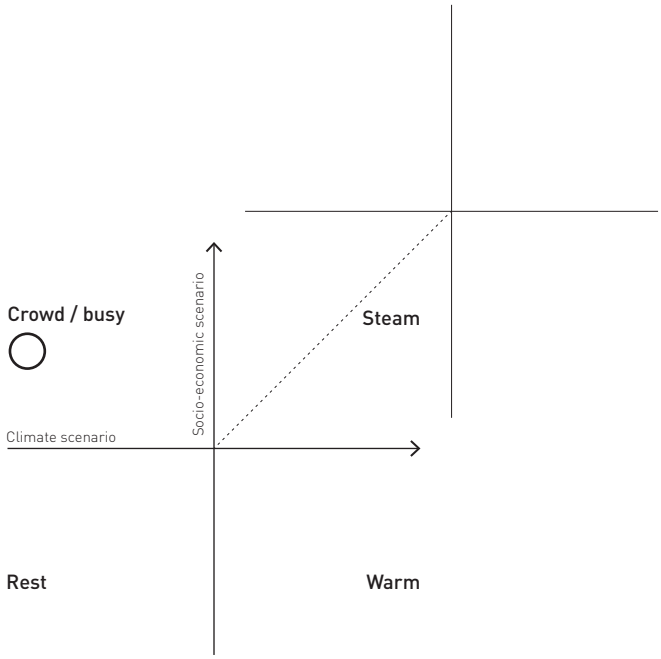
- Individualism
- Market driven decisions
- Growth
- Business as usual
- Hight tech solutions

Strategies:

- Hydraulic invariability, channeling capital into the refurbishment of existing stock (sunsidizing this kind of mechanisms)
- Environmental compensation / adaptation / mitigation mechanisms.
- Incentives / gains for private stormwater decentralization.

The rationality behind the representation of each spatial configuraiton of the scenarios adaptation are given by the partly, low aìor full reactivation of specific patches and corridors in the Micro basin.
The more a patch or corridor or element is opaque the least reactivated it is...

- Municipal Green areas influence
- Fluvial corridor
- Green regional corridor
- Hybrid corridor
- Local green corridor
- Urbanization of the countryside
- Private stormwater decentralization
- Municipal green areas
- Open space patch



Crowd / Busy:

General considearations

- None or moderate increase in the number of inhabitants.
- Moderate rise in average temperatures, dryer / warmer summer, soft increase in winter precipitation.
- Controlled / guided urbanization
- Balanced and progressive collaboration between public entities and the private sector.
- Rapid transition toward a circular and bio-based economy.
- Fast energy transition.
- More intensive and more multifunctional agriculture (added value, co-operative based local production)
- Re-shoring and development of new industries.
-High environmental awareness.

Values:

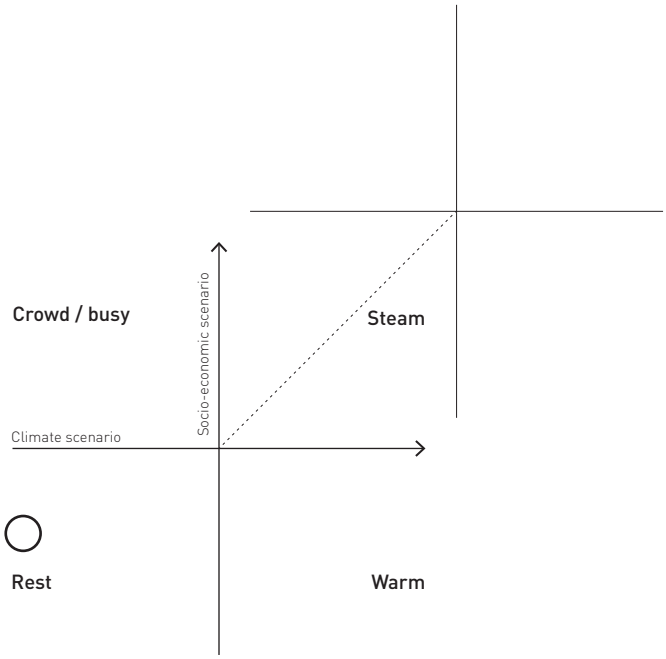
- Trust
- Participation.
- Widespread trust and civil culture reuslting in public investments and private maintanance (appropriatness).
- Hybrid solutions, ecological engineering.
- Ecological awareness.

Strategies:

- Public participation for codevelopment of infrastructures (increasing appropriatness)
- Promote high tech - nature based solutions.

The rationality behind the representation of each spatial configuraiton of the scenarios adaptation are given by the partly, low aìor full reactivation of specific patches and corridors in the Micro basin.
The more a patch or corridor or element is opaque the least reactivated it is...

Municipal Green areas influence
Fluvial corridor
Green regional corridor
Hybrid corridor
Local green corridor
Municipal green areas
Open space patch



Rest:

General considearations

- Moderate rise in average temperatures, dryer / warmer summer, soft increase in winter precipitation.
- limited concentrated urbanization and or shrinkage.
- More regional and multi-functional agriculture.
- Energy transition.
- Nature areas grows slightly.

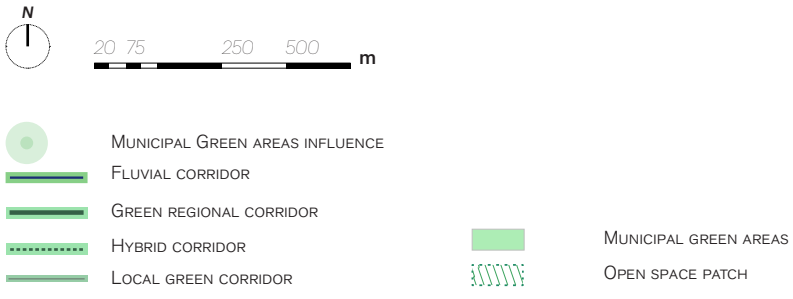
Values:

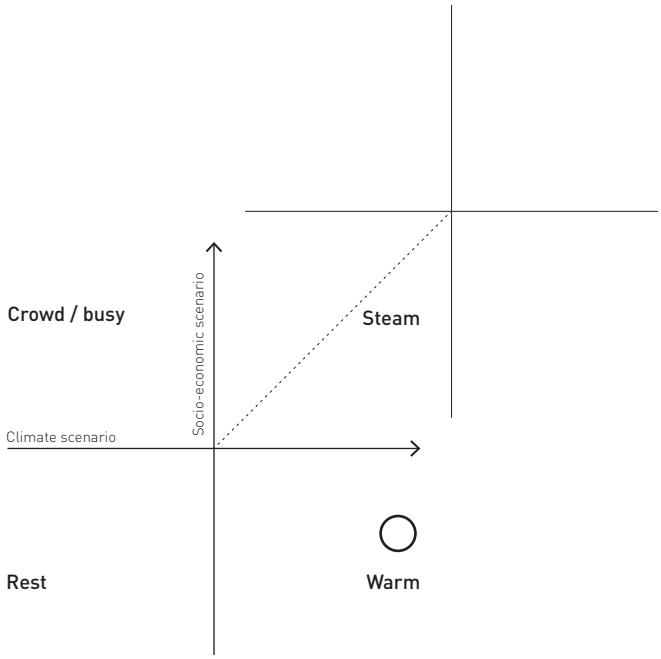
- Collectivism
- De-growth

Strategies:

- Maximize invetments in private areas trhough subsides and incentives (legally binding mechanisms) to mitigate the effects of climate change.
- Pormote low tech / nature based solutions.

The rationality behind the representation of each spatial configuraiton of the scenarios adaptation are given by the partly, low aìor full reactivation of specific patches and corridors in the Micro basin.
The more a patch or corridor or element is opaque the least reactivated it is...


N
20 75 250 500
m
Municipal Green areas influence
Fluvial corridor
Green regional corridor
Hybrid corridor
Local green corridor
Municipal green areas
Open space patch



Warm:

General considearations

- Steady rise in average temperatures, dryer / warmer summer, increase in winter precipitation.
- Low trust in public entities and in return on the investments on behalf of the private sector.
- Urbanization decline strongly.
- Nature areas grows slightly.

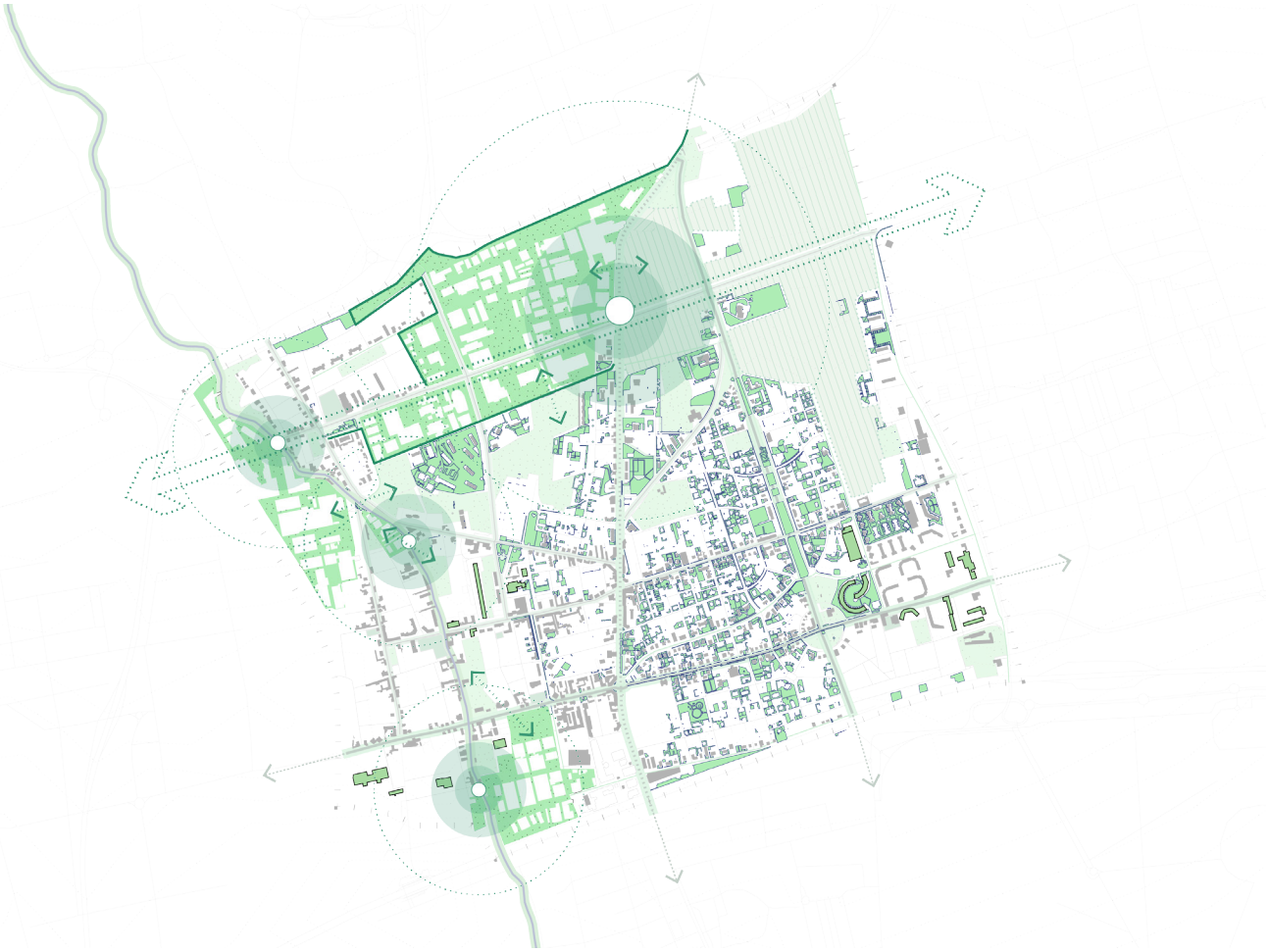
Values:

- Scariness

Strategies:

- Maximize invetments in private areas trhough subsides and incentives (legally binding mechanisms) to mitigate the effects of climate change.
- Promote low tech, nature based solutions.

The rationality behind the representation of each spatial configuraiton of the scenarios adaptation are given by the partly, low aìor full reactivation of specific patches and corridors in the Micro basin.
The more a patch or corridor or element is opaque the least reactivated it is...



Municipal Green areas influence
Fluvial corridor
Green regional corridor
Hybrid corridor
Local green corridor
Third Landscape nature areas
Municipal green areas
Open space patch

Re-Territorialization

5. Genealogies

From Meso to Nano scale.
The genealogies as a key component in the design process starts from the Meso scale by finding similar patterns of spatial conditions (Nano form), and then by appliyng a gradient of mutiple possible spatial operations. Thus it explores open ended and indetemrinate dimensions of transformations in time.
It makes visible, projects, anticipates in a flexible manner, the re-programming of nature in corrodors and patches according to various contingencies.

Genealogies

Similar to taxonomies, genealogy is an exercise dealing with classification, a design process with the aim to explore intederminacy and open endeddness in complex socio-ecological systems through multiple spatial transformations.

Indeed it deals and cope with the temporal dimension.
It wants to design and explore time.

Multiple Spatial operations ;

Flexible adaptation strategies for multiple futures.
Flexibility in governance (planning), i.e. implementation policies and flexibility in design (multiple options in time as plans and projects).

Genealogies becomes instrumental and operational in the manifestation of reterritorializaiton. Thus reintroducin nature, reactivating of ecosystem services.

How are the patterns defined:

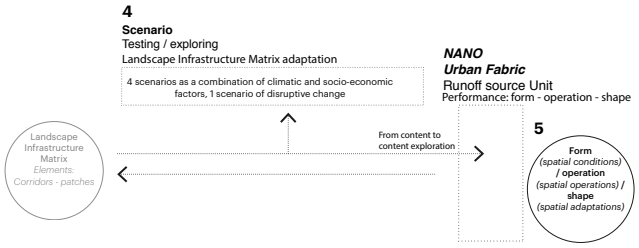
The patterns (gene) are definied Based on the Landscape Infrastructure Matrix corridors - patches spatial conditions, i.e. synthetising parameters related to dimensioning, alignments and importance (Matrix structural elements and hierarchy)
Once patterns have been defined (genes), the exercise projects multiple options of spatial transformations according to degree of alteration and specific contingencies

Genealogies Projection declinations :

Corridors; Linear (Conduit), matrix (Filter), patch (Source)
Patches; regional, local
Built up; GSI of different urban typologies

Eventually, genealogies are also the step in which the ideas and concept brought forward so far, i.e. re-territorialization and multiple synergistic infrastructures, starts to assume and take a spatial dimension.
As previously explained this has been done trough a design process / immagination of “multiple landscape in transformation” which will ideally attune and adapt to the multiple configurations (contingencies/scenarios) that the future might hold and present.

Relation between genealogies (5) and the broader process of the methodology



How to read it :

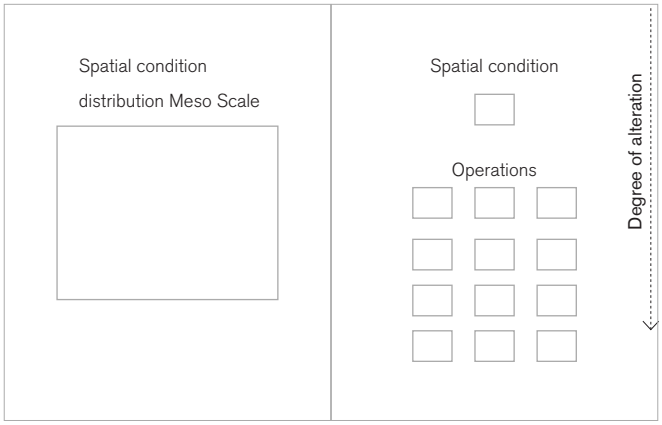
Two main operative actions are visualized throughout the genealogies (Next pages):

Addition (in red) and Subtraction (In violet).
These operations are fuly described (written) in the separate booklet of the genealogies.

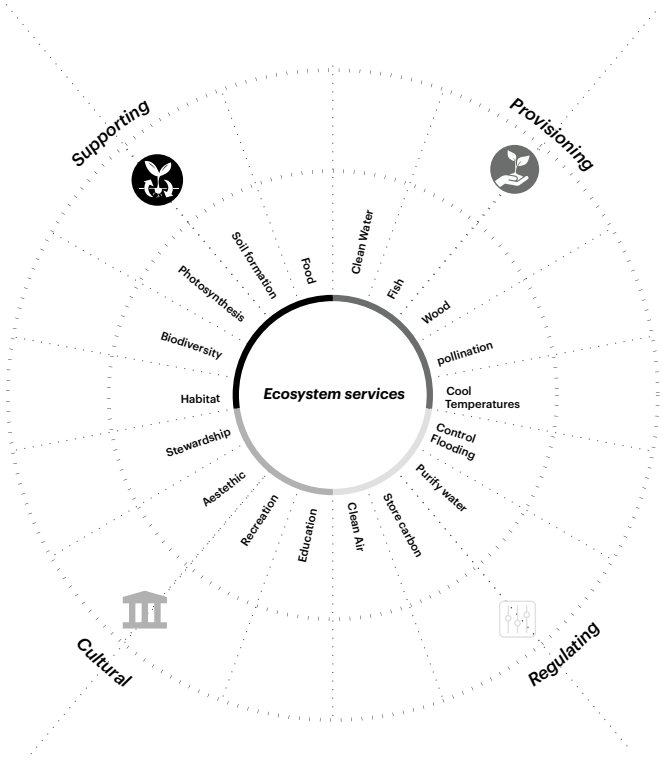
The Degree of alteration it's shown incrementally from top to bottom.

Operations

- Addition
- Subtraction



Ecosystem services diagramm

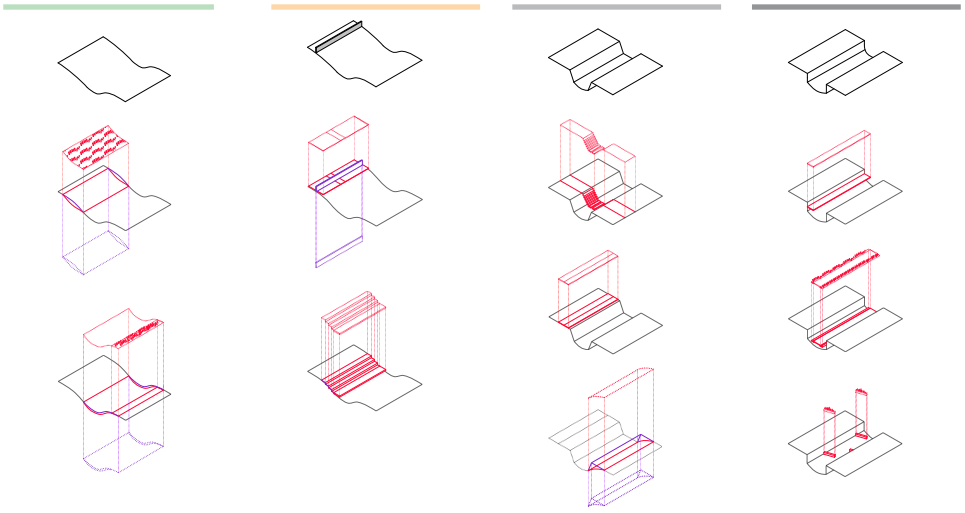


As it is presented in the additional booklet of the genealogies, the ultimate goals of the spatial operations is to reactivate a set of particular services which were outsourced and de-territorialize in the process of territorial formation in the urban region of Milan in the context of industrial economies.

These services stems from the benefits that nature provides to humanity at “no-cost”. The re-activation and representation of such reactivation becomes crucial in the narrative of the project by supporting a set positive conditions generated by ecosystems.

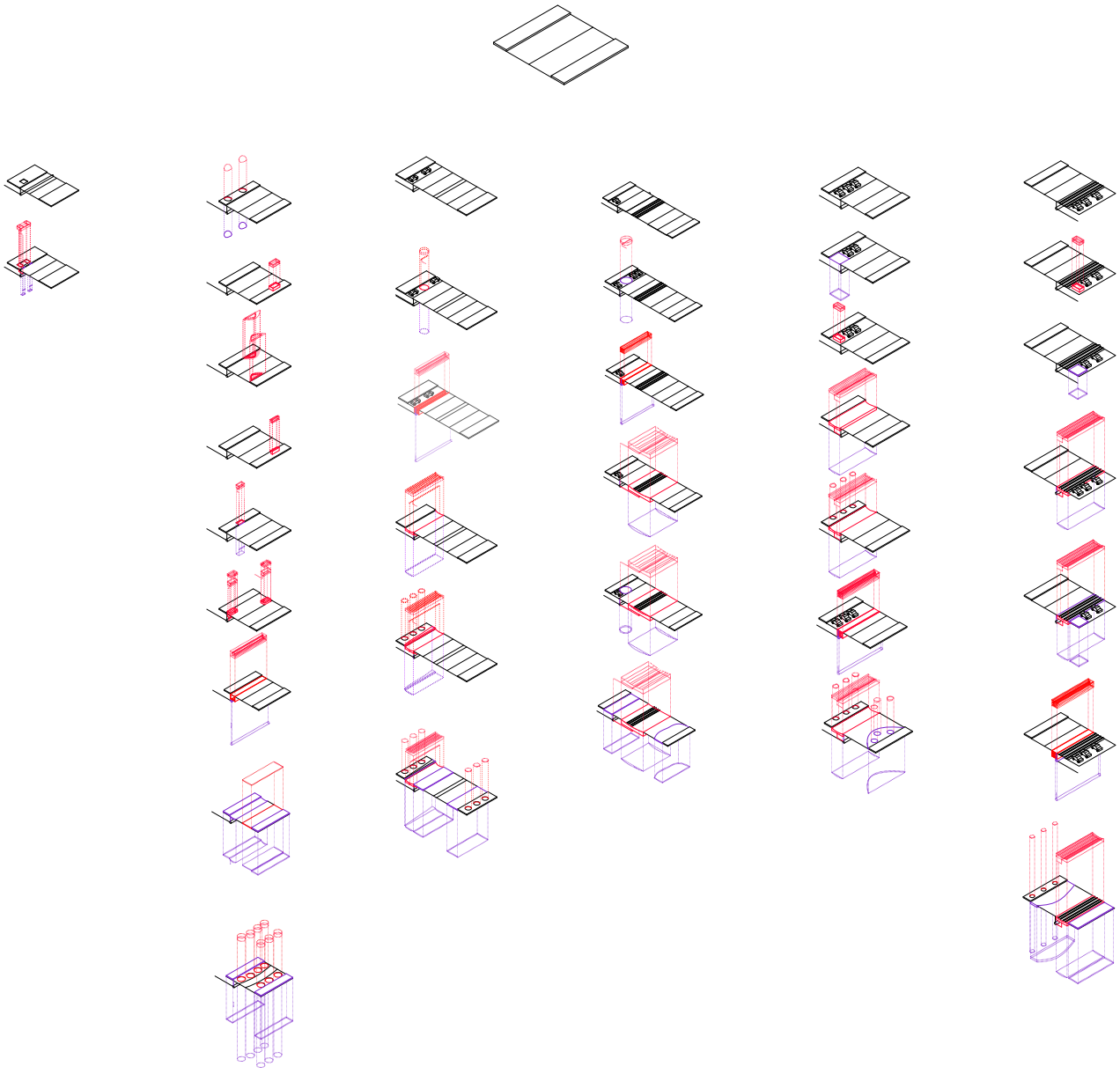
Fluvial space (corridor)

Genealogies



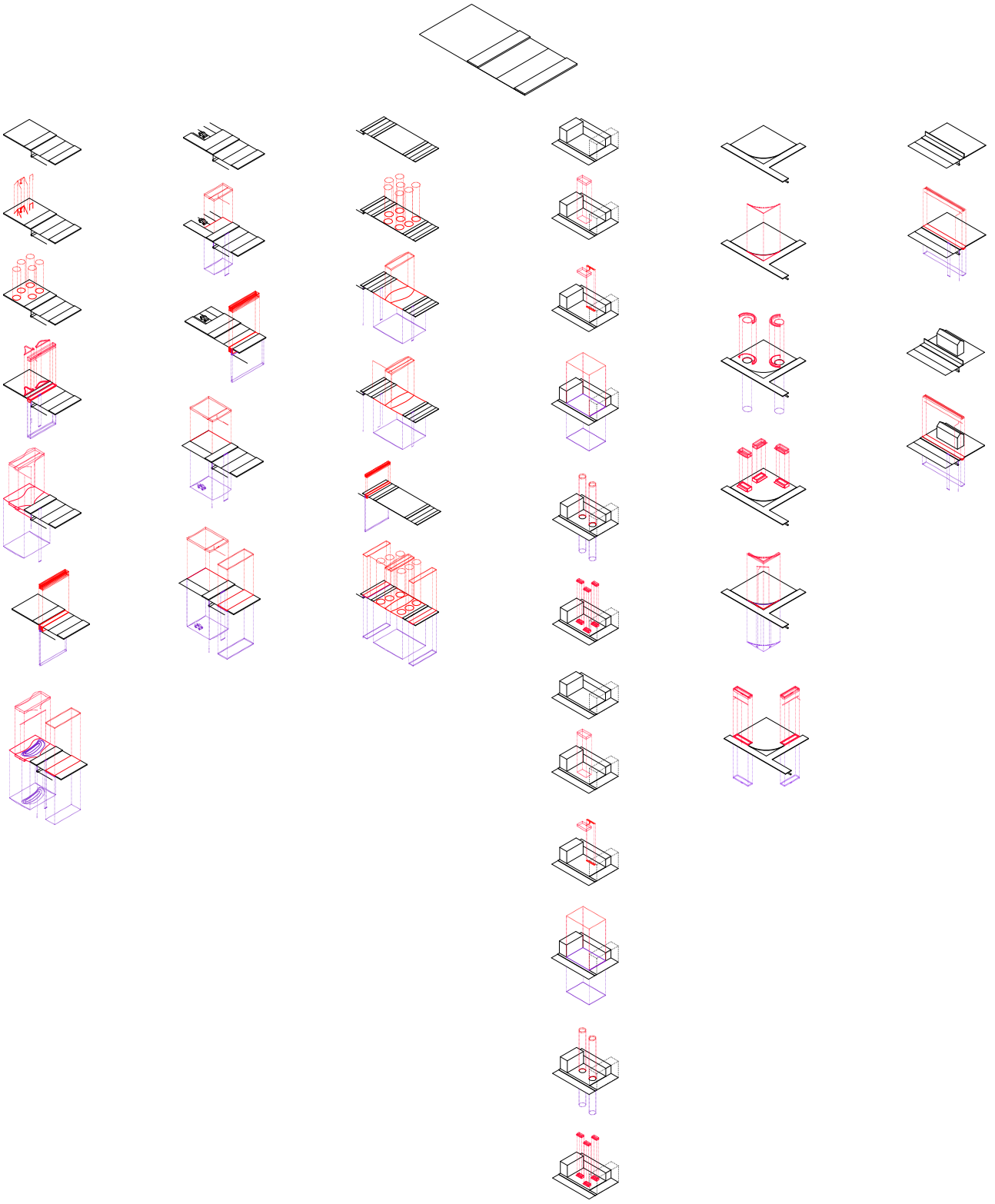
Linear intervention, road (corridor)

Genealogies corridor 1



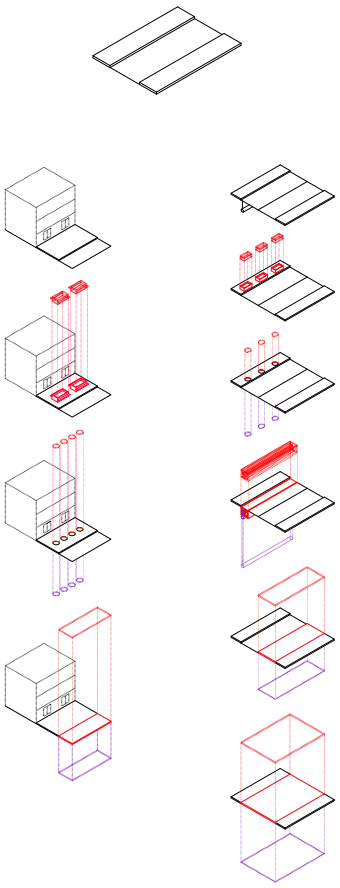
Linear + public space intervention, road (corridor + patches)

Genealogies corridor 2



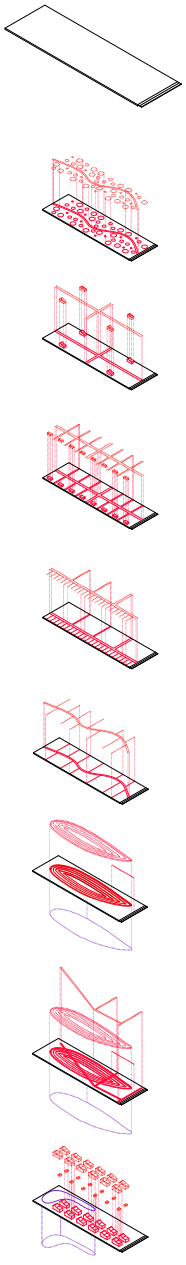
Linear intervention, small road (corridor)

Genealogies corridors 3

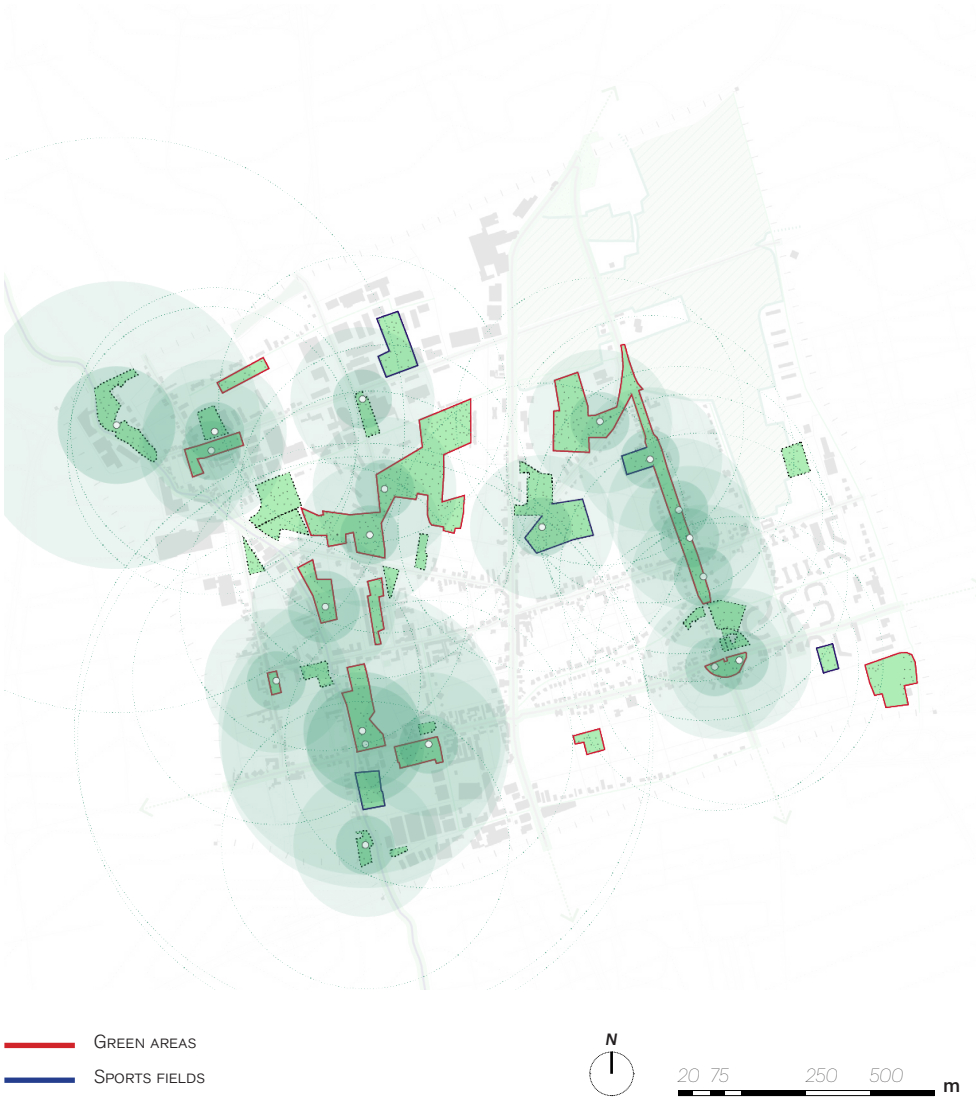


Regional open space, Patch

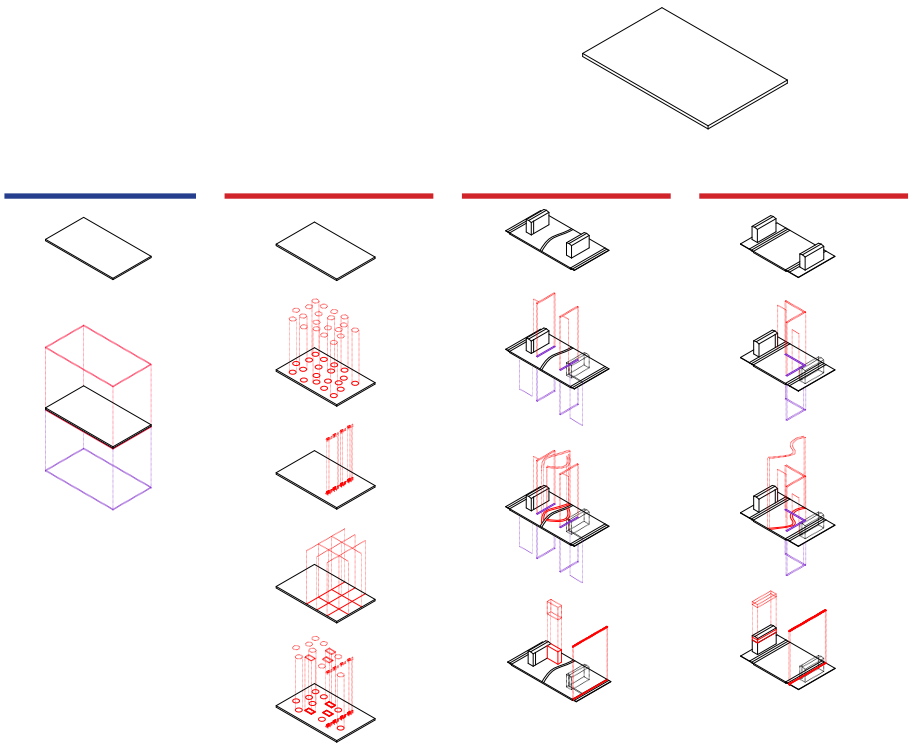
Genealogies open space



Local green areas (patch)



Genealogies municipal green areas



Private space intervention (patch)

CONTINUOS
DISCONTINUOS
INDUSTRIAL
DIFFUSE
DISPERSED

N

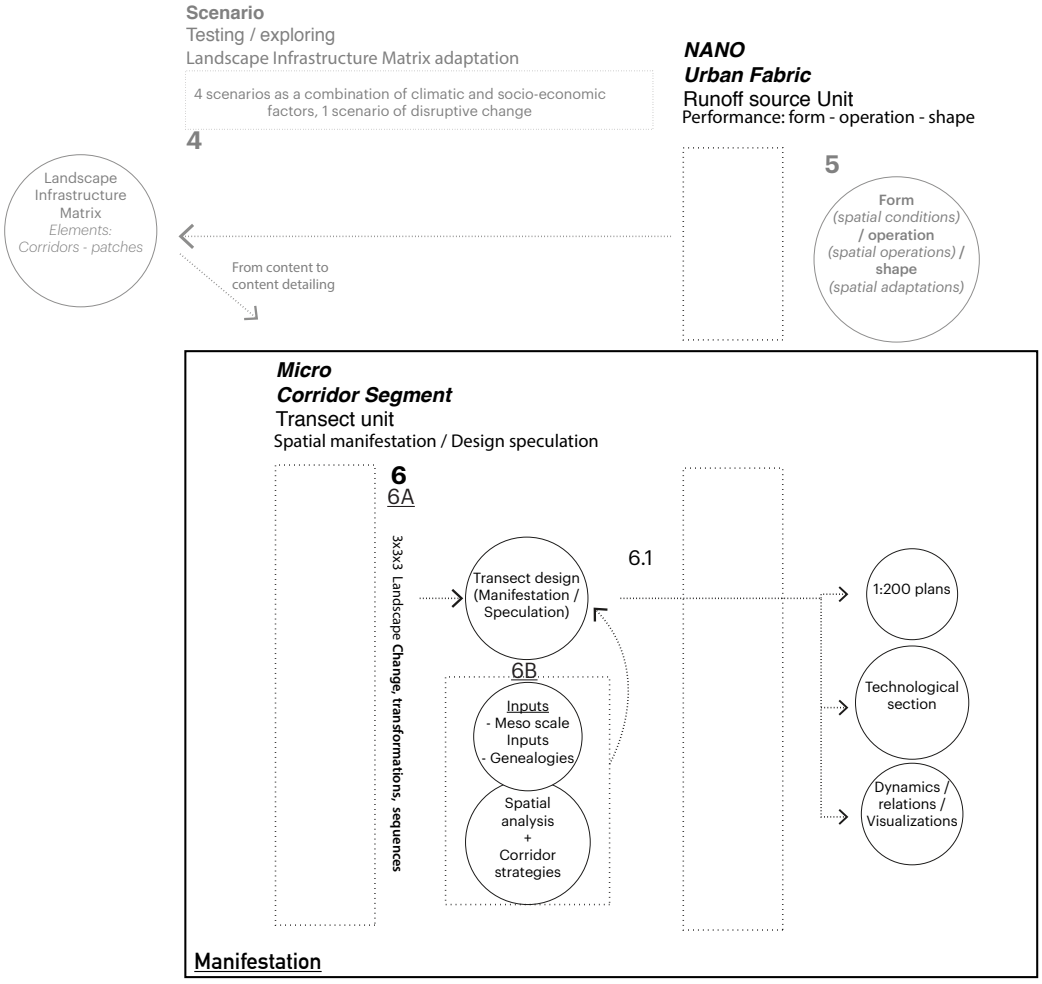
20 75 250 500 m

Built Up Typologies

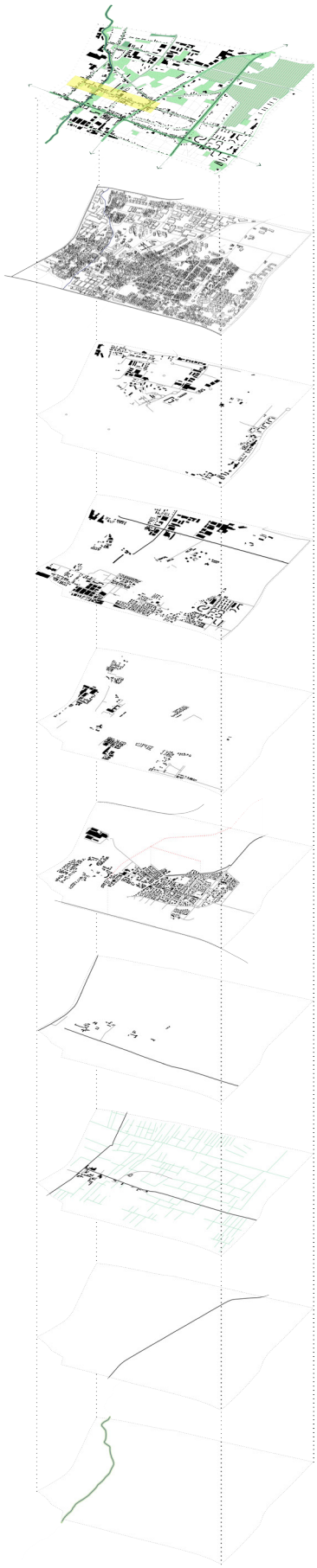
6. Micro - Nano scale

Objective:
The aim of this last section is to speculate on a possible materialization of the interscalar design process taking into consideration specific temporal variables previously disclosed.
Therefore, in the following chapter, an urban and landscape design for landscape defragmentation, mitigation of hydraulic risk and ecosystem services reactivation is visualized throughout.

As in the other core chapters of the work, the methodology here below serves to guide the reading through the section, nevertheless to connect this component in relation to the whole process of the graduation project.



6A: From meso to micro, location choice



From Programming to manifestation:
The micro - nano scale has been developed as the ultimate projective scale. Thus, as a crucial step in the visualization of "re-territorialization" wants to physically materialize and spatially manifest the interscalar design process. Furthermore, through convergent thinking, decides to materialize a specific scenario, which is seen as a desireble future in which only certain types of operations are deployed. In this sense it also shows the crucial step of explaining how the genealogies comes together from fragments of transformations, to coherent units of urban and landscape development.

Last but not least it serves as the "highest" and more powerfull visualization tool to portray the transformations and implications of the initiali Vision (human - non human relations) / Objectives (landscape defragmentation and mitigation of hydraulic risk). Thus doing, the project of "Re-territorializaltion" takes a fully material and spatial dimension.

The horizontal transect (segement of a corridor) has been selected due considerations of various nature.
Specifically, the area taken into consideration represent the most dense setting of the Micro basin. This historical axis has been "grafted" in the 17th century as shown in the 3x3x3 exercise (figure on the left) and it represent the socio-economic core of the municipality of Cusano Milanino with all the administrative and small scale commercial functions taking place here.
Starting from this considerations the spatial manifestation wants to be strategic in showing how public space and environmental design can co-exist in such a dense setting and how they can reinforce each other. Indeed the interralations and interplays, tangible and intangible between the natural and the human domain are disclosed and visualized in this chapter.

Scenario decision

At the Micro scale a projective approach through the deployment of a specific scenario has been explored.
The scenario is taken as a combination of variables in the climate and socio-economic domain, coupled with disruptive changes in the mobility sector.
As previously explained in the "disruptive change scenario", this future stand on the hypothesis that 30% of the space now deployed for mobility would be freed thanks to modern technologies. Moreover, 80 - 90 % of the Parking lots would become obsolete and traffic would be reduced by 40 - 50 % (Ratti, Claudel, 2015)

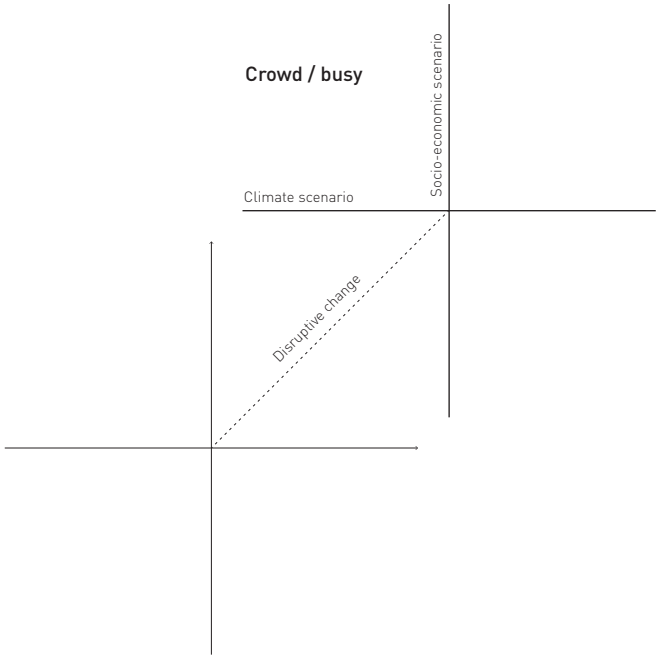
"The American Society of Civil Engineers recently gave U.S. infrastructure a D+, estimating that our country requires $3.6 trillion in infrastructure investment by 2020. If we have to rebuild and revitalize our roads and cities anyway, let's do it in a way that puts people, not cars, at the center of our future"

"A full shift to "Transportation as a Service" is finally possible, because for the first time in human history, we have the tools to create a perfectly efficient transportation network. We saw this potential in 2012 when Lyft became the first company to establish peer-to-peer, on-demand ridesharing",

From:
https://medium.com/@johnzimmer/the-third-transportation-revolution-27860f05fa91#.ll6jlasb6
http://www.infrastructurereportcard.org/executive-summary/

Under this paradigm, the role of mobility and roads from "monofunctional" urban spaces, shifts toward multifunctional, integrated green-blue infrastructures as also shown in the last transformational gradient of the genealogies..

The space left empty by this tehcnological disruption will be used to bring nature back into the urban landscape and to re-activate the "lost" ecosystem services.
Water sensitive urban design / performative nature and revegetation coupled with high tech transport spaces, spatially underpin this scenario and thus the Micro - Nano projective visualization.



Disruptive (Crowd / Busy) scenario:

General considearations

- None or moderate increase in the number of inhabitants.
- Moderate rise in average temperatures, dryer / warmer summer, soft increase in winter precipitation.
- Controlled / guided urbanization
- Balanced and progressive collaboration between public entities and the private sector.
- Rapid transition toward a circular and bio-based economy.
- Fast energy transition.
- More intensive and more multifunctional agriculture (added value, co-operative based local production)
- Re-shoring and development of new industries.
-High environmental awareness.
- Local food production
- Low meat diet - high request of legums and vegetables
- Aging population
- Automation and self driving vehicles
- Re-shoring of industries and Clean Industry 4.0
80% less private cars.
- 50% reuse of road

Values:

- Trust
- Participation.
- Appropriatness
- Widespread trust and civil culture reuslting in public investments and private maintanance (appropriatness).
- Hybrid solutions, ecological engineering.
- Ecological awareness.

Strategies:

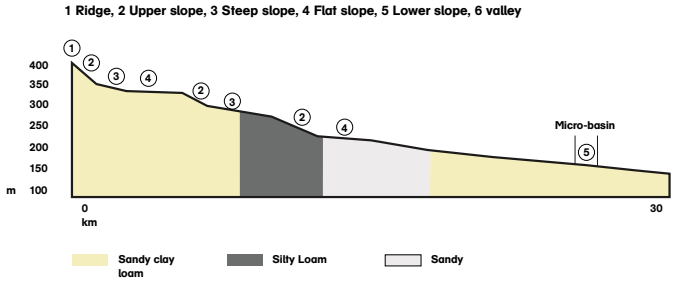
- Promote high tech - nature based solutions.
- Promote appropriatness through design
- Renaturalization as “healthcare strategy” for elderly

6B: Layering

In this paragraph a series of elements endogenous (corridors segment) and exogenous (design process, scales) elements are illustrated.

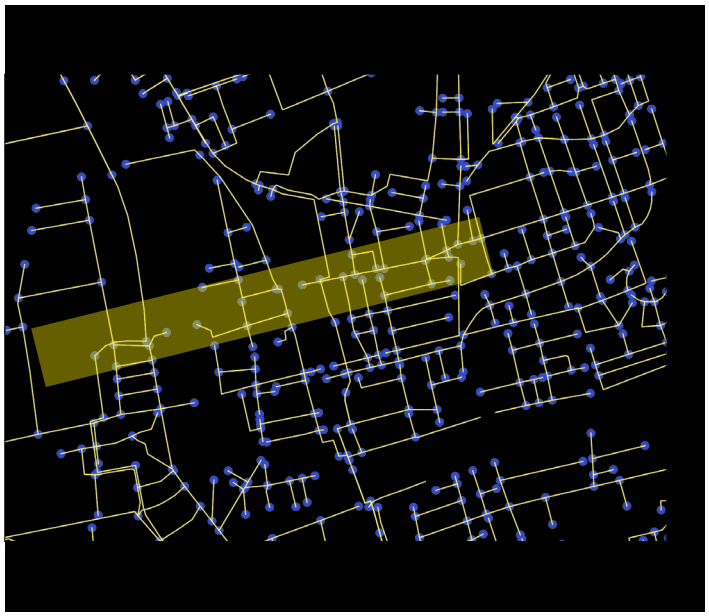
This process of layering sets the basis for the spatial rationalities behind the project development.

TPI

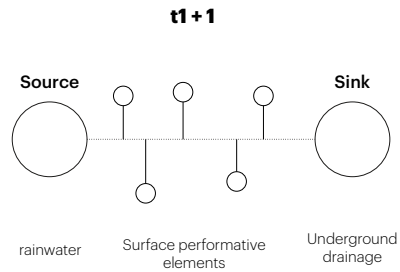


Limitation in discharge due to flat slope.
Soil condition: Sandy clay loam, good for water infiltration.

Underground Drainage System

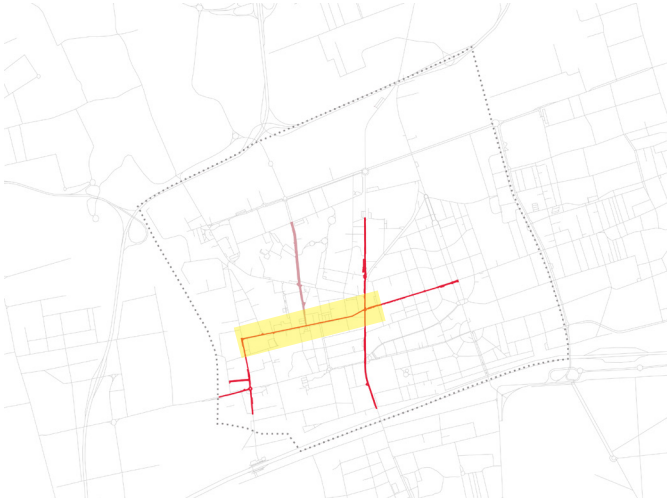


Subsurface Drainage system and inlets (manhole) distribution. These elements are crucial to understand water dynamics and surface subsurface flows as a starting point to mitigate hydraulic risk



AIM: Infiltration,
Delay runoff from the streets to the subsurface drainage system trhrough surface subsurface performative elements.

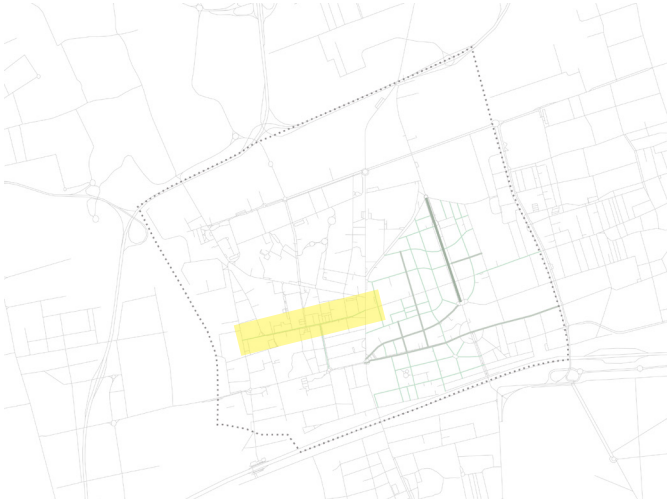
Meso scale commercial axis



As previously explained the decision to locate the design speculation of this specific segement of the corridor is also due to the socio-economic value (in red in the picture on the left) of the axis for the whole micro basin.

Thus doing the spatial manifestation wants to show a possible urban landscape reconfiguration which is able to envision a coexistence of natural and man made elements and their beneficial mutual interralations.

Meso scale green axis



The segment as it is now presents various positive features, first the active presence of socio-economic elements, secondly, the quality of the tree lined street and the heterogeneity in built typologies which defines this axis. Albeit these qualities are depicted as positive, there is also a widespread condition of degradation and lack of “unity” - “continuity” in the perception of public spaces. Furthermore, most of the positive features just described are fading due to aging of public space elements (sidewalks, roads, paving) and the life cycle of the tree lined street.
Under this lens the project as will be further described wants to reactivate the full potential of the conditions described above and proposes a strategy of urban reneawal, according to the scenarios in which it manifest itself.

Spatial analysis

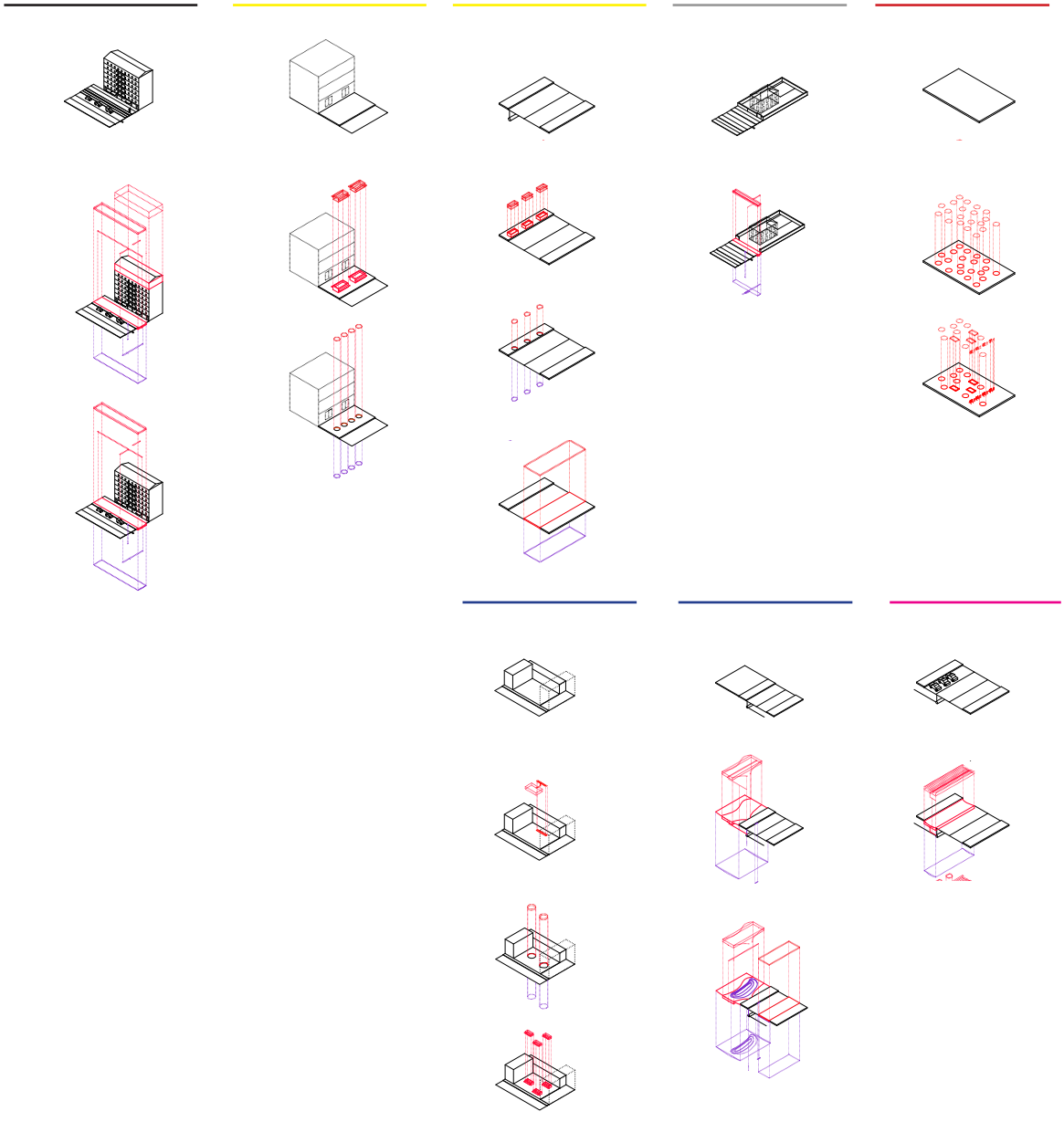
Endogenous dimension:
Toward project...
Building upon and understanding existing qualities.


Active ground floor
Civic buildings
Parking
Important public spaces

Input from genealogies:

The aim of the genealogies is to inform the design of the corridor by unfolding a set of fragments of operations to the urban - landscape designer (progettista)

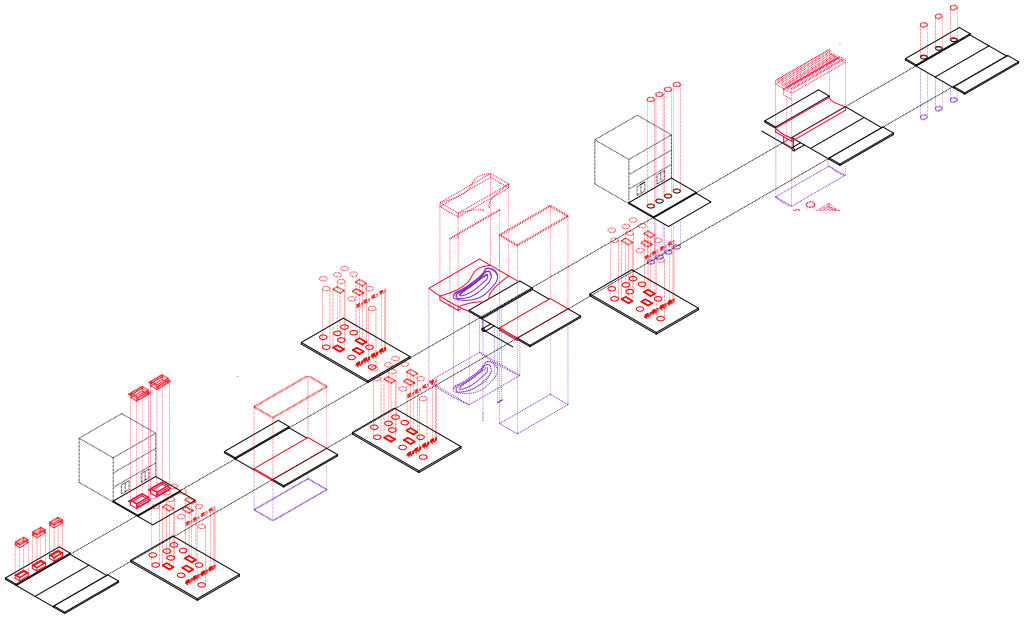
Process.
First:
Selection of spatial condition defined by the segment of the corridor (figure on the right in relation to colours here below).
Second:
Selection of spatial operations which fits the scenarios (below)



The drawings below is taken from the previous exercise in the genealogies chapter in which different spatial conditions are dected in order to decodify the complexity of morphologies and to initiate the process of imaginative alteration through multiple spatial operations in time.

From fragments to a continous contigous dimension.

The drawing here below shows an “abstract” materialization of genealogies as fragments of the corridor.
Below with the Strategies section the continuos dimension of the corridor is disclosed through urban and landscape strategies.

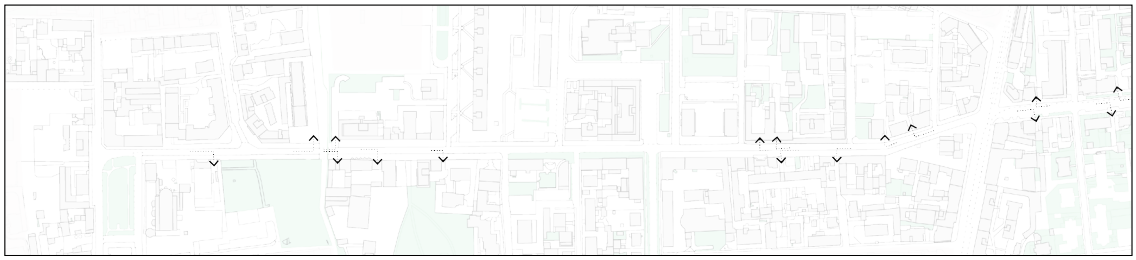


Strategies:

The strategies comes along with an envisioned process of urban renewal, in which different strategies are deployed to reconfigure the corridor.
Urban and landscape strategies of: - Access - levelling, - sinking, - hybridization and vegetation.

▪ Access.

Keeping accessibility to existing houses and innercourtyards. Keeping 3,75 meter as the minimum legal width of urban areas for security reason (fireman, ambulance etc..).

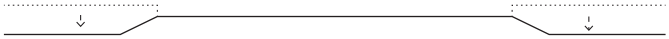


▪ Leveling - Sinking
by urban and landscape design

T0
Road nowadays, on high, hard constructed ground

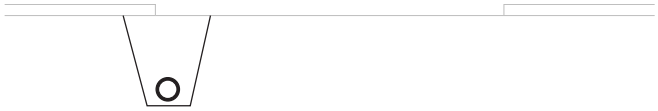
T1
Levelled road

T1
Sink road



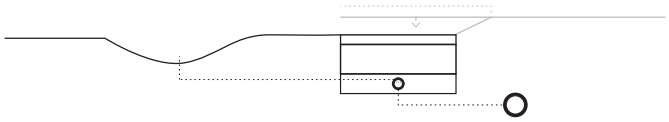
▪ Hybridize
by infrastructural, subsurface - surface technology design

T0
Subsurface water infrastructure now



T1
Curb cut and sustainable urban drainage system.

T2
Outlet is designed as such as excess stormwater from infiltration technology is redirected in a consequent space of storage.



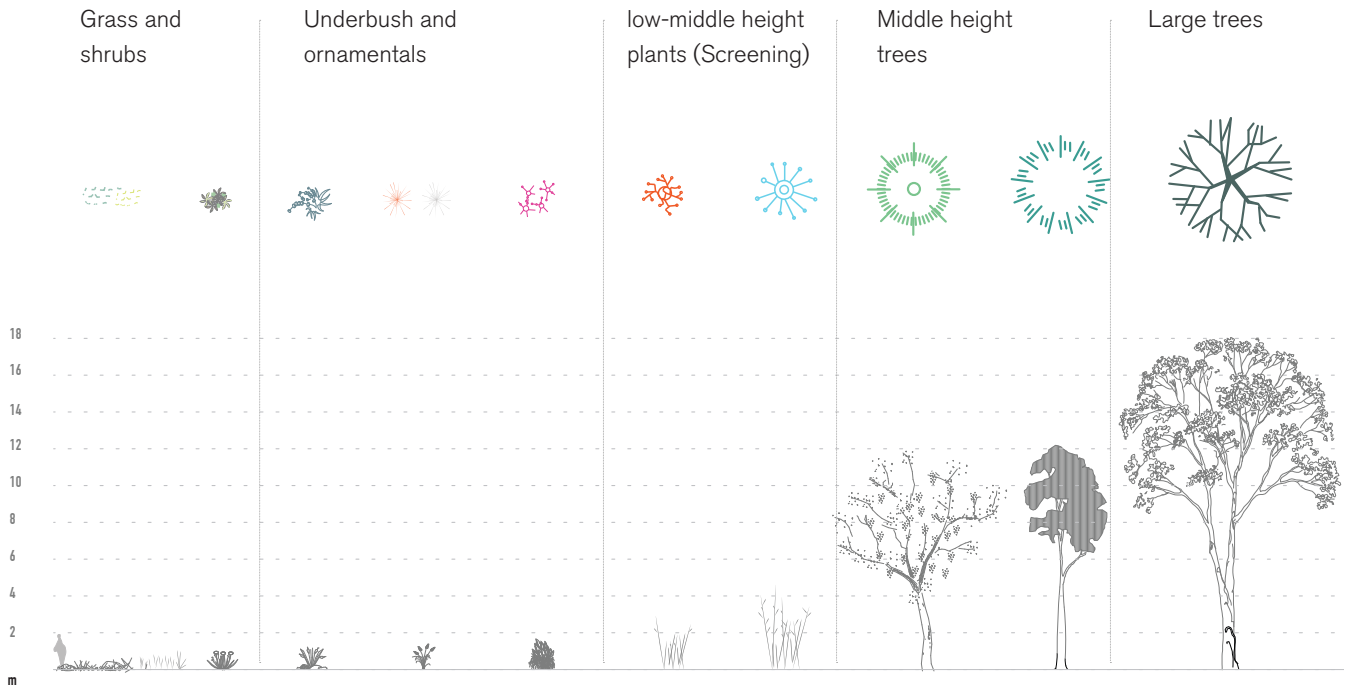
These strategies activate the potential for the technological retrofitting of the water management infrastrstucture.
In the strategy the manhole is progressively substitued with sustainable urban drainage systems, reactivating the potential of nature to infiltrate water..
Also the strategy seeks to reactivate road adjacent spaces which have the potential to store the excess of water.

▪ Vegetation

As a landscape and urban strategy, the vegetation layer is materialized as a structure of different live matters responding to various corridors and patches conditions by evoking different perspectives and sensorial events.

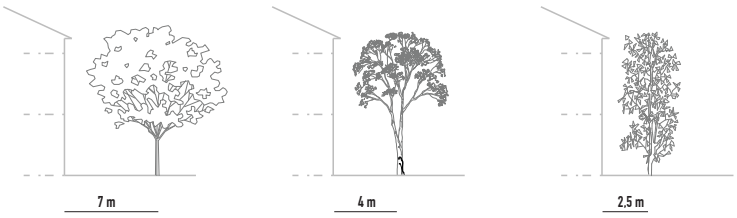
On the right the sections wants to correlate the projection of vegetated surfaces with the vertical perception (sensorial dimension) of the ecological reprogramming.

Vegetation, heights and types recomendation



Although the plants type haven't been specified in their full details, the project reccomends the delpoyment of native - non native communities of plants at different heights, instigating different relationships with the sorrounding built environment and with human beings. Specifically underbushes and grass, middle height plants and large trees as explained sectionally here above.
Based on literature and the climate dynamics which will affect this territory (as explained in the Micro-Nano chapter strategy and in the Crowd scenario, climate paragraph), the work foresees the delployment of low maintanance landscapes, perennials and drought resistance plants to cope with climatic contingencies.
Therefore, based on these landscape - climate objectives and on a research conducted on native - non native species, the native dimension of the vegetation can be found in this document: http://www.piantespontaneeincucina.info/documenti/dalla_brianza_piu_verde_alla_tavola_di_tutti_i_giorni/brianza_verde_tavola_frutti.pdf, while the "non-native" vegetation in order to deal with new climate dynamics envisions the introduction of low maintance and perennial landscape which can be found using the website and inventory of the Royal Hoticultural society of the UK, https://www.rhs.org.uk/, . The database which according to different parameters, like soil type, heights etc.. (previously explained in the project) can show the multitude of vegetated options available.

Sections, vegetative strategies



Corridor strategy in relation to different spatial conditions.
Application of large trees as the corridor main connective element.
Sections shows the different declinations of large trees in the corridor, depending on the corridor contiguity with the urban fabric.

Tree lined streets with specific underbushes plantation. These types of landscapes wants to reintroduce continuity in high vegetative patterns, recreating underbushes ecological dynamics and provide open view on the sorrounding urban landscape.

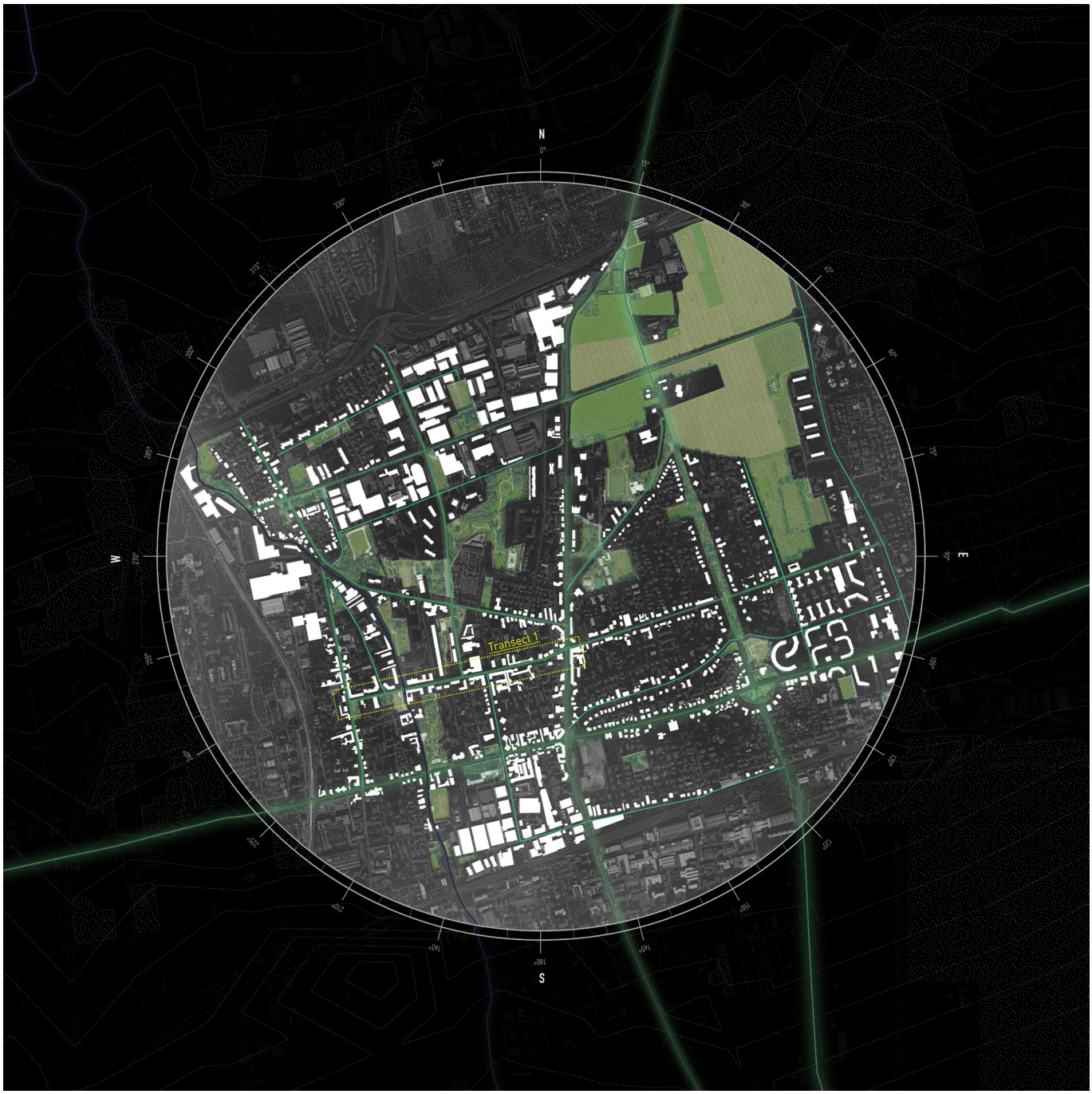
Vegetation programming of large and middle height trees in corridors green patches and public spaces, reevoking native forest landscape previously underliyng this territory.

Specifc type of vegetation could be planted to have a vegetated transition from public to private spaces and to create communities of plants which creates a seemingly “closed” and sourrrounded perspective in public spaces.

Grass, bushes and perennials plantation will be the main landscape straegy for vegetated strips and the local media of “sustainable urban drainage” elements.

6.1 Transect design: spatial manifestation - design speculation

Relation between Landscape Infrastructure Matrix at Meso scale (below) and Micro design (figure on the right)



Below the spatial design for the transect.
The circles represent the projects that are going to be further disclosed in the next pages. They all consist of different and similar products and they have been choosen for their strategic dimension in the transect. Although the 4 projects presents unique carachteristics to be visualized, such as water dynamics, human-natural proximity etc... they all entail similar elements of landscape defragmentation, mitigation of hydraulic risk and biotic and abiotic relations.

The last part of each Micro-Nano project also presents a "display" which shows the specificities of the envisioned event in a specific moment with specific geographical location. Thus doing, the project reinforce the geographical dimension of the project also brought forward with specific elements of visualizations in other scales. Therefore the design is thought as a set of dynamic interactions with seasonal, tmeporal, climatic and geogrpahical dynamics.

P4

- Before (plan)
- After (After)
- Technological Section
- Visualization / impression

P3

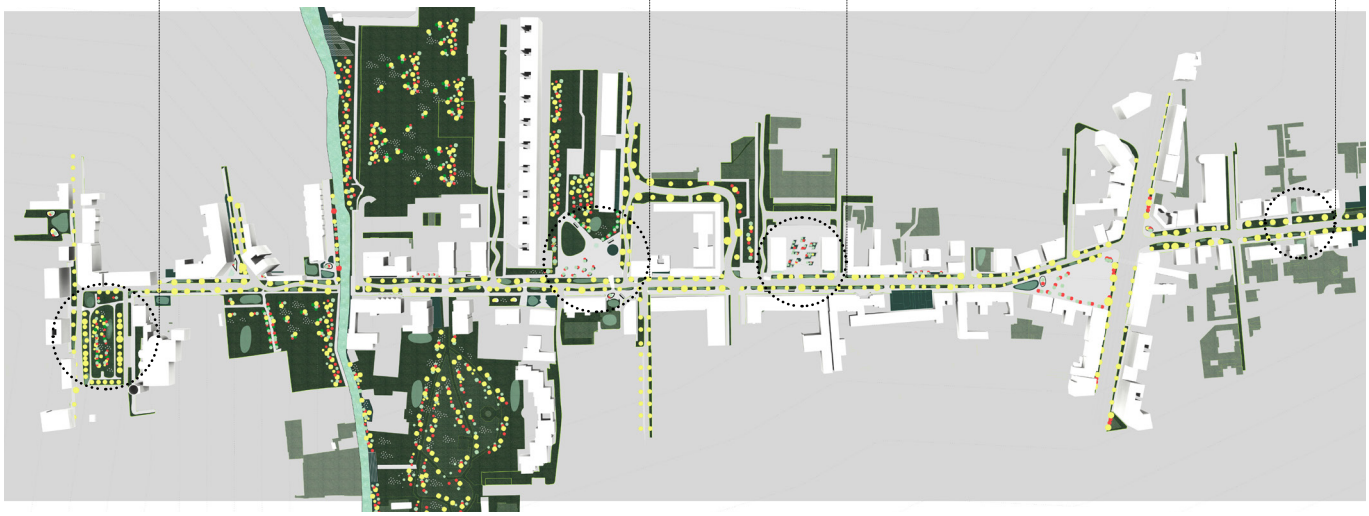
- Before (plan)
- After (After)
- Technological Section
- Climate Adaptive Design

P2

- Before (plan)
- After (After)
- Technological Section
- Biotic - Abiotic interactions

P1

- Before (plan)
- After (After)
- TechnologicalSection
- Visualization / impression



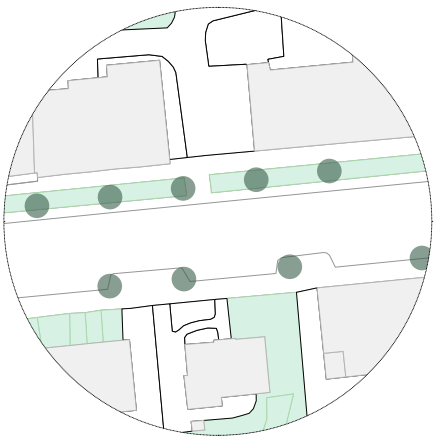
Shared space / public (circulation and public spaces)
Fluvial corridor
Municipal green areas (corridors and patches)
Private Green patch
Vegetation masses

P1

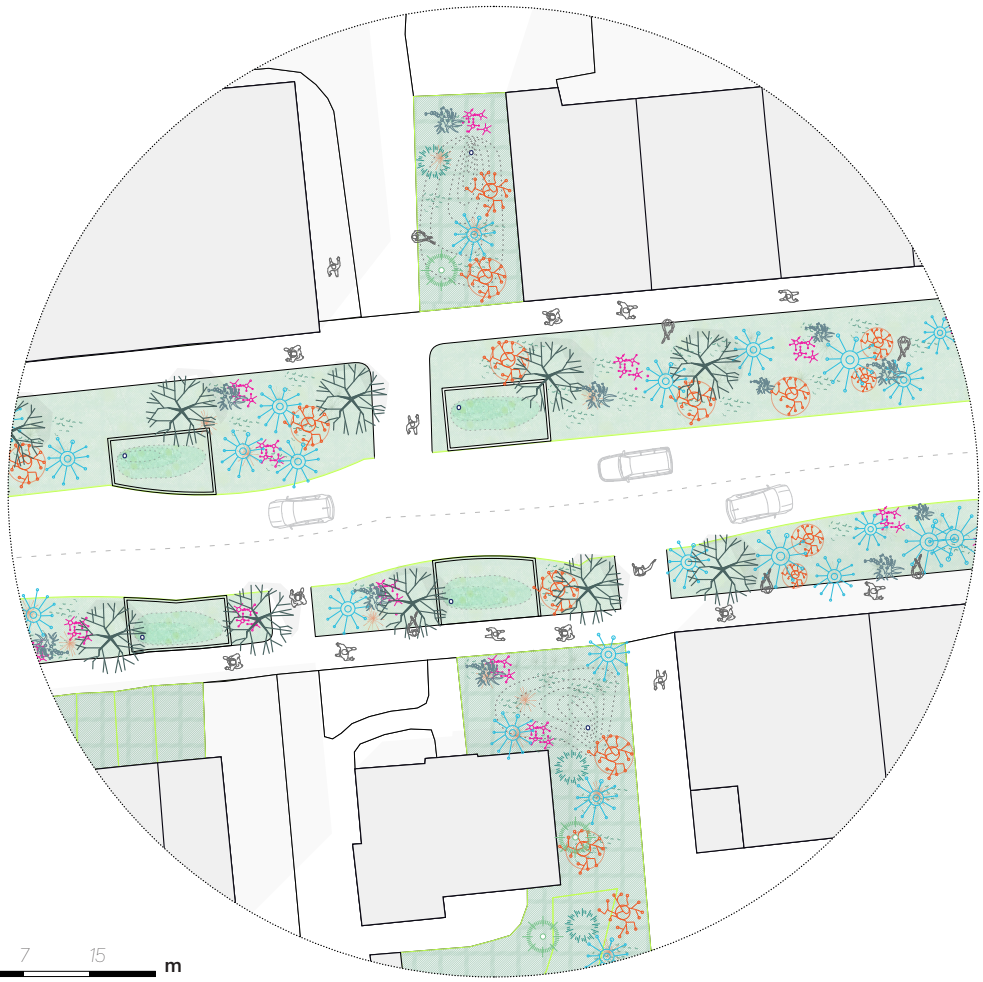
Local Corridor and private patch:
The plan visualizes a specific section of the corridor in which the public - private dimension is hybridized through landscape design and in which the renewal of the public space, i.e. street, sidewalk and water management infrastructure is projected.

The section wants to show the relation between vertical patterns of vegetation and the urban realm, neverthelss it shows in details the new urban landscape infrastructure to mitigate the risk of pluvial flood.

Before

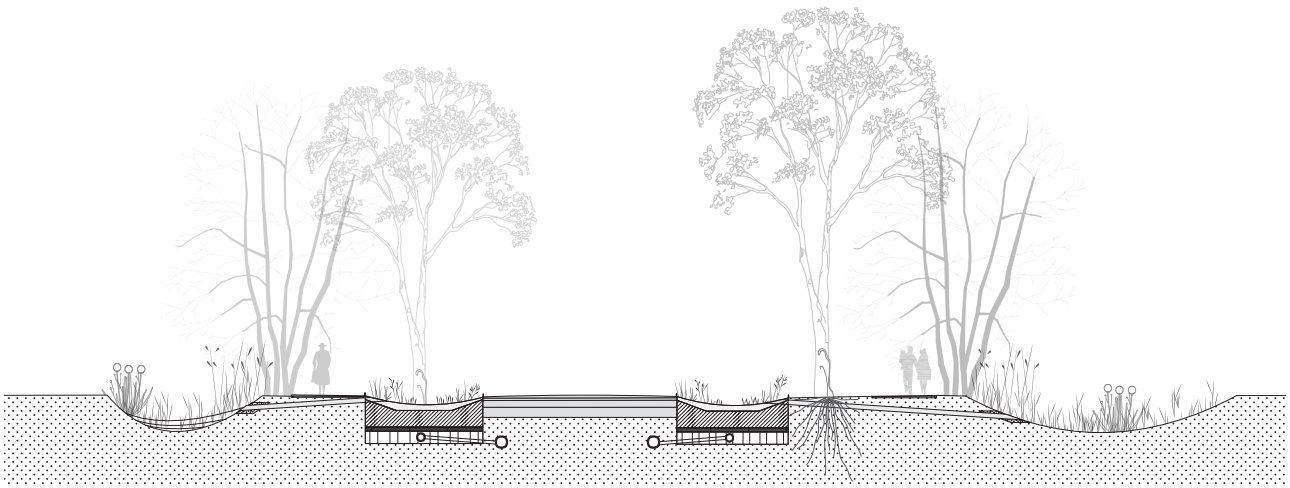


After



- Private green extension
- Depaving zone / soil addition
- Buildings
- Vegetation (specificities, page 138)
- Green areas
- Equipped green areas
- Water sensitive green areas
- Green areas boundaries
- Circulation systems
- Crossing

Technological Section



Visualization / Impression

The visualization on the right, represent an eye view perspective on a section of the spatial plan represented in the previous page. Specifically, it wants to highlight the spatial qualities of the newly designed public space, landscape design, infrastructural design and public - private border condition. The Circle represent a “snapshot” while the natural elements that goes out of the circle represent the continuity of vegetated system in the corridor.

30th of October

2:30 PM

45°33'06.09" ***N***
9°11'18.52" ***E***

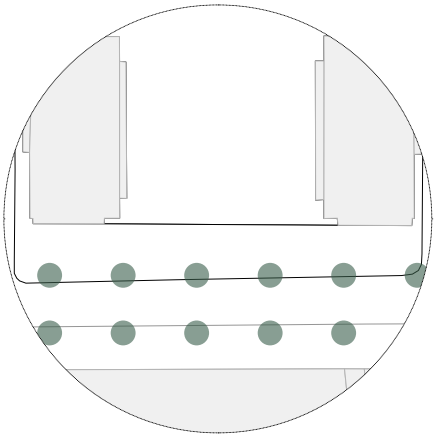
elev 152 m

P2

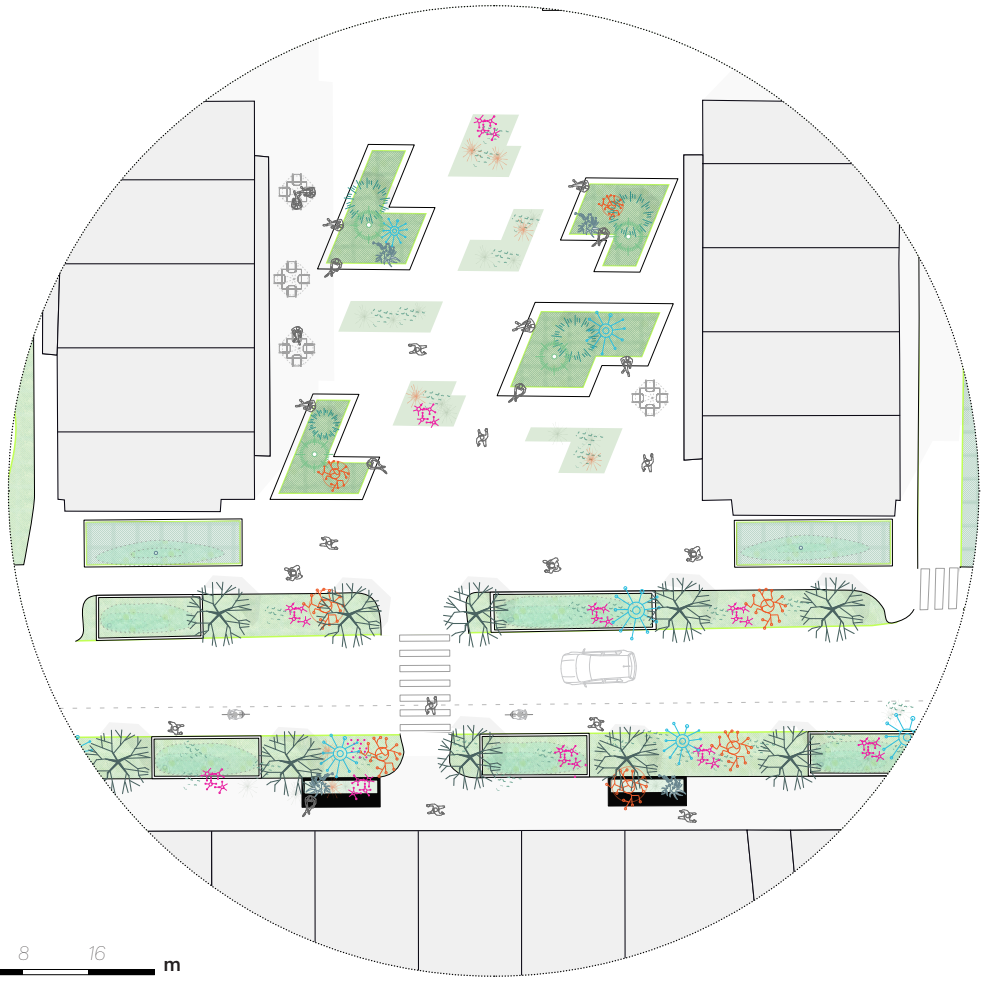
Local Corridor and public patch:
The plan visualizes a specific section of the corridor in which the a formerly degradated public square is renewed with different urban and landscape element of addition and subtraction. Nevertheless it shows the continuation of the corridor with different vegetative elements and the water management infrastructure.

The technological section on the right shows the relations and perspectives between vegetative elements and the new equipments, neverthelss highlights the new vertical dimension, containing soil engineering, bioengineering of plants and local media for the new water management infrastructure.

Before



After



- Private green extension
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- Buildings
- Vegetation (specificities, page 138)
- Green areas
- Equipped green areas
- Water sensitive green areas
- Green areas boundaries
- Circulation systems
- Crossing
- Equipment
- Hybrid equipment

Technological Section

Biotic - Abiotic interactions

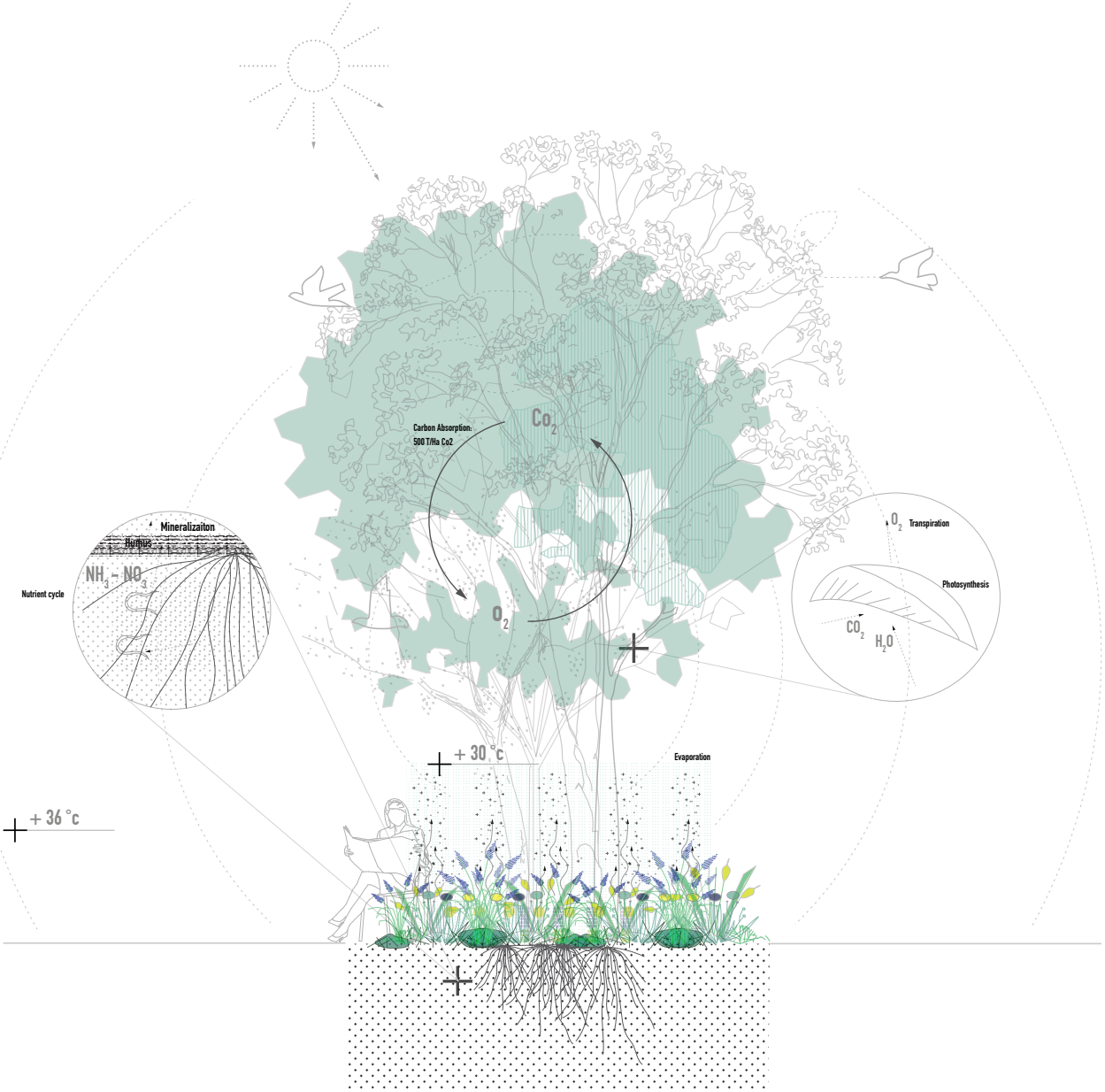
The visualization on the right shows some of the interactions happening between abiotic and biotic factors. According to the new low maintanance, diverse vegetative system in the square and in the transect.
Nature, trees and healthy soil in urban areas can provide various positive externalities (ecosystem services) as previously disclosed in the genealogies chapter.
Under this lens, this drawing wants to bring to the front different dynamics that nature in urban areas process.
The production of oxygen to breathe, the absorption of Volatile organic compound, the decomposition of leaves and plants into the soil, decomposed by bacteria, fungis and worms which consequently contributes to humus (organic matter / healthy) in the soil.
Last but not least, the vegetative system through shadows and evapotranspiration contributes to mitigate the Urban Heat Island effect.

30th of July

1:30 PM

*45°33'02.77" **N***
*9°10'57.98" **E***

elev 151 m

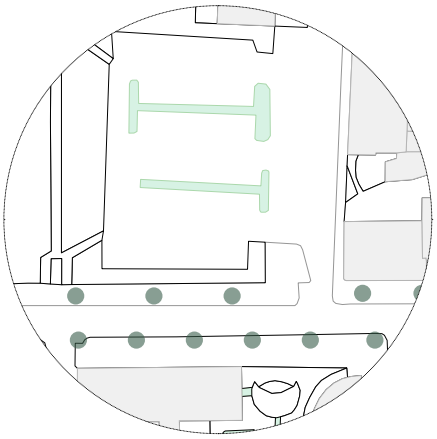

Carbon Absorption.
500 T/Ha Co2
Co_2
O_2
Mineralizaiton
Humus
Nutrient cycle
NH_3 - NO_3
O_2 Transpiration
Photosynthesis
CO_2
H_2O
+ 30 °c
Evaporation
+ 36 °c

P3

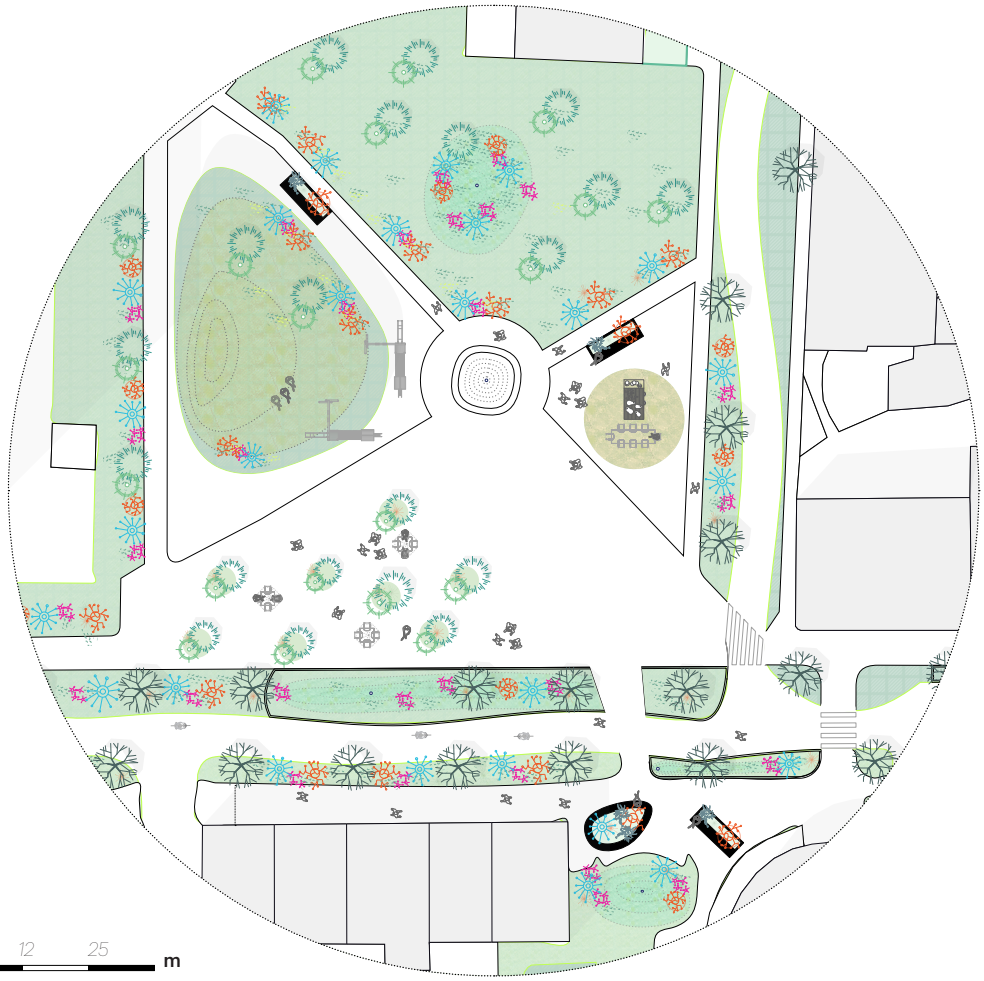
Local Corridor and public patch:
The plan visualizes a specific section of the corridor in which a former parking lot is transformed into a new public - floodable square. It also shows the new connections with the sorrounding areas, and the continuity of the “stepping stone” corridor through new vegetated strips containing high and middle vegetation as well as sustainable urban drainage systems along with the bioengineering of plants and local media.

The technological section on the right shows inlet and outlet design to store, retain and infiltrate water, according to different rainfall event. It shows the flexibility brought by the technological dimension of “climate adaptive urban design” through subsurface infrastructures for surface qualities and the recombination of hydraulic / civil engineering with landscape and urban design.
This adaptive dimension of the project is further shown in page 152.

Before



After



- Private green extension
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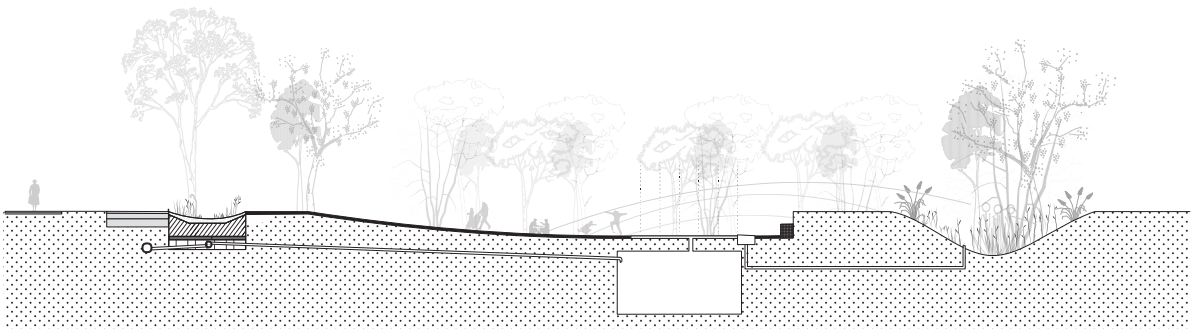
- Green areas
- Equipped green areas
- Water sensitive green areas
- Green areas boundaries
- Circulation systems
- Crossing
- Equipment
- Hybrid equipment

Technological Section



Climate Adaptive design

The sequence of drawings on the right shows the adaptive dimension of the new urban water management system. Specifically the sequence shows a potential configuration on landscape and infrastructural dynamics in the case of a normal rainstorm event, an extreme rainstorm event and the final sequence of infiltration and evapotranspiration.

30th of August

6:30 PM

45°33'01.97" ***N***
9°10'50.21" ***E***

elev 151 m

Rainstorm event,
normal intensity

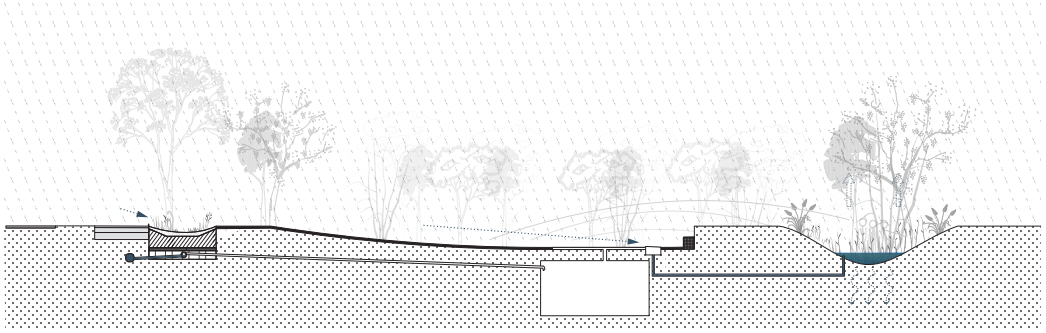
- Sustainable Urban Drainage System
Infiltrate

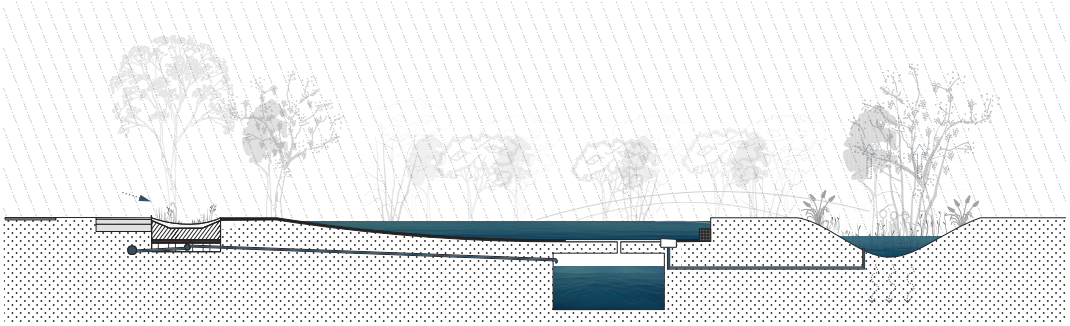
Cloudburst,
Extreme intensity
Managing exceedence

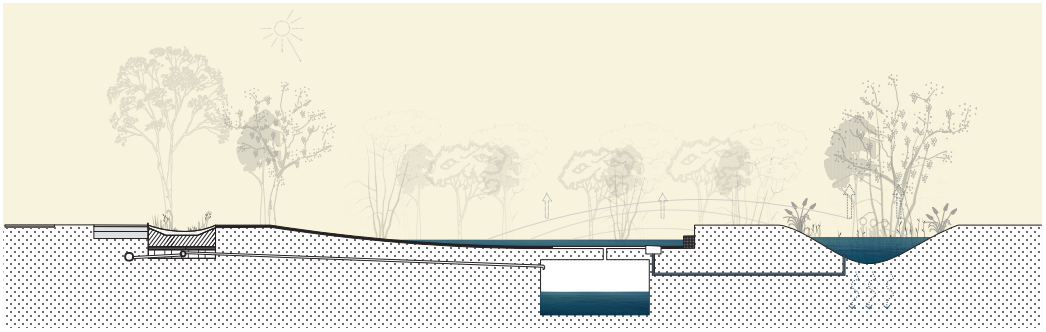
- Flooded square
Infiltrate + Store / Delay

After Rainstorm event,

- Discharge flooded square's rain into an retention basin
Store + Delay + infiltrate







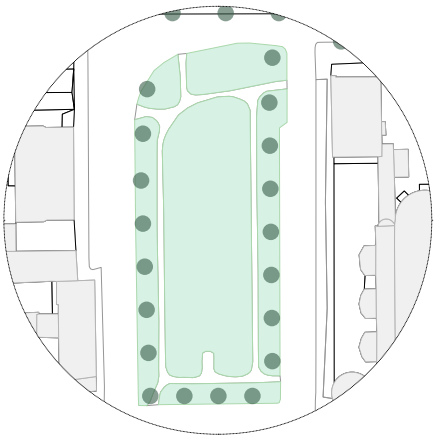
P4

Local Green area (Patch)
The plan visualizes a specific section of the corridor in which a municipal public green area is redesigned as an urban forest with specific points of programmatic public equipements. It reformulates circulation systems with points of new natural and urban equipments and surface programming (Carbon sink).

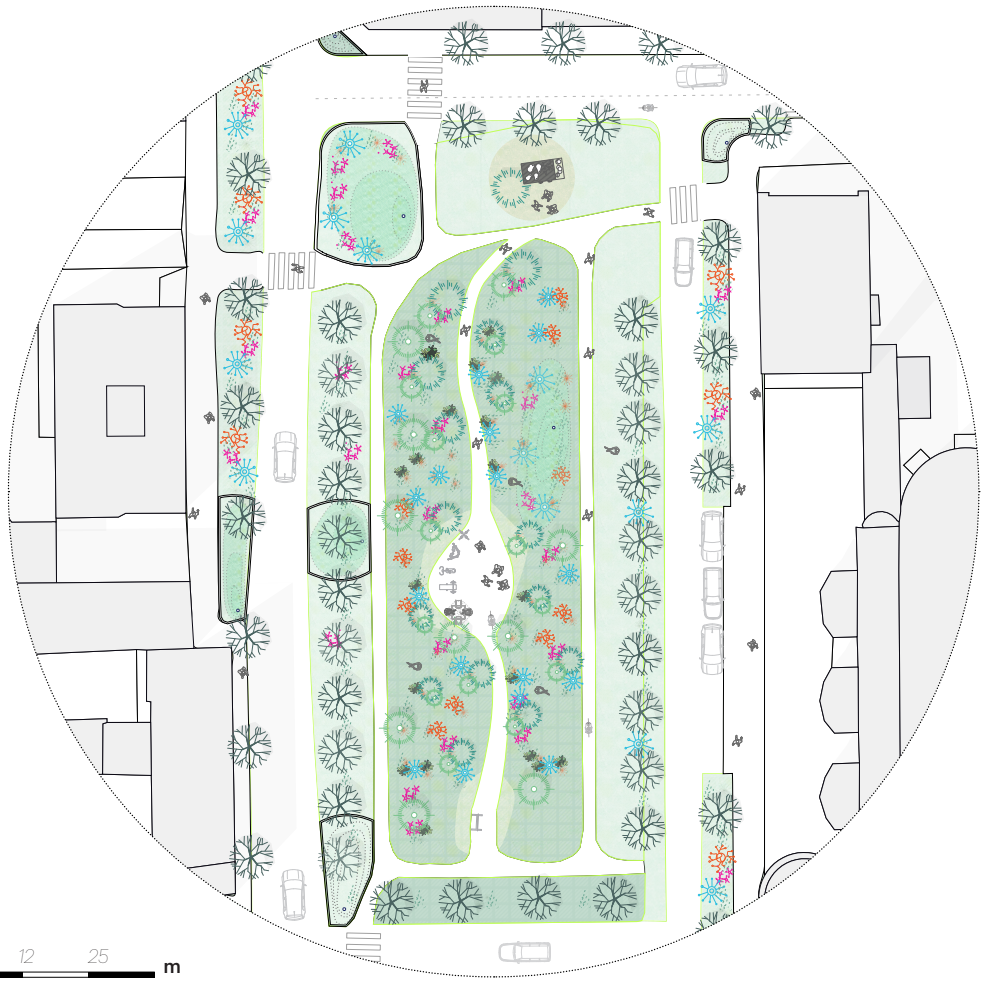
The technological section on the right shows also the function of the park as a retention basin to accomodate extreme rainfall events, nevertheless it shows sectionally the different altitudes of vegetative patterns to be re-introduced in the local park.

The sensorial and qualitative dimension brought by this new reconfiguration will be further showed in the next pages through a photomontage.

Before



After



- Private green extension
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- Green areas
- Equipped green areas
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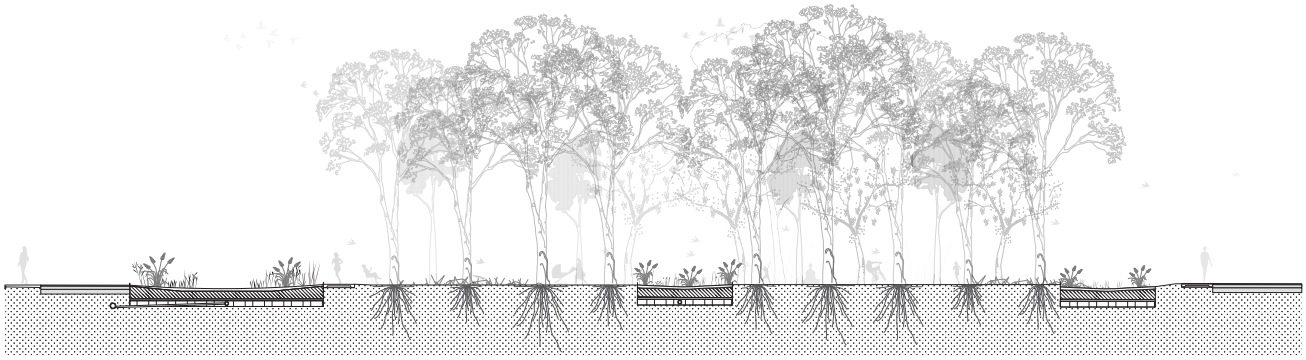
- Green areas boundaries
- Circulation systems
- Crossing
- Equipment
- Hybrid equipment

Technological Section



Visualization / Impression

The representation on the right, portrays a perspective on a municipal green areas in which a surface programming of new vegetated and equipped areas is visualized. Specifically, it wants to highlight the sensorial qualities of the newly designed public space, and system of circulations. The Circle represent a “snapshot” while the natural elements that goes out of the circle represent the continuity of vegetated systems (lower strips and trees) in the corridor.

30th of January

10:30 AM

*45°32’58.59” **N***
*9°10’33.67” **E***

elev 161 m

7) Reflections / Conclusions

A) Objectives reflection

▪ *The general objective is to To embrace a transcalar approach toward the understanding, planning and design of the urban landscape*

The transcalar approach has been disclosed through the working on various scales. Specifically the understanding of the urban landscape from the Watershed to the Nano scale and the projective dimensions from the Macro to the Nano scale. Very important in this process of transcalar work was the methodology undertaken and specifically the setting of landscape scales as crucial for ecological performance and to overcome the jurisditional engineering at stake.

▪ *To achieve flexibility in green – blue transcalar design by exploring the indeterminate and open ended dimension of the design process.*

The flexible dimension of the reprogramming of green - blue systems has been disclosed in the genealogies chapter. Moreover the anticipation by multiple spatial configurations using scenario making as a tool adds flexility and adapatability of the project to deal with various contingencies and governance conditions.

▪ *To defragment the landscape through green –blue infrastructural design.*

The defragmentation of the landscape through Urban-landscape Syntax and Landscape Infrastructure Matrix has been explored from a spatial perspective. In general, and also valid for the next objective, the work takes the spatial dimension and its possibility of transformations as the key inquisitive process.

▪ *To mitigate pluvial flood risk in the Seveso river basin.*

The mitigation of pluvial flood risk, has been explored through the projection of landscape based systems at various scales. Although the hydrological regime has always been a key factor in the development of the project, the scales that deal directly with it are the Micro and Nano scale (runoff scale). In this scales was crucial the representation of new nature based infrastructures through plans and technological sections and to project their climate adaptive dimension, in case of exceedence, through a meteorological / technological dynamic sequence.

However the scientific dimension of water management, i.e. the reduction of the 89l/s/ha of runoff toward the 20l/s/ha, which is the regional normative must be explored and tested with a calculation of green - blue spaces retrofitted (or areas of subtraction of impervious areas). A hydrodynamic model would be needed in that specifc case. The choice not to test this objective “scientifically” is due to the decision during the design process to explore the multifaceted dimensions of transformations and thus not particularly dealing with only one. Nevertheless, when the choice of the scenario has been done at the Micro scale, the coupling of hydrodinamic modelling / calculations could be one of the possible future next steps in the project.

B) Hypothesis verification reflection

▪ *Transcalar design of green-blue systems addresses the issue of landscape fragmentation through landscape connectivity.*

The objective of transcalar design to overcome landscape fragmentation has been tested trough the work. The verification of the hypothesis on landscape connectivity can be explored on the multiple possible combinations of elements of aggregation, i.e. spatial operations in a specific corridor. How the genealogies comes together to inform and shape a segment of a corridor has been disclosed in the Micro-Nano chapter.
So, depending from the degree of change (which comes from spatial operations choice, which depends from contingencies, and the importance of the corridor in its regional ecological performace), Corridors connectivity may differ in various degrees. Generally, in landscape ecology, two major types of ecological corridors to reconnect patches could be achieved: linear connections of vegetated strips, water protection riparian corridors, wildlife movement routes and walking trail routes. The second best way to provide connectivity is with stepping stones.
In general the design, being projective and speculative presents different degrees of connectivity that could be

reached, from depaving a whole lane and reprojecting soil and vegetation in a case of disruptive changes (vegetated linear corridor), to adding shrubs or trees wherever it is possible (Stepping stone). Thus the corridors can vary according to different environmental gradients.

The verification on the type and specificites of corridors can have variyng attributes. The external structure can be verified and evaluated according to gap sizes, variability in width, curvilineaty and alignments. In general corridor connectivity should be measured with gap frequency, large or small gap and the conditions around the gap are also important to be detected (Formann, 1996)

▪ *By exploring open ended and indeterminate processes the project increases inbuilt flexibility in the achievement of the objectives according to various contingencies.*

Linked to what just described above, in the verification and evaluation of corridors connectivity , the project is able to define flexible ways of connectivity thanks to the exploration of open ended and indeterminate deisgn processes. The latters were crucial to project the design as a process and not as merely transcalar projection in space. How much connected do we want our corridors to be ? What kind of corridors ecological attributes do we want to achieve ? How much productive do we want our patches (land surfaces) to be ? The temporal dimension of the design is thus verifiable with the act of materializing or triyng to imagine implementation processes (which differs from socio-economic-climatic contingencies) which aggregates genealogies into the full complexity (contiguity) of corridor and patches.

C) Links between sub research questions and methods

1) How can the exploration of indeterminate and open-ended design processes (the temporal dimension) add value to the process of designing green – blue infrastructure at multiple scales?

▪▪ *Design Method*: Divergent Thinking…
Analysis + synthesis + projection
▪ *Core Exercise*: 4) Scenarios + 5) Genealogies
▪ *Page*: 98 - 125

The notions of open ended design and indeterminacy are explored trough mainly two exercises. Scenario in this case is used as a design tool in order to broaden perspectives to multiple possible futures. This method of “applied divergent thinking” set the condition for a speculation of possible spatial configurations by anticipating and exploring the spatial effects of socio – economic – climatic contingencies.
The method used to develop the scenarios has been previously tested during the experience as assistant researcher for DIMI Special Project: Subsurface infrastructures for surface quality. In that case, and also in the graduation work the scenarios have been adapted from the Delta programme scenarios.

Another design method / used to explore this sub-research question is the genealogies exercise. In this moment of the project, the design thinking methods of analysis through separation and classification, synthesis through relations and simplification and Projection, through multiple re-assemblage of the spatial conditions, becomes key in the exploration of multiple possible options through which the green-blue matrix could be reactivated. As a final exercise, drawing these operations together, a matrix has been developed to put into relation multiple options of spatial operations in relation to the reactivation of ecosystem services and the suitability to specific scenarios…
Generally, the work of scenarios and genealogies explores divergent options for the achievement of Macro scale objectives…

2) How to program the transformation of the urban fabric with green – blue elements?

▪ *Design method*: Analysis + synthesis + projection
▪ *Core Exercise*: 5) Genealogies
▪ *Page*: 110 - 125, Genealogies Booklet, page: 0 -75

In order to explore this sub research question the main exercise is the genealogies and its relation to scales and time of implementation. Synthetically, the method has been the following: Urban fabric (spatial condition) classification; consequently: programming the transformation by projecting spatial operations (green-blue elements)

in relation to scenarios that gives an overall flexible programming of the implementation dynamics…
The method used not only defines what is possible in the process of retrofitting the urban fabric with green blue elements, but by exploring the complex interrelations between temporal and spatial dynamics wants to program, with an inbuilt flexibility, this transformation.

- How can this transformation adapt to various contingencies?

▪ *Design method*: Divergent / convergent thinking. projection of dynamic sequences of climate adaptive design at Micro scale.
▪ *Core exercise*: Genealogies booklet
▪ *Page*: 0 -75

Contingencies in socio-economic-climatic trends, are explored through the coupling of Genealogies, scenarios and the reactivation of ecosystem services.

Climatic contingencies at Micro-Nano scale are explored through projective methods, in particular with the development of technological subsurface - surface section in relation to metereological events.

3) How to define "fixed" and "dynamic" elements in the transcalar design?

▪ *Design Methods*: Projection
▪ *Core exercise*: 2.1) U-L syntax, 3-4) Meso = fixed Programmatic elements. 5) Nano = dynamic operative elements
▪ *Page*: (Fixed) 50 - 67, 81 -97, (Dynamic) Genealogies Booklet, page: 0 -75

The following sub research question has been explored with different considerations on the relation between structural elements and the various scales.
The fixed elements come from the framework, i.e. urban landscape syntax elements which set the objectives at the Macro scale. They are "fixed" in the sense that they set the ecological performance goals of the region / sub river basin in terms of hydrological cycle (water), soil (Carbon cycle) and air quality.
At the Meso scale the full extent of the landscape infrastructure matrix elements has been decodified with the method of the genealogies, which explores the dynamic reconfiguration of spatial conditions in order to achieve the macro objectives.

4) How can the spatial manifestation of green – blue infrastructures help to reintroduce spatial qualities in the built environment?

▪ *Design method*: Divergent / Convergent thinking Analysis + synthesis + projection
▪ *Core Exercise*: 6.1) visualizations / interactions / dynamics
▪ *Page*: 142 - 157

The following sub research question is explored through visual medium such as representation and perspective visualization at the Nano scale, following the design speculation / spatial manifestation at the Micro scale.

7.1) Project conclusions / reflections / considerations

The graduation project brings forward important themes regarding urban - landscape planning and design in complex systems and in critical territories.
These disciplines are crucial more than ever, in the light of the myriad of socio-economic and environmental challenges underliyng and generated by processes of urbanizations.

In countertendency with current urbanistic / territorial practices, and inspired and guided by the notion and field of Landscape Ecology, the project thus undertakes the design of networks, corridors and patches, as multiscalar structuring and functionally performing elements, vital for the strategic and operational reprogramming of nature in urban regions.

The graduation work advances the above mentioned design task and tries to achieve it with two core exercises: Designing through scales (1), from the strategic (the programmatic question) to the operational (the generative question), and the process of designing with time (2).

Following below the conclusions and other considerations on the achievements and implications of the graduation work.

1) Designing transcalar systems.

In order to deal with the question of scales and governance and the need for territorial (macro) and micro scale design, the project takes as a central design task the design of green-blue systems at multiple scales…

Transcalar processes such as urban systems and environmental systems need transcalar governance that needs transcalar design. In this view the importance of designing through multiple scales lies in enabling governance mechanisms to work effectively by facilitating spatial thinking and pragmatic discussion between stakeholders of different territorial units.

Political and territorial units (land use engineering) as explored in the work, are static entities, and their process of transformation could take a long time. As a disruptive medium, transcalar design dynamics tweak this static process with agility, fluidity and potentials.
This new dimension of design will hybridize scales and synchronize implementation mechanisms. In this regard it links the programmatic instruments; I.e. the strategic level - the visionary - the territorial, with the social, the sensorial and most importantly with the generative question of forms and operations, triggering and instigating new innovative ways of territorial production.

Specifically, synchronization between the programmatic and the operational level, and hybridization of territorial units and decision-making processes. Thus making design a fluid medium for multiple scales of environmental governance.

Following this speculative line of thinking, which foresees the mainstreaming of such practices in the long term, municipal administrative units will see their decision making boundaries erode, nevertheless their borders will fade in the light of fluid (from regional to material) transcalar design.

2) Designing with time.

As stated at the beginning of this chapter, the temporal dimension wants to respond to the question of designing for complex systems, i.e. socio ecological systems, i.e. cities, in time of uncertain futures. Cities such as landscape follow non – linear temporal patterns, in this sense exploring and projecting design of open-endendness and indeterminate processes, helped coping with the complex dynamics at stake.
It addresses these factors by exploring and building adaptive capacity in order to respond and to be prepared to various contingencies.

Specifically, the time factor has been investigated in 3 different interlocking moments.

2.1) Through research by design it explores the diachronic development of territories at various scales by mapping transformations in three main layers; landscape, occupation, infrastructures. This work facilitates the understanding of the territory as a long process of formation, a stratification of different moments of human occupation. Nevertheless, it gives the sensibility to graft the projective design as a continuative practice, attuned to the inherited spatial conditions. As the next sequence that fit existing historical development patterns.
2.2) At the Meso scale it explores the landscape infrastructure matrix adaptation according to various socio – economic - climatic contingencies. Thus increasing the capacity of the matrix to anticipate and adapt to various unexpected conditions. In this sense the partial or complete Re-activation of corridors and patches of the matrix, shows open and flexible configurations according to each scenario.

2.3) At the Nano scale by projecting a series of

multiple spatial operations in time, it explores potential implementation fields by showing the adaptive capacity in the operations, and thus raising preparedness to the contingencies. Synthetically, genealogies anticipate and test adaptation to space.

Thus doing the project both deals with a process of "divergent thinking" and of exploration of the unexpected… but also deals with the diachronic and almost geological dimension of our inherited territories…

Other considerations:

Dynamic Vs. Static

Another important findings of the project lie in the reflection on the static and dynamic levels that the work holds at different scales.
As an implication of the methods used and also according to how the project is developed … the strategic, programmatic question at the Macro scale, which sets Macro objectives for the environmental performance of the region (quality of air, water and soil) through Landscape connectivity, and landscape re-activation, are the most important and less dynamic elements. By setting the spatial objective to be reached, it delineates hierarchies and prioritizes implementation.

As the work moves toward the Nano scale, and in particular, with genealogies, the dynamicity of the operations to reach Macro objectives is disclosed. Indeed the dynamic dimension, represented trough a multitude of potential shapes construct the adaptive capacity and shows the multiple options through which the Macro scale objectives could be reached according to various contingencies.

Convergent thinking and the question of contiguity, revealing the sensorial

Another key step of the project lies in the relation between the exercise of genealogies and how do these inform the ultimate spatial manifestation at the Micro scale.
As previously stated, genealogies are the strategic link between the goals at the Macro scale and the operations to be made according to spaces (spatial conditions) and contingencies (scenarios). By doing so, these fragments (genes) they set flexible spatial guidelines to retrofit the urban fabric, thus informing the micro scale deployment according to the contingencies in which they are implemented. Therefore, the Micro scale projection, as a design speculation of certain socio – economic – climatic conditions, is informed by a set of specific spatial guidelines, and by putting them together, as a sequence of heterogeneous conditions, it finds a continuity and unity in the contiguity of space. Therefore it materializes the goals through the site specific tailoring of design guidelines (input coming from genealogies). In doing so, not only reveals the contiguity and complexity of specific spaces but also looms the horizontal and the vertical dimensions, surface and subsurface relations. Last but not least, it brings alive the sensorial, I.e. the dimension of perception, it shows the reintroduction of seasonal dynamics, the vegetal and mineral materiality, it portrays a set of events in which human and non-human elements dynamically and infrastructurally interact with each others…

Upscaling

The methodology allows the guidance of the design process also in other dimensions. The methodology itself as a structure/ framework (exogenous dimension) could be replied.
Clearly the content (endogenous dimension) will have to change according to the case study taken into consideration.

Design thinking to deal with complexity.

As an opposite view to problem solving, typical of single-minded disciplines, the project is based on problem framing and synthesis. Typical of the humanistic world, synthesis requires the process of "putting pieces together" and thinking through relations. Without any doubt the project presents analysis and separation typical of techno-scientific world, however, deliberately wants to be synthesis oriented.

It wants to bring forward a counterproject in which the currently dominant techno-scientific paradigm fades in the light of humanistic relational thinking. As Renato Rizzi, professor at IUAV in Venive says, "they are two different cultural paradigm, two grand visions of the world, radically contrasting. The first frame the world as isolation and separation, the second as unity and relation…"

Links between research and design:

Regarding the links between research and design, the project has tried to hybridize the steps of research and design at multiple scales and in various time of the graduation.
For instance, the initial research by design led me to interesting conclusions on the spatial dynamics that have underlined the formation (both urban and landscape) of the padana plain. The exercise, brought forward the notion of "infrastructure" as an essential generator, the main project, guiding urban / landscape development and capital accumulation. Throughout the graduation project, research exercises, have reinforced and informed the design with

new potentials.

Moreover, in each scale the research by design exercise of 3x3x3 guided location choice and it informed through a series of land use successions the issues created by industrial economies. The reconstruction of old cartographic grounds set the basis for a projection of future transformations that fits into the dynamic process of territorial formation. In this sense the diachronic dimension of the project was key to the narrative of Re-territorialisation and to set the sensible dimension of the project as "continuative".

Another milestone, in the link between research and design was given by the notion and concept stemming from Landscape ecology. The latter has introduced the important structuring element of the project, such as; landscape connectivity, corridors, patches and matrix. The ecological ideas brought forward by this subject were applied in various scales and with several implications.

The relationship between the project and the wider social context

The relationships between the project and the wider social context are multiple. As previously explained in the graduation orientation essay, in the ethical paragraph and in the societal and scientific relevance paper, the idea of renaturing cities plays a big role in mitigating and adapting to climate change, to contribute to the right to infrastructure and spatial justice and to generally provide multiple benefits to the inhabitants.

More generally, the conception of landscape and urbanism as inextricably interlinked, reinforce the idea of planning / designing nature and cities synergistically. We can no longer think of the urban and the natural domain as independent variables.

Eventually, the project tries to work on a vast post-industrial spatial dimension characterised by urban – rural dissolution, the configuration of the urban agglomerations of the 21st century (Belanger, 2011). Through this outlook the ability to work through scales, from the regional to the material is a contemporary exercise that spatial designers will have to deal with in the near future.

Relation between the graduation project and the disciplinary field

The project tries to overcome the focus on a specific discipline (i.e, spatial planning, environmental planning, urban design etc..) and on a specific scale (traditional "middle scale" urban design for instance) by showing the recombination and interconnectedness of different fields and grounds regarding territorial transformation, development and management.
The field of planning recently took a complete social dimension and lost its qualitative and physical value, while the field of landscape introduces important concepts in the ay twe think about processes of urbanizations and has an intrinsically multiscalar dimension (Mostafavi, 2015).
The field of urban design and hydraulic/civil engineering combined, evoke and liberate a qualitative /artistic and technical scientific modes of operations.
These have been the subjects that the project touches upon and that tries to bring forward as inseparable and interlinked.
Enlighted by this view the research project brings forward a recent counterculture of the design project which deny a single disciplinary field and that uses design thinking as a tool of inquiry of socio-spatial transformations as well as a projective medium. Therefore, recombining the social with the territorial, the material with the immaterial, the visionary with the operational...

Possible Future steps

▪ Adaptation pathways would be needed in order to backcast (Van den Dobbelsteen et al., 2006) the spatial exploration and the vision. To explore the steps needed to achieve the vision.
This includes the various spatial and non-spatial dimensions of the project.

▪ Despite being "visionary" the operational factors of the project requires a verification of the hypothesis, which was (Urban and landscape planning and design is able to mitigate the hydraulic risk), in this view a Hydrodynamic model in order to test and verify changes in water management would be needed.
In this sense If a "rational" method would be undertaken (a method that beforehand informs how much space would it be required to mitigate the risk) the upscaling and application in other context would result to be easier.

▪ Reflecting on the implications of small scale interventions on the large scale. For example how is the landscape restoration / replenishment of groundwater in the upper plain impacting the irrigation regime in the lower plain ? What's the economic / environmental benefits of such transcalar processes ?

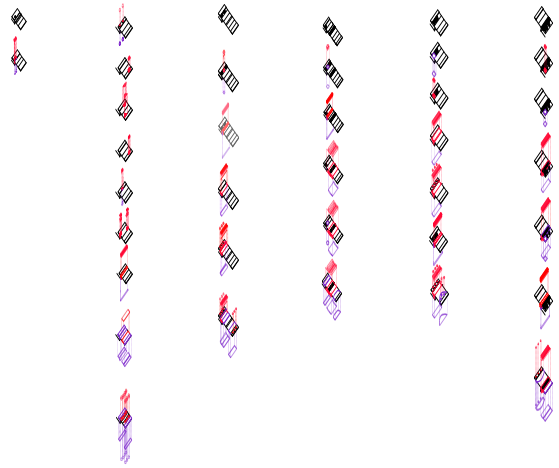
▪ Using the BEST tool to calculate multiple benefits of ecosystem services.

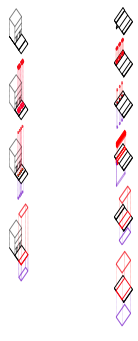
Transcalarity

On the right, a transcalar visualization of the process of green - blue infrastructures at multiple scales. This is just an example, however the five structural elements at the Macro scale that compose theUrban - Landscape syntax could all have been portrayed.

The visualization of transcalar processes determines and facilitates decision making across scales for the implementation of green - blue infrastructures.
By visualizing also the different scales one attach to the other, it is clear how can one small intervention can affect the ecological connectedness of the sub-basin.
The project thus becomes operational, structural and strategic at the same time.
This could be usefull in order to cope with the implementation of projects at different scales and most of all becomes an instrument of negotiation and environmental governance.
In transcalar processes, one little intervention at the smallest scale could infact have consequences on the larger scale.
After all, the spatial configuration of the region nowadays is a manifestation of centuries of small scale transformations. By understanding this process, the projective approach trhough the scale acts as an ecological counterstrategy which have clear spatial guidelines at the regional, *"Macro"* scale, as well as operational instructions at the *"Nano scale"*.
Eventually the strenght and power of this projective interscalarity is to combine the territorial with the social, nevertheless planning with design and engineering, i.e, the visionary with the operational.

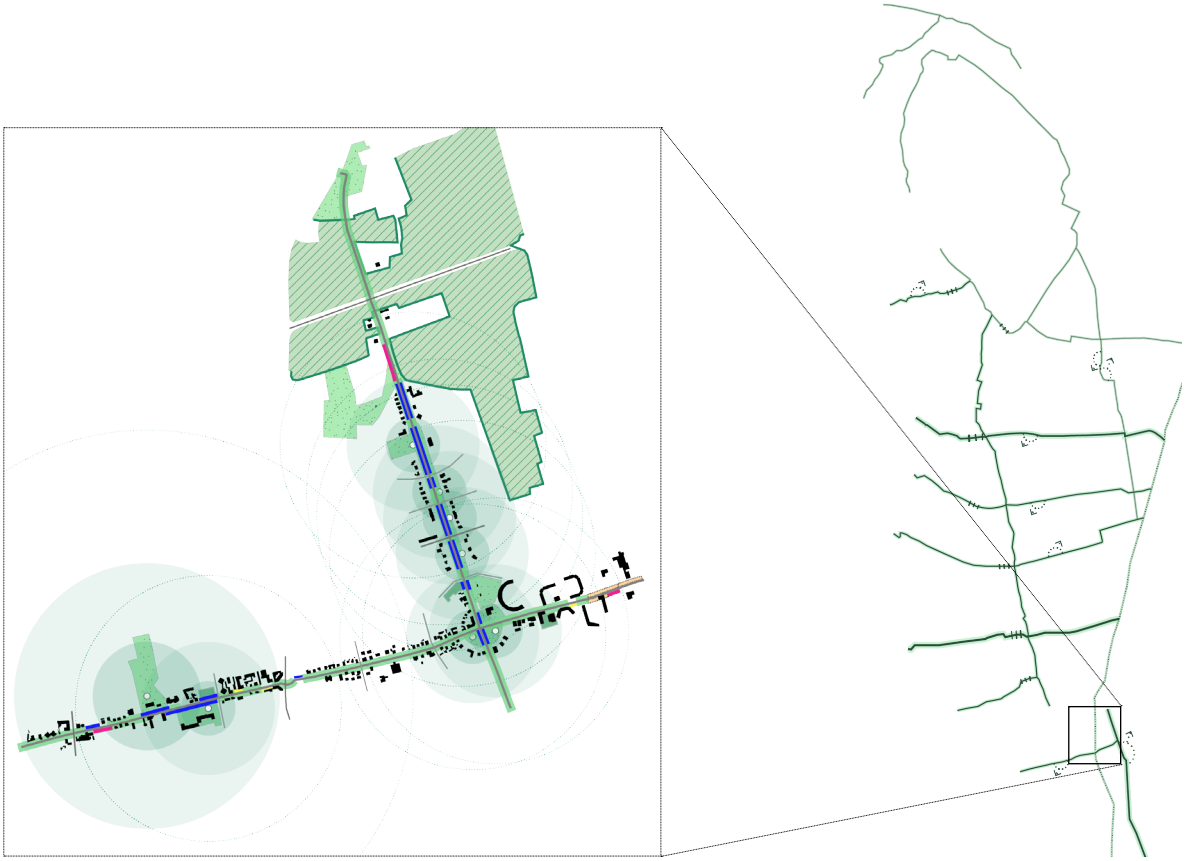
Nano scale





Meso scale

Macro scale



Implementation scheme,
Example of Reterritorialization action plan in Crowd / disruptive scenario:

The sequence of visualizations here below, show a potential scheme of landscape systems implementation at different scales in which the different elements are deployed according to priorities. In this sense the urgency of transformations of different elements respect the ecological impact that these systems have on the territory. So, starting in T1 with the most important elements to achieve landscape defragmentation at Macro scale, such as Macro corridors, i.e. fluvial and green regional corridors. Consequently with the reactivation of the large patches of open spaces preserved and reactivated by the project. Furthermore with corridors and patches at Meso (local) scale which are recognized to be even more importamtly in terms of socio-economic impact but less in the environmental question (which works at an ecosystem scale)

Another subdivision is between the programmatic and operational question and the process of manifestating a possible outcome of this process through a design speculation.

The implementation scheme undertakes a “convergent thinking approach” in which the choice of operations and projects follows the crowd / busy and disruptive scenario, as in the case of Micro-Nano (6) chapter. Following this logic the genealogies which informs the manifestation have beeh choosen according to the suitability to this spefic scenario.

Programming

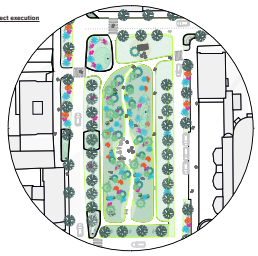
Manifestation

ualization

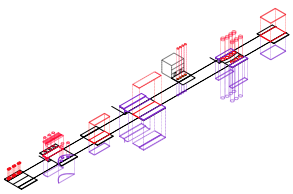
ualizations

Project execution

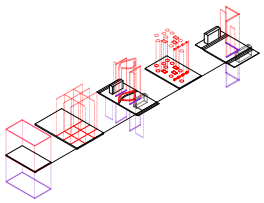
Project execution



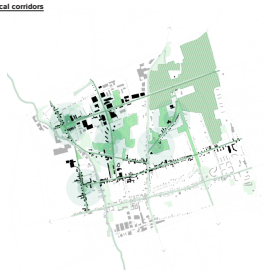
Spatial operations



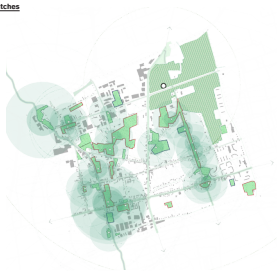
atial operations



so local corridors



so patches



T3

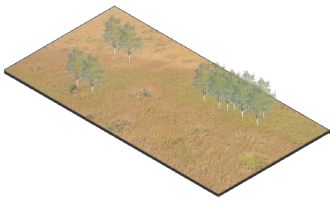
T4

Visualizing change:
Sequence of land use change as staging of surface sequences

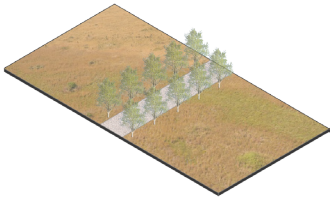
In this page the exercise of small scale land use change (2B-3b) is related with a potential projective outcome of the project.
Again, as in the previous page, a decision of implementation (convergent) has been made from the programmatic and "divergent" side of the project, however, as explored in the genealogies the projective outcomes could have been multiple.

The work as advocated throughout this booklet, sets itself as a "fitting continuation" in the tumultuous process of diachronic territorial formation.

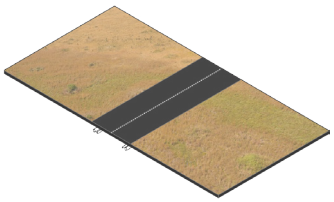
The changes hereby represented are better disclosed in the "*Images From a Territory"* booklet, where drawings and images are shown in a diachronic sequence of territorial De and Re *Territorialization*.



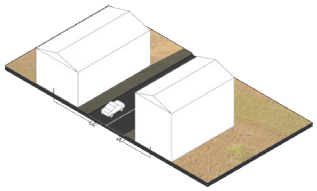
Territory:
Native landscape



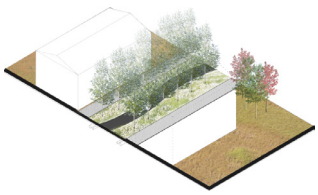
Landscape Subdivision
Landscape Addition



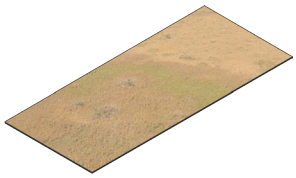
Landscape Subtraction
Landscape Fragmentation

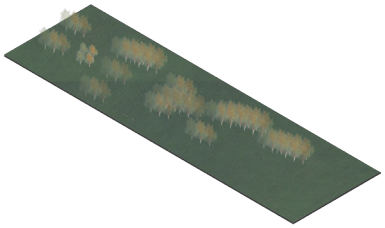


Soil Sealing

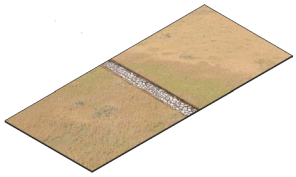


Landscape Defragmentation
Corridor manifestation

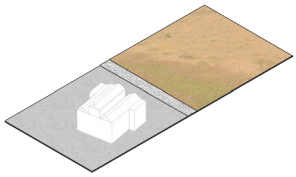




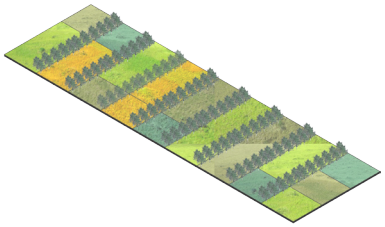
Brughiera (moorland)
Native Landscape



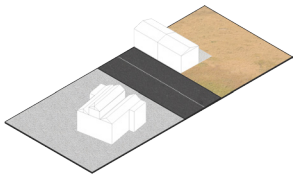
Graft



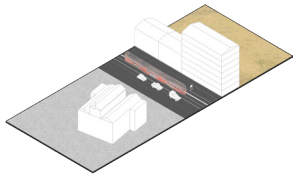
Occupation



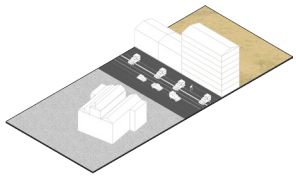
1700
Parcelation (subdivision)
Re-Arrangement
Policulture



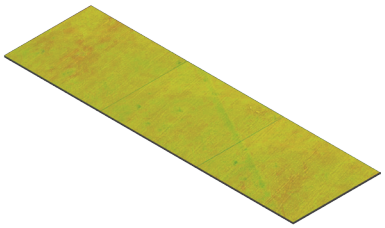
Fragmentation



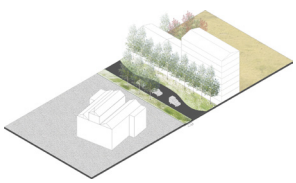
Sealing



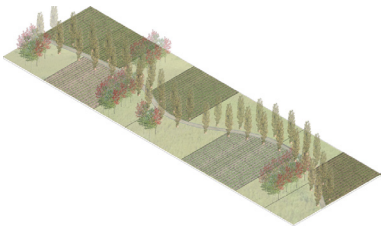
Degradation



2016
Monocultures
Landscape "Banalization"
Landscape Vegetation Subtraction



De-fragmentation



?
Re-parcelization
Multifunctional agro-forestry
Revegetation

Re-Territorialization

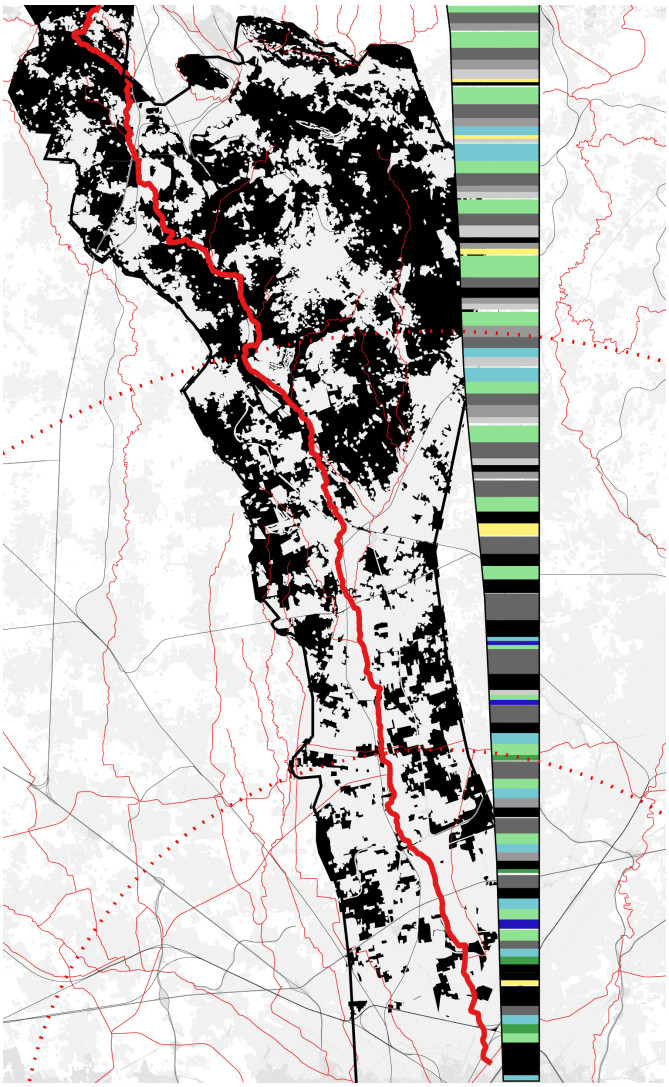


Figure:

Shows typological built distribution around the region, this map was part of the process of understanding and mapping the territory, however it hasn't been projectually usefull in the first part of the booklet.

Anticipating what is shown in the Apendix, i.e. sections of the most important works which has been done and hasn't been used as part of the final project rationality.

8. Appendix

The appendix section shows a variety of exercises which supported and generated the development of the graduation work.

Specifically, a series of essays, among others on: theorethical framework and the societal and scientific relevance of the project.
Furthermore, design exercises and products which have contributed the acquired knowledge of the process and have informed the design with potential.
Moreover the Delta Intervention exercise in which a comparison regarding geomorohology and water dynamics is disclosed between the North of Milan and the Netherlands.

Last and most importantly a list of references is unfolded.

Theorethical framework

The issues at stake call for an interdisciplinary thinking in which the fields and topics of landscape, hydrology, urbanization, and governance are seen as intertwined and co-dependent.
The theoretical framework is thus a combination of different bodies of knowledge, projective operational strategies and design by different practitioners, research bodies, and intergovernmental institute, which are dealing with similar topics.

The theoretical underpinnings of the research mainly come from three bodies of knowledge: Landscape urbanism, Urban Ecology and Landscape Ecology.

As explained before I was interested in explorations that aimed at having a more systemic approach regarding the studies of territories as complex systems of land, water and air.
One interesting approach comes from the body of knowledge related to the theory of landscape urbanism. Landscape, being the underlying factor generating and supporting urbanism, which has to be acknowledged as such (Waldheim 2006). The book Landscape Urbanism Reader is the first attempt to collect a series of essays of practitioners and academics within this line of thinking. Recently, the debate on landscape urbanism have seen the rise of the concept and idea of landscape Infrastructures, theorized by Pierre belanger, in his PhD thesis at Wageningen University: Landscape Infrastructure, urbanism beyond engineering.
These publications among others have greatly inspired me to deepen certain topics related to processes of urbanization, landscape and environment.
In order to understand the complexity of Landscape urbanism and specifically how the urban domain function with respect to specific ecological processes (Ahern, 2007) of great help was to deepen this approach with theoretical perspectives and insights stemming from Urban Ecology and landscape ecology.

Urban Ecology is a subfield of ecology concerned with the understanding of the ecology of urban environments. Urban ecologists started this discourse by recognizing the importance of linking human and ecological processes in studying dynamics of urban ecosystems (Alberti, 2014). It deals with questions such as: what are the effects produced by urban areas on the environment? What are the physical anthropogenic impacts on the environment? How is the natural environment been modified by humans activities?
In my case, insights from Urban Ecology made me focus on the question of a changing hydrological regime due to specific urbanization patterns.

Landscape ecology is a growing subfield of ecology. Its main concern is with the study of large – scale spatial heterogeneity, and the effects of this spatial configurations on ecological processes (Fortin & Agrawal 2005). Moreover landscape ecologists are interested in questions regarding connectivity and spatial - ecological dynamics. Specifically, the concepts of patches, corridors and matrix (Formann, 2008) are very useful to understand spatial principles, with several implications for land-use planning and

Furthermore, the specific concepts underlying the theoretical framework are related to the topic of Green Infrastructure. The design inputs and reference projects, along with their theoretical underpinnings, were very useful to bridge the gap between theory and design.
As part of the theoretical framework, theories and examples of the implementation and deployment of projects, policies and programmes were very useful in order to understand the translation of similar issues/ opportunities as theoretical inputs part of the design process.

Green infrastructure is defined as "Spatially and functionally integrated systems and networks of protected landscapes supported with protected, artificial and hybrid infrastructures of built landscapes that provide multiple, complementary ecosystem and landscape functions to the public, in support of sustainability" (Ahern, 2007). The topic has recently called the attention of academics, scholars, practitioners and policymakers in order to achieve goals related to sustainability and resilience. For instance the European Union, specifically the European Commission has set green infrastructure as a tool to reach biodiversity targets and achieve integrated spatial planning. As they put it:

"Green infrastructure also promotes integrated spatial planning by identifying multifunctional zones and by incorporating habitat restoration measures, and other connectivity elements into various land-

use plans and policies, such as linking peri-urban and urban areas or in marine spatial planning policy. Its ultimate aim is contributing to the development of a greener and more sustainable economy by investing in ecosystem-based approaches delivering multiple benefits in addition to technical solutions, and mitigating adverse effects of transport and energy infrastructure"

Eupean Commission on Green infrastructure and territorial cohesion, 2010.

More recently, green – blue infrastructures can be seen as a theoretical and design advancement of green infrastructure as well as moving beyond specific fields related to water management in urban areas, such as: Water Sensitive Urban design (WSUD, Australia), Sustainable Urban Drainage (SUD, U.K) and Low Impact Development (LID, U.S.A). The legacy of G-B infrastructures advocate for a more systemic, multifunctional and multiscalar design of infrastructural networks and is regarded as one of the way in which cities can achieve resilience (Ahern, 2015). An example of a projective strategy at

different scales, linking multifunctional networks with design performance could be traced in the work of Taneha Kuzniecow Bacchin, in her recent PhD thesis (2015): Performative nature, Urban Landscape Infrastructure Design in Water Sensitive Cities.

Eventually, the theorethical framework is enriched with literature and knowledge stemming from Italian scholars who have researched and described from an analytical, conceptual and phenomenological perspective the contemporary spatial conditions along with their implications in North Italy.

Literature:

Notions from Ecology / landscape Ecology / Urban ecology:

Edward Eugene Odum, fundamentals of ecology
Richard Formann, Urban Regions; ecology and planning beyond the city.
Richard Formann, Land Mosaics.
San Rocco magazine, Ecology.
Wenche E. dramstad and Richard formann: Landscape ecology principles in landscape architecture and land use planning.
http://www.stockholmresilience.org/
Marina Alberti, Advances in Urban Ecology.
Ian Mcharg, design with nature.

Notions from Urban and Landscape planning and design:

James Corner, Landscape Imagination.
Chris Reed and Nina Marie Lister, Projective ecologies.
Pierre Belanger, Landscape Infrastructures, Urbanism beyond Engineering.
Charles Waldheim, Landscape Urbanism reader.
Pierre Belanger, The new geographic Landscape.
Pierre Belanger, redefining Infrastructure in Ecological urbanism.
Neil Brenner, Implosion/explosion.
Sasskia sassen, Expultion, Brutality and complexity in the Global economy.
Carlo Gasparrini, In the city on the cities.
Alessandro Franceschini, sulla città futura, Verso un progetto ecologico.
Herbert Girardet, London's ecological Footprint.
Seto, The new geography of contemporary urbanization and the environment.
LLoyd, Infrastructure as Architecture, designing composite networks.
S. Bartel, J. Colding. Principles of socio ecological Urbanism: case study Albano Campus Stockholm.

Notions from Italian Urbanist:

These 5 books helped me enourmously in understanding existing conditions form socio-economic structures, political dimensions and spatial arrangements, namely:
Stefano Brandolini, a piedi nella città.
Pietro Mezzi, Dorsale Verde.
Luca Marescotti, Città tecnologia ambiente.
Paolo Pileri, Cosa c'è sotto.
Eugenio Turri, La Megalopoli padana.

Green - Blue Infrastructures:

T. Bacchin, Performative nature
J. Ahren, Green infrastructure for cities, the spatial dimension
R. Hansen, S. Pauleit, From Multifunctionality to Multiple Ecosystem Services? A Conceptual Framework for Multifunctionality in Green Infrastructure Planning for Urban Areas
T. McPhearson, A. Hamstead, P. Kremer, Urban Ecosystem Services for Resilience Planning and Management in New York City.
J. Tratalos, Richard A. Fuller, Philip H. Warren, Richard G. Davies, Kevin J. Gaston, Urban form, biodiversity potential and ecosystem services.
B. Jacksona, T. Pagellab, F. Sinclairb, B. Orellanac, A. Henshawd, B. Reynoldse, N. Mcintyrec, H. Wheaterc, f. Amy Eycottg, Polyscape: A GIS mapping framework providing efficient and spatially explicit landscape-scale Valuation of multiple ecosystem services
H. Sousa Ferreira, A. Leitão, Integrating landscape and water-resources planning with focus on sustainability.
J. Abbott, P. Davis, P. Simkins , C. Morgan, D. Levin, P. Robinson, Creating water sensitive places, scoping the potential for Water Sensitive Urban Design in the UK.
J. Hoyer, W, Dickhaut. Water Sensitive Urban Design : Sustainable Stormwater Management in the Cities of the Future
Environmental protection agency, EPA, green infrastructures documents
Hitrud Potz & Pierre Bleuzè Green-Blue grids

Theory paper

 # Essay 1

Abstract:

Cities alter local and global environment in various ways (Seto et al. 2010), this process comes along with different spatial temporal implications. The magnitude and rate of this change it's now more visible than ever in the context of unprecedented population growth (UN, 2008) and anthropogenic driven climate change (IPCC 2014). The urban region of Milan is an interesting study case in order to understand processes of urbanization growth, environmental degradation and alteration of hydrological regime, in connection to governance. This geographical context is represented by a dissolution between urban and rural domain (Vogt, 2015), geographical horizontality and the presence of a discontinuous and diffused urban landscape. It's the outcome of a diachronic process, a stratification, of different moments of human occupation, starting with the Roman civilization of the fertile Po river valley in the 2nd century before Christ.
In order to conceptualize these processes in a systemic manner, and construct a body of knowledge toward a projective perspective, the theories and insights stemming from urban and landscape ecology, coupled with the legacy of green-blue infrastructures provide an interesting and inspiring outlook through which the urbanization question can be framed.

1) Introduction

Territories comprise land, air and water. When studying human settlements we know a lot about land, i.e. human occupation patterns, urbanization patterns, morphologies, land uses, land cover etc., however, we know little about the implications on air and water (Marescotti 2008)We know that Cities shape and change local climate systems, land cover, local hydrology etc. (Seto, K 2015, Alberti, 2014), but a clear scientific understanding of it is still lacking. Should planning and design be concerned with the totality of the environment that we shape / alter? Or should it still be bound the "built"? Forgetting the rest…
One recent specific disciplinary field, which aims at constructing a more systemic and interdisciplinary legacy has been the one of green and blue systems for urban and landscape planning and design. More generally the field of landscape urbanism (Waldheim, 2006) or ecological urbanism (Mostafavi, 2010), or recently, landscape infrastructure (Belanger, 2013) wants to reclaim the loosing ties between natural and built environment, between the landscape and urbanism thus reclaiming an integrative approach in which territorial development, i.e., land use planning is studied along with water and air, nevertheless with their spatial – temporal implications (Marescotti, 2014).
This body of knowledge addresses questions such as: How do cities change the local environment in relation to water cycles? What is the relation between specific urbanization patterns and environmental degradation? What will be the future of urban infrastructures for resilient cities? What could be the re-acquired role of performative landscapes in relation to urban environments and infrastructures? What can cities do in order to mitigate and adapt to climate change?

1.1) Relevance of the topic

The relevance of the understanding of the environmental question in relation to human settlements is today more relevant then ever, in the context of changing climatic patterns and weather unpredictability (IPCC 2014). Scientist are now telling us that major biogeochemical cycles, for instance nitrogen and phosphorus, have been altered by humans and theirs activity on the planet (Vaughan, 2015), this contemporary condition has been framed as the Anthropocene (Crutzer and Stoermer, 200) the era of man, taking over the holocene. Within this paradigm "man made" impacts are now surpassing planetary boundaries, which are the safe operating place for humanity on the planet (Rockstrom2008). These global change, are related also to land use change, and the question of territorial development, urban and landscape planning and design becomes crucial.
More specifically, and in relation to hydrology, our over engineered system of infrastructures can't deal anymore with specific natural events, this is clear in the particular case for urban water management, indeed underground systems are reaching their limits (Dreiseitl, 2013) and causing floods all over the world (Munich RE, 2011).
In general the issue and the question between the

inseparability between human and natural system, and the need to have a systemic approach to urban and landscape planning and design is clearly visible and possibly, to be reclaimed, in Italy where, where Out of 8.100 municipalities, 6.600 are in hydrogeological risks (Legambiente 2014).

1.2) The Environmental question: A long and changing story.

The environmental question has been discussed daily since the start of what we can call the modern environmental movement. The latter was inspired and triggered by the publication of Rachel Carson: Silent Spring (1962) which described modern post world America through the lens of its obscure side, environmental degradation and pollution. Decades have passed and discussion has never stopped; however, public officials and governments have failed to provide top-down solutions to resource depletion and environmental degradation (Rio, 1992, Alborg, 1994, Lisbon, 1996, Kyoto 1997).
Now with climate change and the evidence of human disruptions facilitated by the ease of communication networks and the post modernism, liquid society (Baumann, 2005), we are seeing an interesting trend; people that Increasingly wants to take control over the infrastructures that support them with food, energy and multiple services. These are exactly the systems, which have caused environmental degradation and resource depletion. This shift is clear in the documentary of Naomi Klein (2015), this changes everything in which it is shown that progressive communities in Germany are already fighting back the centralized, privatized, corporate system of control over infrastructures, by reclaiming them as public and co-owned systems (klein, 2015).
According to this general premise, there is an increasing attention towards thematic related to infrastructures, environment and landscape. This process is relevant for the discipline of urban and landscape planning and design since it is "our" role to guide, negotiate and design their specific deployment.
Under this lens interdisciplinary approaches are not only needed but possible and a set of questions have been emerging and more and more practitioners, academics and public officials are questioning the role of infrastructures in relation to issues regarding the commons: the water cycle, soils, energy, waste, mobility, as vectors to regenerate our cities and fight climate change (Gasparrini 2014). Therefore, new questions are emerging, such as what's the role of infrastructures in relation to environmental degradation? How can we implement new types of landscape infrastructures? What is the role of government, institutions, design practices and civic society ? How can the new generation of urban infrastructure provide and generate multiple socio-ecological benefits? Can a new type of infrastructures perform from an "infrastructural point of view", for instance, stormwater management, and simultaneously be a civic project? What is the role of specific subfields of ecology in informing and theorizing this change?

2) Urban and Landscape ecology.

Given the vastness of the issues at stake, I will focus on the specific subfields of urban and landscape ecology, and eventually exploring and reviewing existing projective and operational mode over the deployment of green-blue infrastructures. The latter is interesting because it could be seen as a projective proposal, stemming from the same line of thinking of ecological and landscape urbanism. Moreover, In order to understand how the complex and various urban and landscape matrix function (such as Milan Urban Region) in relation to specific ecological processes, we might look at the scientifically based principles, theoretical perspective and insights stemming from Urban and landscape ecology (Ahern 2007b).

Urban Ecology is a subfield of ecology (the study of the relation between organism and their environment), consequently a subfield of modern biology (Odum, 1971). It is concerned with the understanding of the ecology of urban environments. Formann (2008) considers it to be the "study of the interactions of organisms, built structures, and the natural environment" where organisms are plants and animals; built structures are buildings and roads etc… and the natural environment is soil/water/air. For this reason is interesting to review urban ecology as a discipline which contributes immensely to an integrated urban and landscape planning and design.
Urban ecologists started this discourse by recognizing the importance of linking human and ecological processes in studying dynamics of urban ecosystems (Alberti 2014). It deals with questions such as: what are the effects produced by urban areas on the environment? What are the physical anthropogenic impacts on the environment? How is the natural environment been modified by humans activities? Urban Ecology becomes an interesting theoretical toolbox in order to understand complex human – natural interactions in urban ecosystems. Various scientific testing have been describing the various implications of urbanization patterns (different urban gradients) in relation to specific processes. These include: nitrogen depletion and retention, biodiversity, biological processes, late afternoon temperatures and hydrology (Alberti 2014). The latter, specifically, it's of particular interest when dealing with over-engineered and recklessly urbanized watershed. Indeed we know that impervious areas lack the ability to infiltrate and retain rainfall and this can have several negative implications for an altered water cycle due to runoff and discharge intensity. All the critical components such as magnitude, frequency, duration, timing, and rate of change of hydrologic conditions (Alberti 2014) are all disrupted by human related activities and are the consequences of specific types and magnitude of urban development.
For example the size of an urban patch and its biological conditions becomes interesting and usefull when studying matters related to hydrology. The imperviousness of the patch (TIA, Total, Impervious, Area) directly affects the

hydrologic regime of a basin, flow patterns, discharge time, and especially increasing stormwater runoff. These increase flood frequency and in most of the time double flood peaks (Alberti, 2014)
Urban Ecology in this sense suggest us that urban studies, morphological and typological questions alone are not enough when studying complex socio-ecological systems such as cities.
Therefore an extra layers of environmental implications and changed ecological processes and regimes should be added to understand relationships between landscape-urban patterns and ecological conditions to have a more systemic understanding of urban ecosystems.

Landscape Ecology

Landscape ecology has been emerging as an integrative discipline which focuses on spatial structures and dynamics of landscape systems (Cushman et al. 2010) It could be seen as a subfield of ecology, moving beyond the studies on population ecology (Odum, 1959). It has been producing several theoretical insights in relation to urban and landscape systems as spatial heterogeneities at various scales interacting with ecologies (Cushman et al. 2010).
Generally, spatial heterogeneity could be seen as a natural or human product, and it's in the intersection between the implications humans grafted on the landscape through their artefact that the legacy of landscape ecology becomes particularly interesting. As a matter of fact, theories related to landscape ecology have been inspiring different practitioners, scholars from various discipline, and today is a well-established field internationally (Turner, 2006).
I will review and talk about the specific conceptual paradigm of the Landscape Mosaic Model: Patch – corridors - matrix, theorized by Richard Formann, in his book: Land mosaics, The ecology of landscapes and regions (1995).
A patch is "a wide relatively homogenous area that differs from its surroundings" (Forman 1995). It is important to map these patches because its size can influence various ecological and human processes. The patch could also vary from the scale, which we are looking at, so the question of scale when looking at patches it's crucial. Also the grain of the landscape entails different composition and guides the diversity of plants and species. These spatial principles directly influence the design, and representation of urban regions at the different scales (Formann, 2008).
Patches are connected through corridors, for instance streams and rivers. These categories could be diverse themselves, for example a steam could be curvilinear or meandering (Formann, 1995) and its characteristics, such as connectivity, width, nodes and breaks can influence the factors determining whether a landscape element is a barrier or a conduit for a particular species.
Under this lens we can understand the watershed as a an ecosystem, an area or volume where species interact with the physical environment (Forman 1995) with a linear corridors such as streams, creeks and rivers, all, which entail functional connection with the landscape.
It is interesting to here to make a relationships with Humans Infrastructures, I.e. Artificial ecologies (Hight, 2014) such as roads, dams etc. to understand some of the implications on environmental connectivity. Many times, human systems act as barriers for natural elements, breaking ecological continuity which is what permits environmental function to occur (Ahern, 2007), i.e. causing fragmentation of habitat and of flows of energy and materials (Forman 1995).
Acknowledging these disruptions on the landscape make us shifting perspective toward the restoration of these systems by focusing once again on the open spaces in urbanized regions.
Eventually, another important concept stemming from multi-scalar approach in landscape ecology is the land unit as the study of a complex body of relationships, a set of internal as well as external relationships within a hierarchical wholes (Zonneveld 1989). Especially, the chorologic relationships within a landscape system (horizontal heterogeneity) and the topologic relationships (vertical heterogeneity) (Zonneveld 1989) could be very useful in order to understand human / natural exchanges, synergies, conflicts and relationships.

3) Prospects; towards a design approach

Early examples of ecologically sound planning approaches, in which theories stemming form landscape and urban ecology were foresighted, are to be found in the projective application and theorethical work of The American landscape architect, Ian McHarg.
He published "Design with nature" (1969) in which introduced a methodology based on a layer approach taking geomorphological characteristics of the geographical context as structural elements of the landscape.
Soil, climate, hydrology among others features, were studied first in order to understand natural constraints and the possible consequences and synergies with urban and landscape development. Moreover, we can say that he formerly introduced a "system" approach to synthetize the complexities of the landscape in a spatial manner.

A similar variation of this model could be traced in the work of Dirk Sijmons (1991) 'framework model' also known as "Casco Concept". It is an integrated approach for the design of 'frameworks' in the urban landscape (Hoojmeier, 2014). A framework that can be conceived as a set of natural and man- made structures like green and blue patches, and corridors like rivers and parks and human systems, like roads, all of which can support a flexible urban and landscape development in the long term by accommodating different and emerging programmes.
While the model of McHarg was more focus on layers i.e. vertical approach, Sijmons concept introduced the decisive factor of time at different scales with different consequences (Van Shaick et al 2011).
In this sense his work, which was used also in spatial planning in the Netherlands, could be referred as the precursor of the "temporal and phasing" approach (as the more cited Parq de

la Villette scheme by OMA) influencing the work of several landscape and urban design firms, among others: Stoss, Landscape urbanism (Herinneringspark, 2014), James Corner Field operations (freshkills design competition,2013), Lateral Office (Reykjavik, 2007), where a landscape framework coupled with sequencing and phasing strategies become the structural and functional factor for urban and landscape development.
Additionally, the spatial framework model, could be correlated to the contemporary approach of green – blue infrastructures in delivering a scheme, consisting of landscape elements acting as armatures for future development and for a better interaction between human and natural systems. (Nijhuis & Jauslin 2015), the landscape park in Duisburg-Nord is an example of this approach, here one of the most polluted rivers in Europe is being transformed into a new natural, recreational and cultural corridor (IBA 1990).

One other example it's the Staten island blue belt, which is also regarded as one of the best example to understand the importance of connectivity of green-blue areas in a hybrid hydrological system, thus combining a protective strategy for existing wetland and an opportunistic strategy to use the natural system to retain and delay stormwater runoff from the areas and introduced aquatic plants for reducing contaminants through bioremediation (Ahern 2007).
The plan, implemented by a former student of Mcharg shows the idea of keeping natural features to functionally perform in relation to human altered processes, i.e. stormwater runoff. It even shows the concept of incorporating surface elements, i.e. green-blue systems, performing as infrastructures, creating a spatial framework, i.e. armatures, keeping ecological connectivity for multiple benefits. This shows also the belief of Conceiving Nature as infrastructures, moving away form "technological fixes".

4) Green - blue Infrastructure

As we can draw from this short review on landscape, urban ecology and design theories, we can say that the contemporary legacy of green – blue infrastructures is referring to key ideas and principles stemming from them; first, the concept of multiscalarity, secondly the association between spatial structures and patterns in correlation to ecological processes, nevertheless an emphasis on physical and functional connectivity (Ahern 2007b).
Green – blue infrastructures is a recent ecologically sound and systemic approach and has been regarded as a way to both move forward from the technical field of WSUD, Water Sensitive Urban Design (Australia,) LID, Low Impact Devolpment (USA,), SUD, Suistanable Urban Drainage system (U.K) by incorporating theoretical insights stemming from urban and landscape ecology. This could be specifically seen in the recent work of Bacchin: performative nature (2015). Moreover, the application of green – blue networks as structurally performing systems is developing new trajectories to realize and guide the organization of human/natural systems for the future transformation of urban regions. (Bacchin et al. 2014) In addition to this, its systemic, multiscalar, multifunctional agenda, is regarded as one of the five strategies in which cities can build resilience capacity (Ahern, 2015)
As previously said multifunctionality is regarded as a key concept for the application of green – blue systems in urban regions.
Lately a conceptual shift from multifunctionality to multiple ecosystem services could be seen in the work of Rieke Hansen and Stephan Pauleit (2014) Because landscape infrastructure is, by definition, multifunctional (Ahern, 2007), and can function at different scales, the ecosystem services concept is useful to explicitly identify and assess its multiple functions (Colding, 2011). Planning and designing for multiple uses can also be a useful strategy for cost effectiveness and for building a broad constituency of public support (Ahern 2007).
Furthermore, securing ecosystem functions, which are so essential for human settlements, through the application of landscape infrastructures in urban regions, could be seen as a way to regionalize or localize some of the functional interdependencies, which now impacts the globe.
It could reverse some of the dynamics which are causing an extension of the metabolic processes supporting and generating human settlements, such as socio-ecological upscaling (Sassen 2009), and from which cities are seen as command and control centres of resources and ecosystem services around the world, i.e. cities as "metalogistical" spaces (Marvin et al. 2011). It could provide the basis for a better and closer human / environmental interaction, thus contributing to a smaller environmental footprint and more circular metabolism(Girardet 2006).
Thus the legacy of green – blue infrastructure could be seen as a way to secure the provisioning of ecosystem services in human-dominated landscapes and is increasingly recognized that its legacy and its multiple functions should be incorporated into urban planning practices (Colding, 2011, Ahern et al. 2014).
The field can also help to reverse the compartmentalization and sectorialization of planning departments at city scale, reclaiming the very connected nature between for instance transportation, housing and environment (Bacchin et al. 2014). Therefore, it can contribute to a more integrative approach that reflects a new paradigm in which economy /society and environment are seen as intertwined and inseparable. (Katz, B 2015)
This conflict and opportunity could be seen with the example and tradition in planning ad designing stormwater infrastructures in cities. Indeed, interestingly enough, stormwater infrastructure is historically built below ground, in hidden piped drainage networks, conceived independently from urban planning and design visions (Bacchin et al. 2014)

5) Green infrastructure for stormwater management

The shift toward a more comprehensive and systemic approach to urban infrastructures, as previously advocated,

is rising in many parts of the world, due to different reasons. One clear example of the evidence (economic benefits) and implications (space) is the application of surface technologies for stormwater management.
Stormwater mitigation has become one of the central urban challenges of the 21st century (McDonald 2015) Replacing combined sewer systems with separate sanitary systems is far too expensive as an option for most cities, thus many cities have already started green - blue infrastructures investments. Only in the USA more than 700 cities have a combined sewer system which could overflow when it rains (EPA 2014) As we can understand from a document of the University of Manchester called: Adaptation to climate change using green and blue infrastructure, a database of case studies, which researches the field of Stormwater management / Urban Heat island / biodiversity in relation to climate change adaptation. From the document we understand that especially in the USA, cities like New York City, Portland, Seattle, Washington, and many others are already deploying surface systems for a more sustainable urban drainage with the aim to adapt to climate change and deliver multiple socio – ecological benefits (Kazmierczak and Carter 2010). The risk of flood events, replenishment of groundwater and a reduction of severe overflow events are directly link to sustainable urban drainage, nevertheless they are part of many other benefits which green infrastructures elements entails (EPA 2010) as advocated and described above.
The economic benefits of green infrastructures can be seen in the case of Portland, Oregon.
An investment of 9 million in Portland is considered to save taxpayers 224 million in CSO (Combined Sewer Overflow) costs such as in maintenance and repair cost over the next years (EPA 2010). A very similar financial expenditure for grey infrastructure maintenance could also be found in Italy, where 30% of all taxpaying money of municipalities is spent on maintaining drainage system (Pileri 2015), but where the implementation of these system hasn't become mainstream yet.

6) Conclusions

According to the general and specific theoretical insights explored above, cities must be understood as complex socio-ecological systems, therefore the separation between sectors (housing, environment, transportation) and domains (natural, artificial), Is no longer valid.
The specific topics and fields of urban and landscape ecology, enriches significantly the practical deployment of green – blue systems. The latters must be conceived as infrastructures by reclaiming landscapes, This proposal could be a trajectory for the conception and development of urban regions both by grafting performative systems (infrastructures), and by providing multiple socio – ecological benefits (ecosystem services). In this sense, reactivating surface qualities could reclaim the role of Infrastructures in regard to the "commons", the public domain.
This paradigm shift implies also that infrastructures are no longer bound to a single disciplines like civil engineering, hydraulic engineering or landscape architecture, but to a crosscutting, interdisciplinary field in which the role of designers is essential (Nijhuis & Jauslin 2015).
Most importantly is crucial to acknowledge that this discourse also entails some issues underlying the urban and landscape planning and design field but also it's important to envision the conflicts that could be generated by it.
The "neoliberal paradigm" in which land is more a commodity than a value, as a matter of fact the current development model fostered by the neo-liberal economic system is inexorably based on the destruction and degradation of ecosystems services (Nansen 2000). Under this lens the legacy of green – blue infrastructure could be a way to reactivate local - regional ecosystem services thus steering and generating implications on a political or even geo-political level.

On the other hand its deployment generates conflicts that includes the pressure of space over land use choice. Weather we plan a car park or a tree, it is a question of political decisions and public - private negotiation. This process is underlined by a specific cultural and political question, such as; in what kind of cities do we want to live in? What kind of cities do we want to build?
Moreover issues on the applicability of green – blue infrastructures are related to maintenance, the applicability in very dense environments, but most of all the engagement and coordination of hundreds and thousands of landowners, which could be the main challenge for many cities (McDonald 2015).

Eventually, following ecological theories it is becoming more and more evident that urban management needs to operate at an ecosystem scale that is beyond the traditional boundaries of the city, both with respect to the biophysical and social (Anderson & Elmqvist 2012) Working at an ecosystem and landscape scale, such as the watershed is not an easy task; administrative units unlike ecologies are static. More flexible governance mechanisms such as intermunicipal, interregional or even interstatal tools to cope with this cultural change are still lacking.

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Ethical Paragraph

 # Essay 2

The aim of this chapter is to highlight the importance of the environmental question addressed in the graduation project in relation to societal values and ethical questions. Specifically I will talk about the legacy of green – blue infrastructures in relation to spatial justice, the right to the city as well as about our position as Urbanist regarding these topics.

The concept of spatial justice raises interesting insights when talking about green – blue infrastructures, especially for topics related to "environmental accessibility" and the right to infrastructures.
Spatial justice is a term used by geographers and planners to understand the field of justice and injustice in a critical, spatial and geographical manner (Soja, 2009). Among others David Harvey (1973) Peter Marcuse (2009), and Edward Soja (2010) have been extensively talking about the subject and the importance of this concept as a reaction to the production of space in the context of neo-liberal global capitalism.
Although the concept of Spatial justice have been more used to describe unequal allocation of resources in space, especially in topics related to jobs, political power and income (Marcuse, 2009), the concept has also been related to environmental justice to describe a spatial condition of justice or injustice related to the access to green areas. For instance, researches have demonstrated a negative correlation between public green areas and socially deprived neighbourhood in the United States of America, causing high level of pollution, higher crime rates and food desert zone (Miranda, 2011). In this sense we can talk about the lack of, the right to food, the right to clean air etc..
Overall we can talk about the lack of the right to infrastructure and in general the denial of the right to the city (Lefevbre, 1968).
In relation to this, the case of Milan urban region is particularly interesting to analyse some of the quantitative and spatial outcomes of what stated above. As a matter of fact, the hydrological problem in the region it is strictly related to the diachronic loss of performative open soil, a particular urbanization pattern which has produced a specific way of territorial production, depleting ecosystem services and denying the role of landscape in urban development. Consequently the city and its metropolitan north are very much correlated to a lack of public green space per capita (OCSE) We can clearly see this in the comparison with other important cities in Europe, where figure are much different (figure 2.6))
It is exactly the lack of environmental justice and lack of public green areas that is causing environmental risk such as high pollution indexes and altered hydrological regime.

In this sense, conceiving a multi scalar network of open spaces (green – blue) for environmental performance that could be deployed as a CIVIC project, restoring ecosystem services and reclaiming

"Thinking spatially about justice not only enriches our theoretical understanding, it can uncover significant new insights that extend our practical knowledge into more effective actions to achieve"

Edward.J.Soja in The city and Spatial Justice, 2009.

surface stromwater management as public space, advances an interesting scenario for the spatial (environmental) justice of the territory.

Eventually, I believe that urbanist should be engaged in questions regarding the commons; the redistribution of wealth through planning and design, weather is through a socio-economic policy, a political action, an infrastructure or a design element. In this sense the access to public and green areas and green – blue infrastructure as a civic project could be the ethical "leitmotiv" of a particular branch of urban and landscape planning and design..

Societal Scientific relevance

 # Essay 3

The dispersed and diffuse urban condition, which flourishes all across Europe (Wandl, 2015), is characterized by horizontality, rural-urban dissolution (Vogt, 2015) and the coalescence of new forms of spatial structures, it is thus crucial to understand this situation as the urban - landscape configuration of the 21st century. Conurbations, Agglomerations, Metropolitan landscape, Urbanized landscapes, are the new medieval city centres in which people dwell. Consequently, It is very important to map these spatial conditions, nevertheless understand their relationships with environmental factors (Seto, 2007), both locally (pollution, altered hydrological regime), and globally (socio-ecological upscaling, (Sassen, 2011). Acknowledging and studying these conditions, with a special emphasis on environmental degradation and risk, could contribute to a more systemic and progressive urban and landscape planning and design framework for existing, and yet to expand, urban regions. The importance of these issues is today more relevant than ever in relation to the degree of change predicted by the United Nations in the next 50 years and under the framework of climate change and unpredictable weather patterns. Specifically in relation to water cycle, and increase in heavy rain events (IPCC 2014) the question and field of green-blue infrastructures becomes an interesting medium trough which urban regions, cities, neighbourhood and roads, could be rethought to adapt to new conditions, build better environments and provide multiple socio-ecological benefits.
The specific relevance of these topics and the conflict between urbanization patterns, governance and environmental rosk is clear In Italy, where Out of 8.100 municipalities in Italy, 6.600 are in hydrogeological risks (Legambiente 2014).

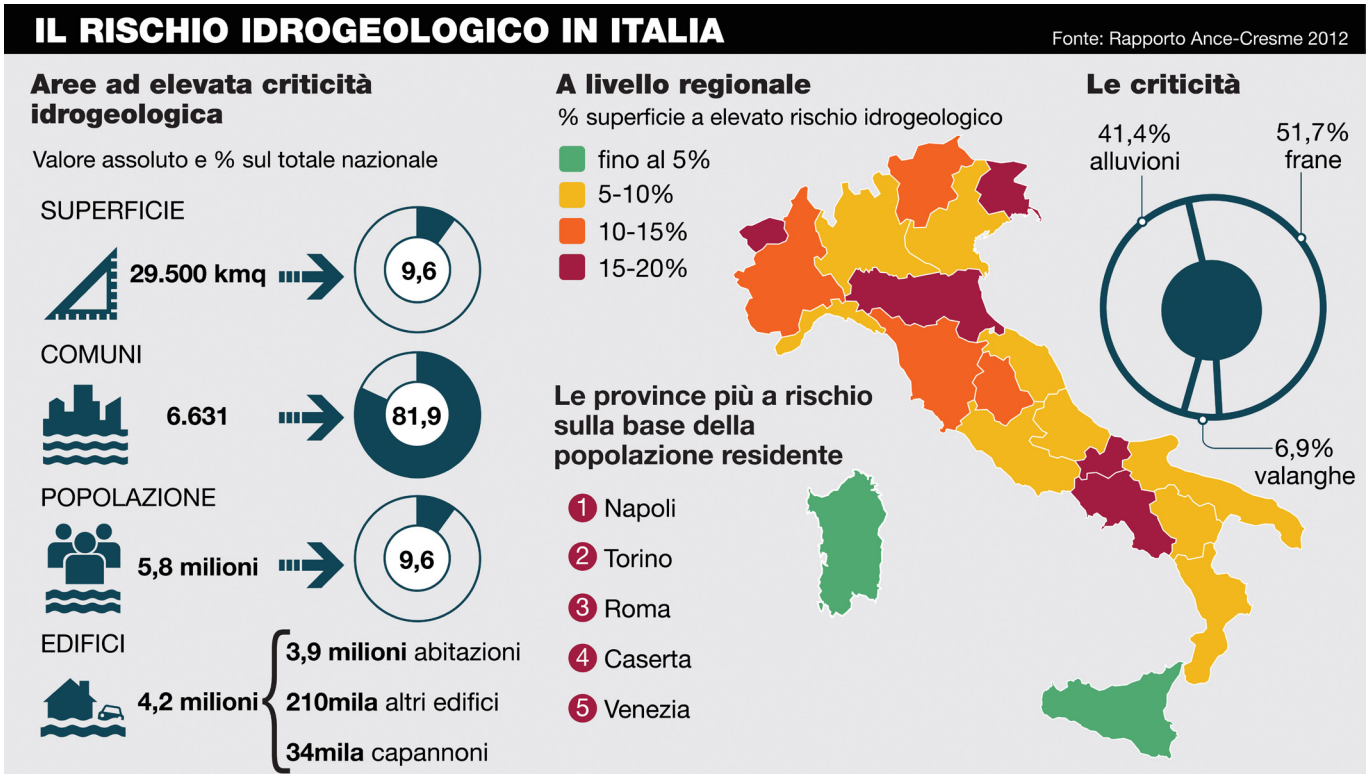


Figure
showing quantitative data of hydrological risk in the various region of Italy. Hydrological risk from stormwater vents (inundations), which links to my case, account for 41,4 % of total risk, Source, Legambiente 2014

Graduation Orientation

 # Essay 4

"Water management and infrastructure systems are becoming increasingly important in urban areas. Existing underground systems are reaching their limits"

Herbert Dreiseitl in Topos magazine, 2013

The research project, being located at the intersection between hydrological cycles, landscape and urbanism, or between hydraulic engineering, urban and landscape planning and design wants to embrace a Tran-scalar approach in order to understand ecological processes within specific occupational patterns and the possible opportunities in the field.

Water is becoming increasingly important in thinking about urban systems and their impacts.
If we take a step back to understand the relation between these two domains, it is clear that water was a precondition for human civilizations to flourish (Bertrand 2009). In fact we can say that the first real strategic planning decision for the deployment of infrastructures dates back to the oldest civilizations in Mesopotamia where water irrigation triggered the beginning of human societies (Marescotti 2012).

With the industrial revolution, and the development of modern engineering techniques, water was seen more as a "threat", rather than an opportunity. The mainstream approach was triggered by new scientific models, techniques and materials and consisted in conveying runoff in engineered infrastructures. A "linear system": Water runoff – underground pipes – surface water.
This approach is clearly visible in the work of the 19th century engineer George Waring, the "father" of hydraulic engineering, whic,h in his manifesto; Draining for Profit, Draining for Health, states three main principles for managing water in urban areas: 1) The exclusion of sea water, 2) The removal of the causes of inundation from upland, 3) The removal of the rain fall and the water of filtration.
This linear system base on fixed capacities is today no longer valid. There is a lack of flexibility embedded in the system, which can't cope with the complexity of urbanizations and its endless interactions with nature (Barthel et al. 2013). Moreover, it often base its functioning on the externalization of biophysical elements, which are not taken into consideration within the process of "infrastructural production". Let's just think for example of nutrient depletion in cities and concentrated nutrient loading in estuaries and deltas, causing oxygen depletion and eutrophication where most of our marine ecologies breathe (Belanger 2010).

Furthermore, the question of urbanization and the embedded anthropogenic impacts of its spatial development in connection to processes related to infrastructure, environment and landscape is perhaps one of the most interesting outlooks to try to understand specific conditions of contemporary urbanism. The hydrological risk provoked by relentless urban growth is devastating territories and impacting on thousands of lives every year (UNISDR 2015). As previously mentioned, in Italy, but more in general all over the world, our engineered system of infrastructures can't deal anymore with specific natural events. This condition has still to be acknowledged In relation to pattern of urbanizations and specific processes of territorial production. Moreover, the political willingness to respond to these conditions has been very weak (Gasparrini, 2014),

and practical projective designs limited.
However, water sensitive strategies and attention to these topics has recently been growing (Hoyer et al. 2011) and the set of opportunities don't lie only within the fields of hydraulic and civil engineering, in fact design disciplines and especially the field of urbanism, architecture and landscape architecture will have to play a big role in retrofitting our "over-engineered" infrastructures and steer climate adaptation capacities.

"This could be a unique opportunity to engage the landscape of living systems as urban infrastructure".

Pierre Belanger, 2014

There is an inspiring, and forward looking, rising trend within progressive municipalities which are already taking back in the public agenda issues regarding the "commons": the water cycle, soils, energy, waste, mobility, as vectors to regenerate our cities and fight climate change. (Gasparrini 2014).

Specifically it is interesting to conceive the landscape as a set of green and blue systems, as the main infrastructures that underpins and supports urban life. In this sense, working toward a hybrid water management perspective by using the landscape as an element of performance could be relevant for most part of the world vulnerable to natural events and in which re-thinking urban infrastructures is needed.
Climate change is telling us that we can't subtract ourselves from the force of nature, neither we can predict its trajectory (IPCC 2014). Within this context, there is an urgent need to move beyond an "industrial model" of infrastructures based on fixed capacities and linear systems, in this sense the recent legacy of green blue infrastructures wants to add contingency and flexibility with the graft of performative landscapes strategies and design (Bacchin, 2015) to adapt our urban systems to changing climatic and socio-economic condition.

According to these general premises the project wants to explore projective transcalar possibilities, and their implications in implementing green - blue infrastructures.
The goal is to produce "new territories" with aim to restore ecosystem services, pursue hybrid infrastructure, i.e. artificial / natural, Subsurface / surface for
stormwater management, by retrofitting, plan and design the existing urban landscape.

 # Essay 5

The issue of flooding in the seveso sub-basin are being discussed within institutions and administrative units in order to tackle and mitigate the issue. I this short section, i review with a critical outlook the technical hydrological document which provide a solution to the area.

The proposed strategy is delivered within an intermunicipal agreement guided by AIPO, interregional agency for the Po river, directed by Engineering consultant, Etatec, and is proposing 5 large compensation basins to prevent flood to happen, for a public investment of over 32 Million euros. These "centralized" hydrological solution will be able to store 970 mln m3 of water. Moreover, it proposes an enlargement of the existing CSNO, Canale Scolatore Nord Ovest, a compensation canal, aimed at deviating the Seveso river in the case of a storm with a return period of 2 years.

The main critique to this approach, as Cristopher Hight commented for a similar solution in New Orleans, is that "it's treating the symptoms, not the causes".
The environmental risk is partially an hydraulic problem. The problem, as explained throughout this document, has been the diachronic loss of "territorial permeability", i.e. of water absorption capacity of the sandy soil characterizing these territories.
Opposite to the proposed centralized approach, I believe that a more systemic and fine and grain approach could be implemented. Taking this infrastructural issue as a spatial opportunity to reclaim the role of landscape as urban infrastructure and as a civic project (Bacchin, 2015), delivering multiple services, thus influencing the quality of life in a distributed way. Indeed The 5 proposed compensation basin will positively affect, in terms of aesthetic value, recreational opportunities etc.… only the "few" inhabitants having access to these places.
Another critique is the lack of multifunctionality of the proposed infrastructures and its disconnections with a territorial vision, its integration with spatial planning and design.
I believe that a systemic and comprehensive way to manage our territories could be through urban and landscape planning and design, a disicpline which acknowledge the interdependencies between urbanization processes and ecological dynamics. Which conceive "nature as urban" (Sijmons, 2014), thus planning and designing it for mutual support and synergies.

Eventually, the compensation basins have been already criticized for their diminishing efficiency in the long term. Indeed the storage capacity is believed to decrease by 30% in 10 years due to rising groundwater level (Conti, 2014).

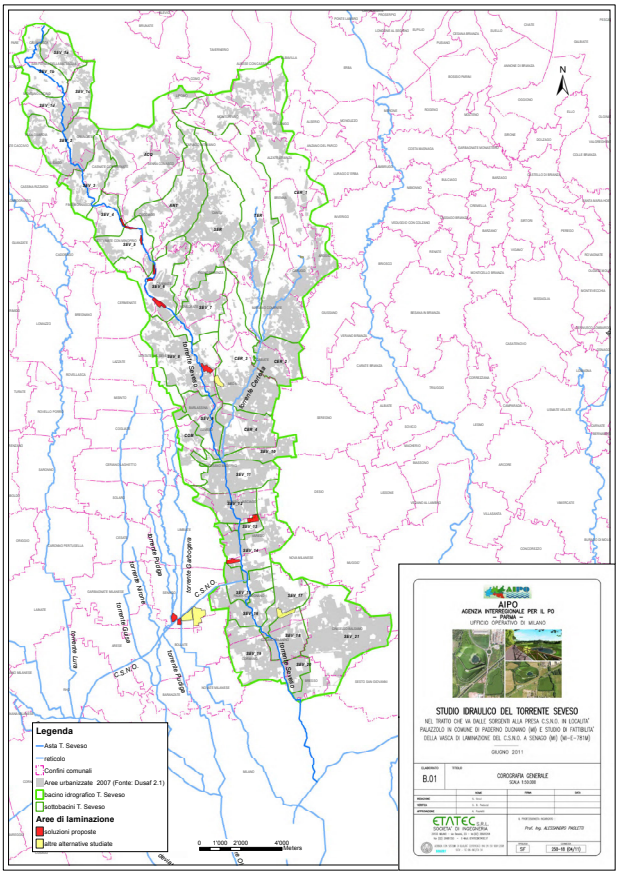


Figure
showing the proposed plan of the five compensation basin, red, and their distribution in the sub-basin.
Source: AIPO (2014)

Deliverables

In order to represent the aims and the objectives of the current project, the main deliverables are highlighted. Since the research and design entail different sections, each of them requires specific way of representation and deliverables.

The deliverables in the research phase are a mix between visualized research and research by design findings.

The first analysis part will contain the deliverables to understand the process of territorialism at different scales. In order to do this, the 3x3x3 analysis, as a part of the research studio of Delta Urbanism, is the main deliverable. This first analytical exercise will be crucial to construct and begin the leitmotiv and the narrative underlying the graduation project.

The morphological analysis will highlight public and private spaces and spatial structures and will be represented at different scales through a taxonomic representation according to Ground Space Index. At the meso scale the territory is divided in 2x2 squares and distributions of land-use are classified to understand the spatial distribution and characteristics of the whole river seveso sub-basin. In the Micro and Nano scale a more fine and grained and 3-d representational outcome will be the main deliverable. In the geomorphological analysis a set of maps and images will be the main deliverables illustrating the specific objectives.

The theoretical framework will entail the theory paper, which aims at showcasing the basic theoretical inputs and knowledge on the topics of green-blue infrastructures, landscape ecology and ecosystem services. Moreover, the theoretical framework in the thesis plan aims at describing the processes and reasoning on the choices of theories according to the research questions and objectives. Thus a supporting essay and a list of theories are the main deliverables.

The problem analysis chapter will entail the problem statement and problem field chapters. The latter will describe a list of endogenous and exogenous problems, in which the strategic links and synergies between those are described synthetically and contextually in the problem statement. The problem field is accompanied by several maps and data made by the author. The deliverable is thus a visual essay resulting in a problem statement.

Research question /Objectives / methodology:
The main deliverable in this section will be a set of questions that will result in design and research goals. In order to answer the question and to achieve the design and research goals a set of specific methods for each sub-research question and general methods used in the design process are disclosed.

Design deliverables:

As part of the design process, several deliverables as drawings, projections and visualization are presented.

Some of the representation will be more contextual (regional ecology), especially in the watershed and macro scale.

At the meso scale, vision of the sub-basin is presented as an integrated planning and design strategy to accommodate urban development and deploy green-blue infrastructures.

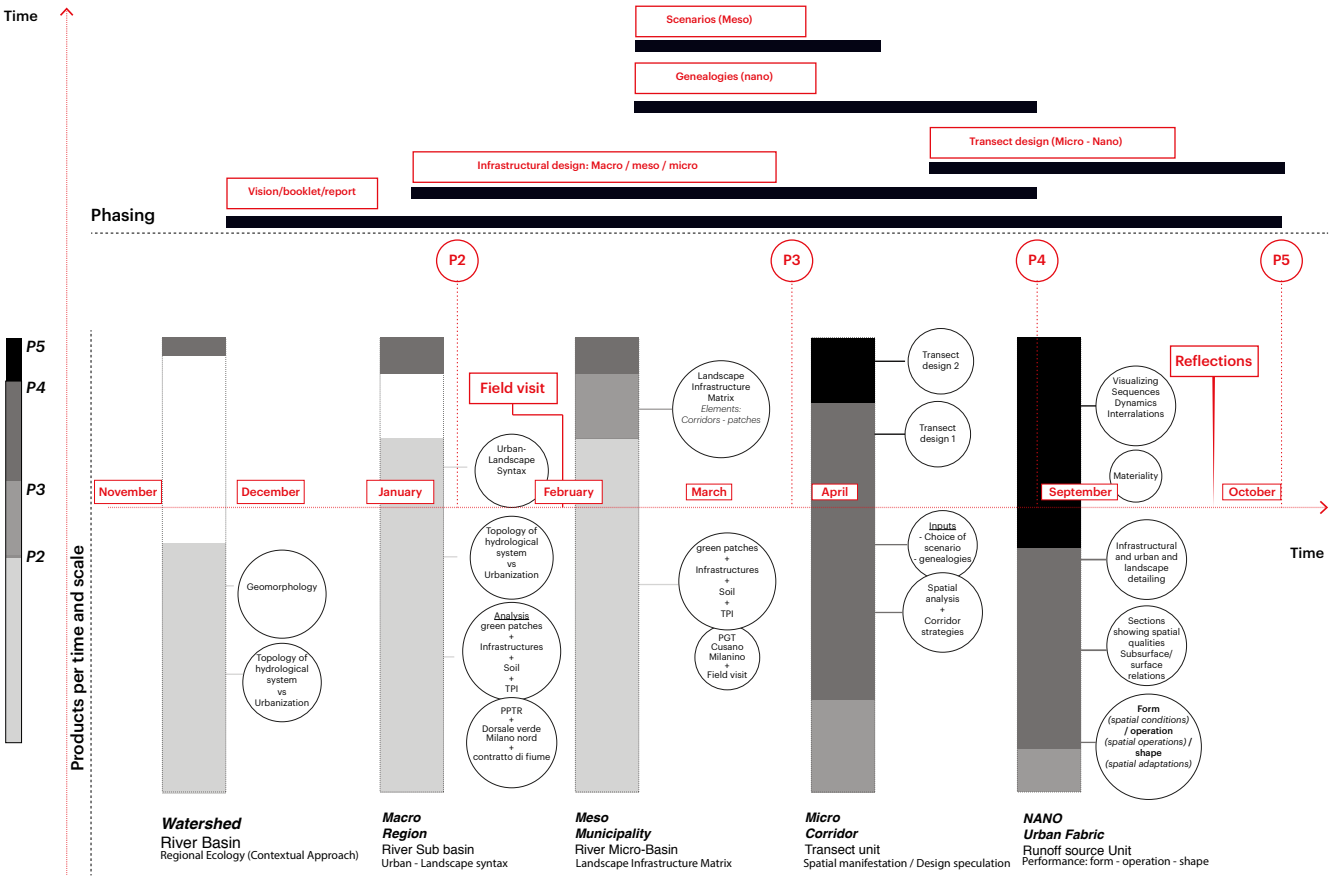
At the Micro scale the main deliverable will be the connective performative tissue “à la Corner”.
To support the findings and the main deliverable, another important delivery at this scale is a precise taxonomy of spatial units, along with GSI and FSI indexes.

At the Nano scale the performative design is translated into the detailing phase, where the project is showcased in a particular road. Moreover through section a new vertical heterogeneity and the relation between subsurface and surface infrastructure for stormwater management is disclosed.

Eventually, visualizations at an eye level to showcase the implication of such reconfiguration will be the main deliverable.

Supporting essays:
In order to support the research approach, its relevance, objectives and implications a set of supporting essays will be delivered. Namely: the ethical paragraph, the Societal and scientific relevance and graduation orientation essay, an essay on specific hydrological findings and eventually, as part of Delta Urbanism research studio, a visual essay, illustrating differences and similarities between the Rhine and the Po river basin.

Design process, time schedule.



Figure

Showing time schedule with the different products to be made for each presentation.

Research by design

Exploring Conditions: places, processes and landscape.

In the following chapter I will describe the main steps, which helped me to explore and understand a set of spatial conditions in the urban region of Milan. This process was fundamental to approach the question in which i was interestd since the beginnning of the year in this specific geographical context. The question of urbanization, of landscape changes and their implication for the environmental domain. Eventually, it helped me to construct a narrative, which will support, underlie and generate the problem analysis and the further research and design agenda.

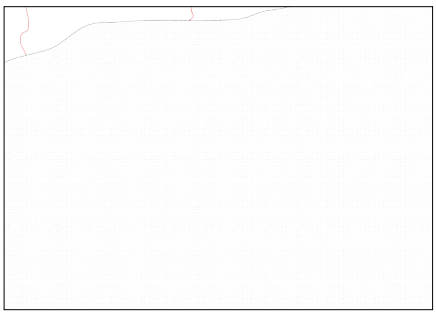


Figure 1.1
showing the extent of the sea in during the Paleolithic age.
Image made by Author.

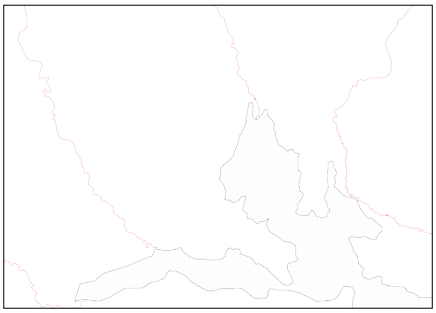


Figure 1.2
showing the shrinking mare padano.
Image made by Author.

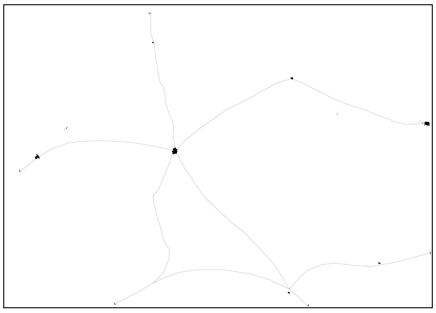


Figure 1.3
showing the first graft of occupation patterns and roads in the roman period.
Image made by Author.

The contextual approach was triggered by a specific need to understand patterns and relations of urbanizations as part of the process of *territorialism.*
Territorialism as a diachronic, conceptual, and analytical exercise to understand urbanization as a part of a complex process of occupation on behalf of one species of a certain environment (Viganò 2012).
From this standpoint, I began my investigation with the 3x3x3 exercise (3 scales, 3 layers: occupation, landscape, infrastructure, 3 different timeframes). As a part of the Delta Urbanism graduation studio, this assignment led me to a research analytical process in which the narrative of a changing landscape acquired a central role.
In addition to this, the "immersion" into a research by design stage since early on was very useful and has guided me to acknowledge the relationships and interlinks between certain forms/ configurations and processes of spatial development in the region. Specifically, this approach was very helpful to understand the contemporary territorial palimpsest (physical changes in the landscape and its various stratifications) in relation to the different moments of human occupation, along with different degree and intensity of changes and disruptions.
I began to see the padana plain as a former sea in the Palaeolithic age (figure1.1), which then, during the last period of glaciation (12 - 110 thousands years ago) due to changes in weather patterns, mountains and lakes were forged. Rivers carried downstream sediments, from which the Po river valley and its fertile soils were created (figure 1.2).
This structural change in the landscape set the condition for the first appearance of human civilization (figure 1.3). Abundance of water and a strategic geographical location steered a specific spatial distribution in the plain. Romans settled on the former shoreline of the shrinking "mare padano", and grafted the first road infrastructures as operational grounds, boosting trade.
Milan, Medio-lanum (which literally means in the middle of the plain) found itself at the crossroad between maritime networks and southern from the Alps in which the first craftsman settled.
It is interesting to see from a spatial perspective how the pattern of road on behalf of the romans is still very visible nowadays as main highways connections between cities in the north of Italy (figure 1.4).

Until the real industrial revolution of Italy (after WW2), this territory was heavily tweaked especially in the lower part of the plain by

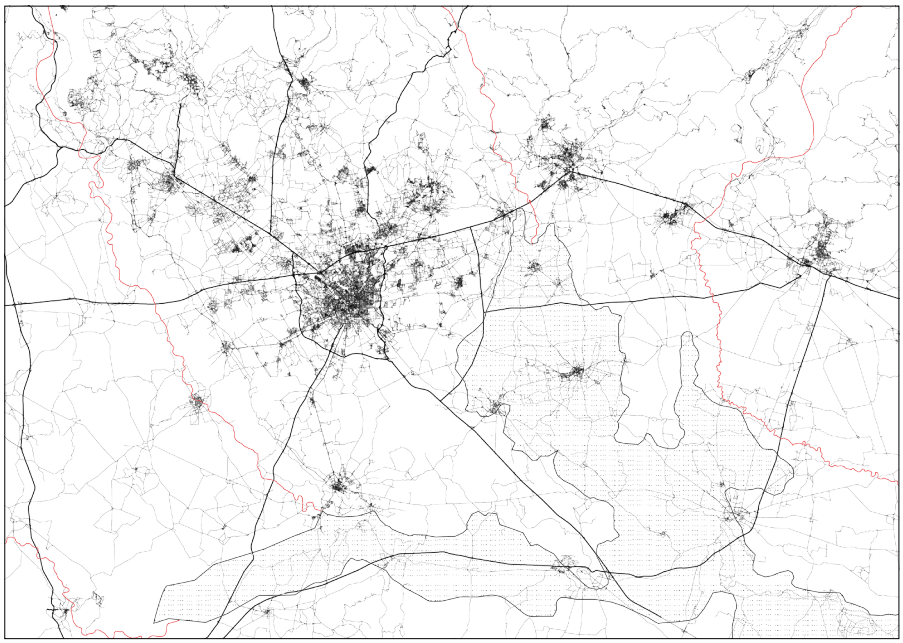


Figure 1.4
showing the correlation between the former sea, "mare padano" and the modern system of infrastructures.
Image made by Author.

"The graft of roman infrastructural networks across the po river valley as a consequence of the trade (commercial relations) between human settlements. This is the historical fact that have signed the destiny, in this sense the very first structural elements and nodes soon to be developed".

Eugenio Turri, in: La Megalopoli Padana.

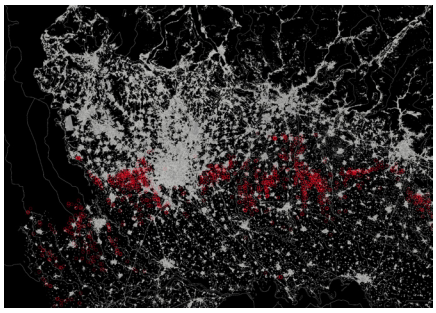


Figure 1.5
showing the distribution of Fontanili in the region.
Image made by Author.

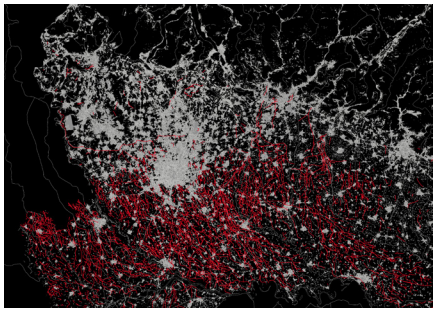


Figure 1.6
showing the artificial water system at the end of the 18th century.
Image made by Author.

the graft of fontanili in the 17th century (figure 1.5). This technique consisted of water springs channelized through artificial embankments that brought water downstream to irrigate fields, which wouldn't freeze during winter, grass was then used to feed cattle.
Furthermore, modern irrigation and drainage canals were built in the 18th century (figure 1.6). These "landscape infrastructures" boosted agricultural production and contributed enormously to the process of capital accumulation.
In the 18th century, the accumulated capital in the lower part of the plain, set the economic condition for a new array of industrial investments in the drier, less costly to drain, higher plain in the north of Milan. Therefore, It begins in this moment (half of 19th century) a new process, in which the effects are clearly visible today: industrial economies, rich of inputs, in continuous development, take over the low plain and will guide the future territorial organization and arrangement of the region (Turri 2010).
The magnitude and intensity of the industrial revolution in north Italy, was quite weak until 1945. After WW2, "the economic miracle" of Italy started and industrial clusters in chemical, textile, manufacturing, mechanical and steel, sprouted all over the north. This phenomenon, coupled with the development of mobility infrastructure, has set the basis for the spatial coalescence, in which the region finds itself today.

This explored condition suggested me to further explore the area where occupational patterns occured in the most intense way, in order to understand their linkages with specific ecological processes.

Due to a contextual investigation on the environmental risk in the region, I decided to further explore the northern part of the region, where three rivers, the Seveso, the Olona and the Lambro are increasingly suffering from anthropogenic pressures. (figure 1.7 - 1.8). Due to the contemporaneity of this condition i decided to research specifically the seveso river sub basin (figure 1.7).
Once again the 3x3x3 exercise in the North of Milan, made me understand the magnitude of change that has occured in this territory. An area that is hard to describe due to its genesis, urban

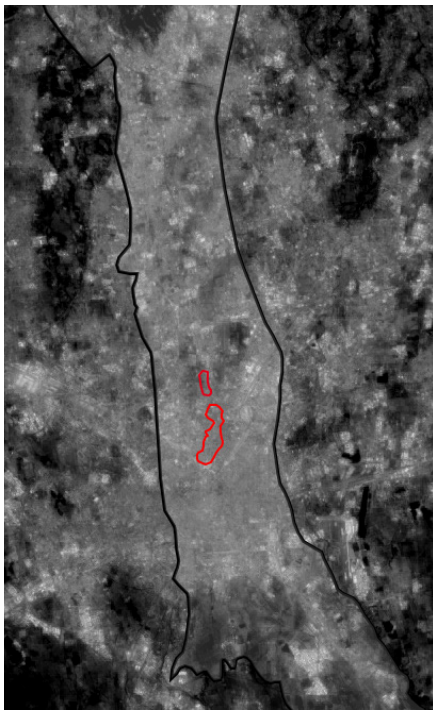


Figure 1.7
showing the sub - basin of the Seveso River and the recent flood in 2014.
Image made by Author.

composition and political situation. Although we know from studies of urban morphology and urban expansion that disperse urbanization patterns leads to high-consumption levels of land, water, and fossil fuels and adversely impacted ecosystem services (Seto et al. 2010), the north of Milan is somewhat more complex than a spatially heterogeneous landscape in which a dispersed urbanization such as we might find in other countries, prevails.
This condition was the conceptual input to further understand the spatial distribution of the region through GIS data visualization.

In terms of land use classification distribution, we can state that the north part (which stretches from Milan municipality border, towards the alp), is characterized by mostly a discontinuous and dispersed urban tissue (figure 1.8.2) which is defined by a: coalescence of the urban structures, a dissolution between rural and urban tissue (Vogt, G 2013), a clear relation between mobility arteries and urbanization and geographical horizontality, given by a spreading and diverse low - medium density urban landscape.

As explained by Italian Architect and Urbanist Stefano Brandolini, in his book: A piedi nella Metropoli , he tries to describe a territory of patches and fragments as a multiplication of infinite subdivisions, with an incredible "urbanistic biodiversity". As he states:

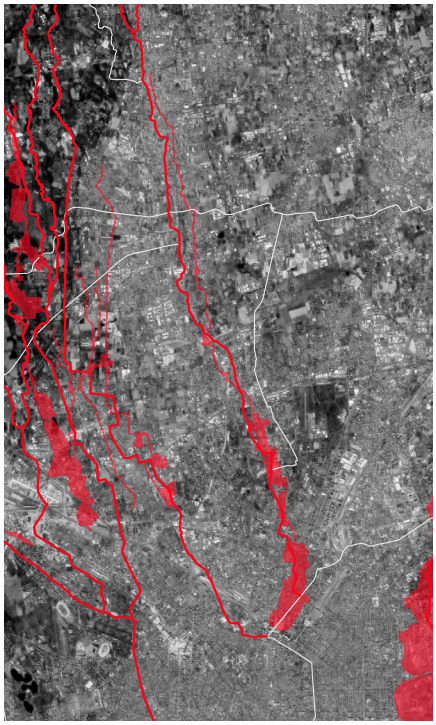


Figure 1.8
showing natural (red) and artificial (white) water system and the environmental risk outilined by Lombardy region.
Image made by Author.

" the North of Milan is still an experiment, which will have to decide what wants to become in the near future. A variety of ideas transpire in the watermark, in between being ghost or angels, they are ideas about the garden city, the automobile city, the tower city, the pedestrian city, the industrial city, the metropolitan city, the agricultural city, the movement city, the shopping city, the regional city and the postcard city... The fact that none of these prevail on the others, means two things: there exist infinite type of cities and that the future of cities always offers much more interesting insights then the one embedded in its anticipations".

"It is possible to conceive ideas and strategies referred to the domain of landscape only after having ascertained the modalities and degrees of the great "advance" of urbanization. Landscape has become a resource of urbanity, such as fresh water, energy etc.. "

Vogt Gunther in:
A piedi nella metropoli, Stefano Brandolini

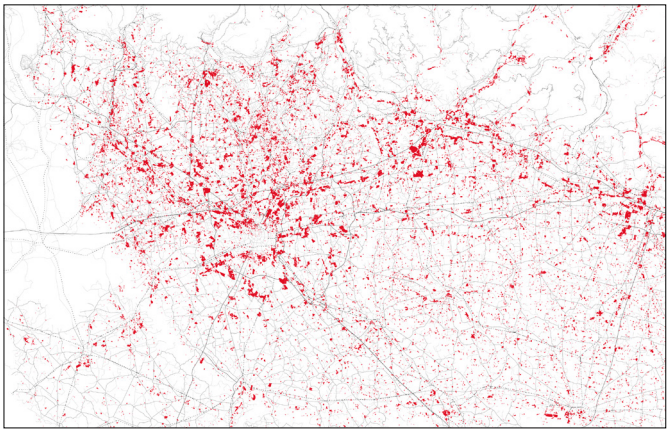


Figure 1.8.1
Showing industrial and commercial development in milan Urban Region.
Image made by Author based on DUSAF 2009

Figure 1.8.2
Showing an early industrial settlement in the Northern part of the region.
Source: google images

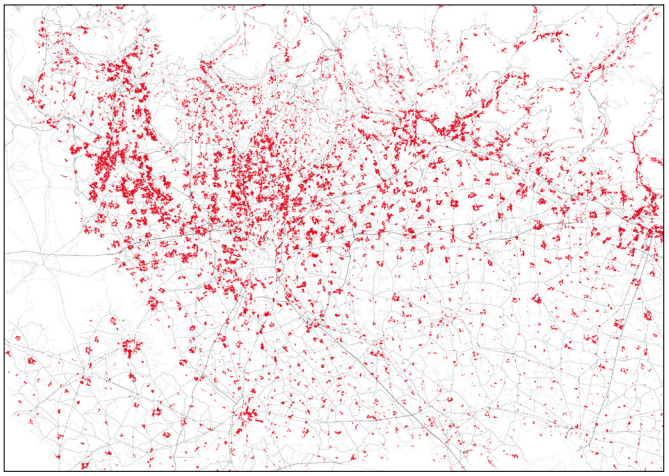


Figure 1.8.3
Showing the distribution of diffuse and discontinuos urban tissue in the region.
Image made by Author based on Dusaf 2009

Figure 1.8.4
Showing a discontinuos typology, the "infinite city" has seen a raise of these units in the last 30 years.
Source: google images

Contextual Conclusions

As a summary of this very first analytical and conceptual exercise aimed at understanding and exploring the complexity of the region and the linkages between human and natural processes, i can sum up with the following conclusions:

1)
A diffused and distributed territorialisation as an historical fact has set the spatial condition for the contemporary administrative fragmentation, spatial coalescence and metropolitan expansion.

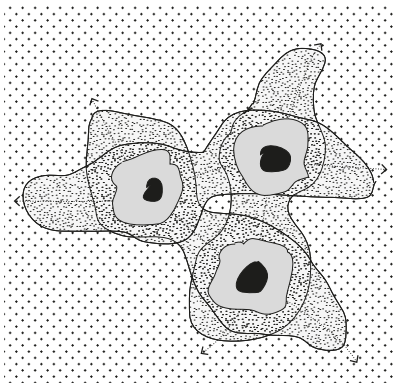
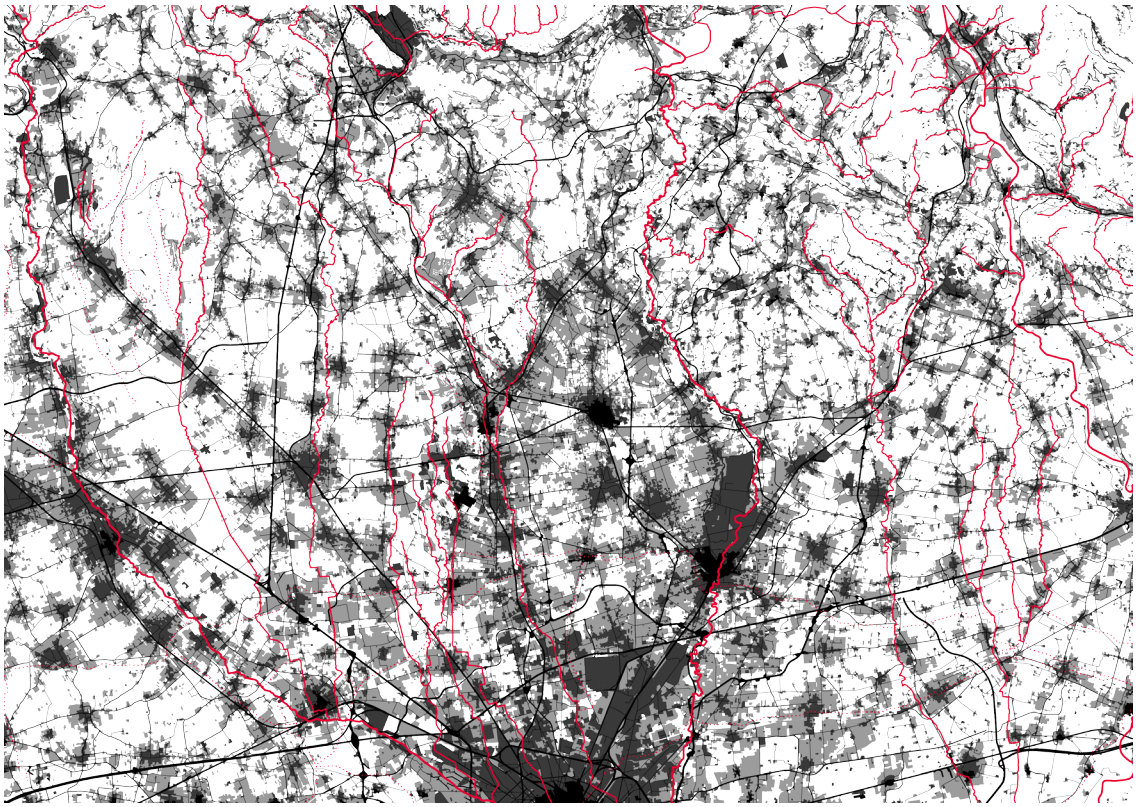


Figure 1.9.5
Showing a schematic representation on the spatial development process.
Image made by Author.



Old New

Figure 1.9.4
Showing old and new settlements, water system and administrative fragmentation.
Image made by Author.

2)
Geomorphological characteristics, such as soil composition and topography have strongly guided and influenced spatial development throughout the years.

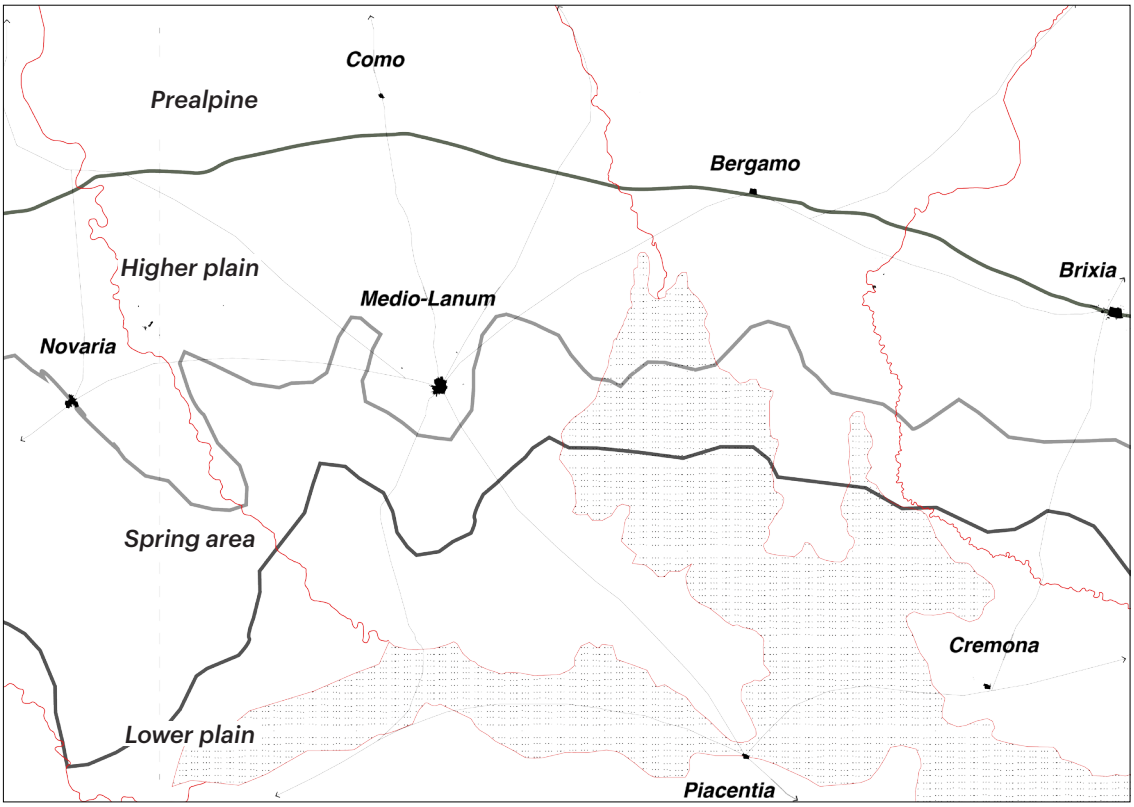


Figure 1.9.5
Showing an overlay of different time scale and information. Specifically geomorphological changes from prealpine to low plain landscape. Moreover it shows the spatial correlation between the shrinking sea from the paleolithic age and the infrastructural and occupational layout of the first roman civilization. Image made by Author.

3)
Infrastructures triggers human occupation and productivity.
it allows and boost Capital accumulation.

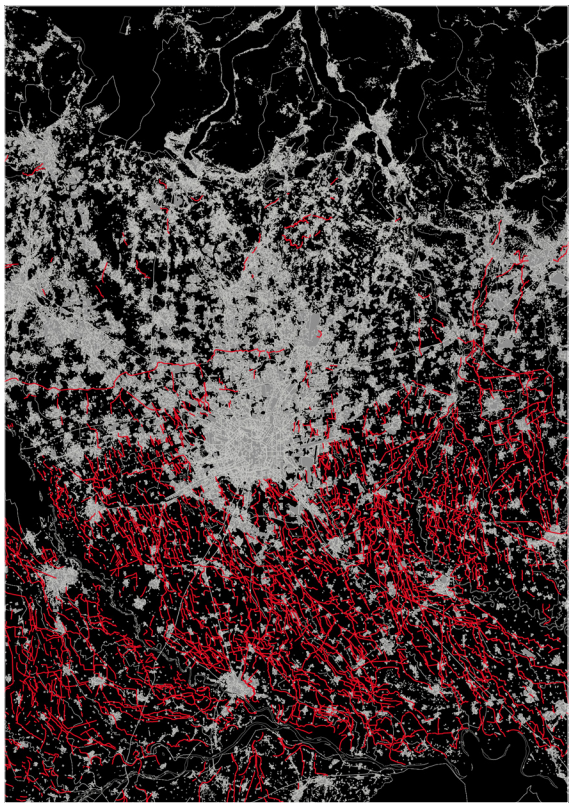


Figure 1.9.6
showing 18th century system of canal built by humans in order to boost agriculture in the southern plain. These landscape infrastructure contributed enormously to this first phase of capital accumulation.

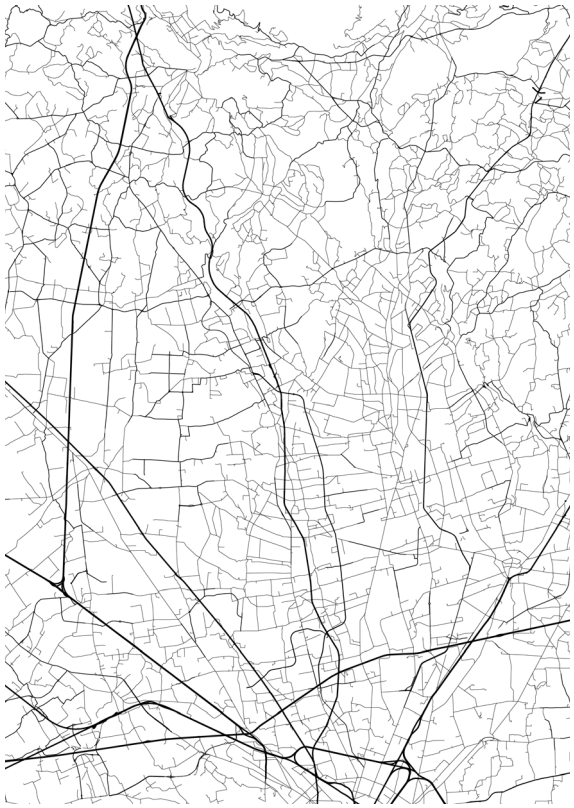


Figure 1.9.5
showing infrastructural layout in 1954, investments in infrastructures permitted and allowed industrial investments in the more arid, less costly to drain north, It set the spatial condition for the contemporary metropolitan expansion.

4)
Different moments in History have prodocued different territories, within this processes it is crucial to acknowledge the importance of infrastructures as one of the guiding field in urban and landscape development. Nevertheless, the correlation and linkages between human and natural dynamics.

"Cities are the summation and densest expressions of infrastructure, or more accurately a set of infrastructures, working sometimes in harmony, sometimes with fraustrating discord, to provide us with shelter, contact, energy, water and means to meet other human needs. The infrastructure is a reflection of our social and historical evolution. It is a symbol of what we are collectively, and its forms and functions sharpen our understanding of the similarities and differences among regions, groups and cultures. The physical infrastructure consists of various structures, buildings, pipes, roads, rail, bridges, tunnels and wires. Equally, important and subject to change is the software for the physical infrastructure, all the formal and informal rules for the operation of the systems".

Herman and Ausubel, 1988, from Splintering Urbanism.

What will be next legacy of infrastructures ?

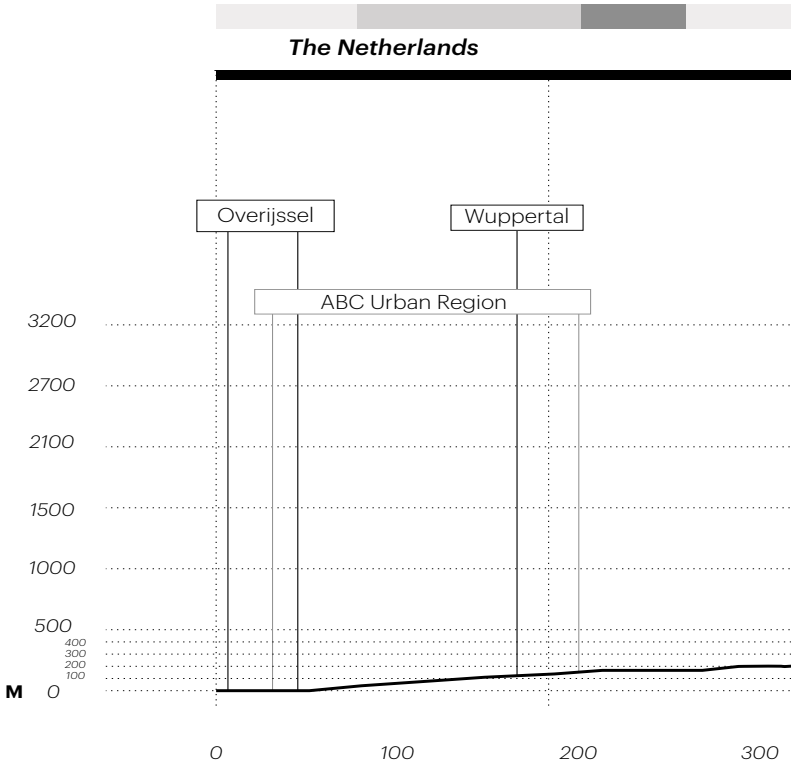
Artificial or Natural ? gray or green or blue ? tangible or intangible ?

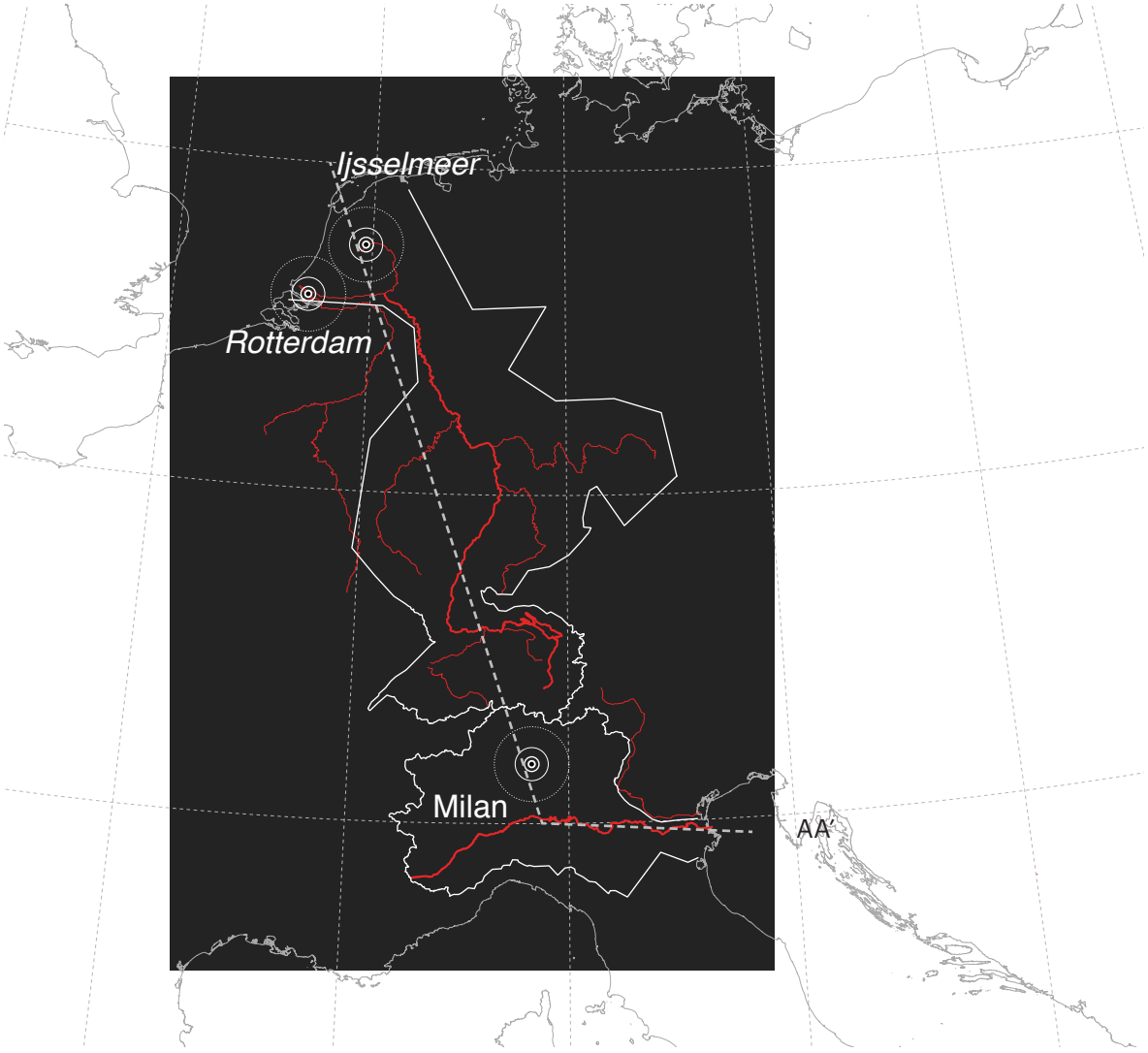
Delta intervention Exercise

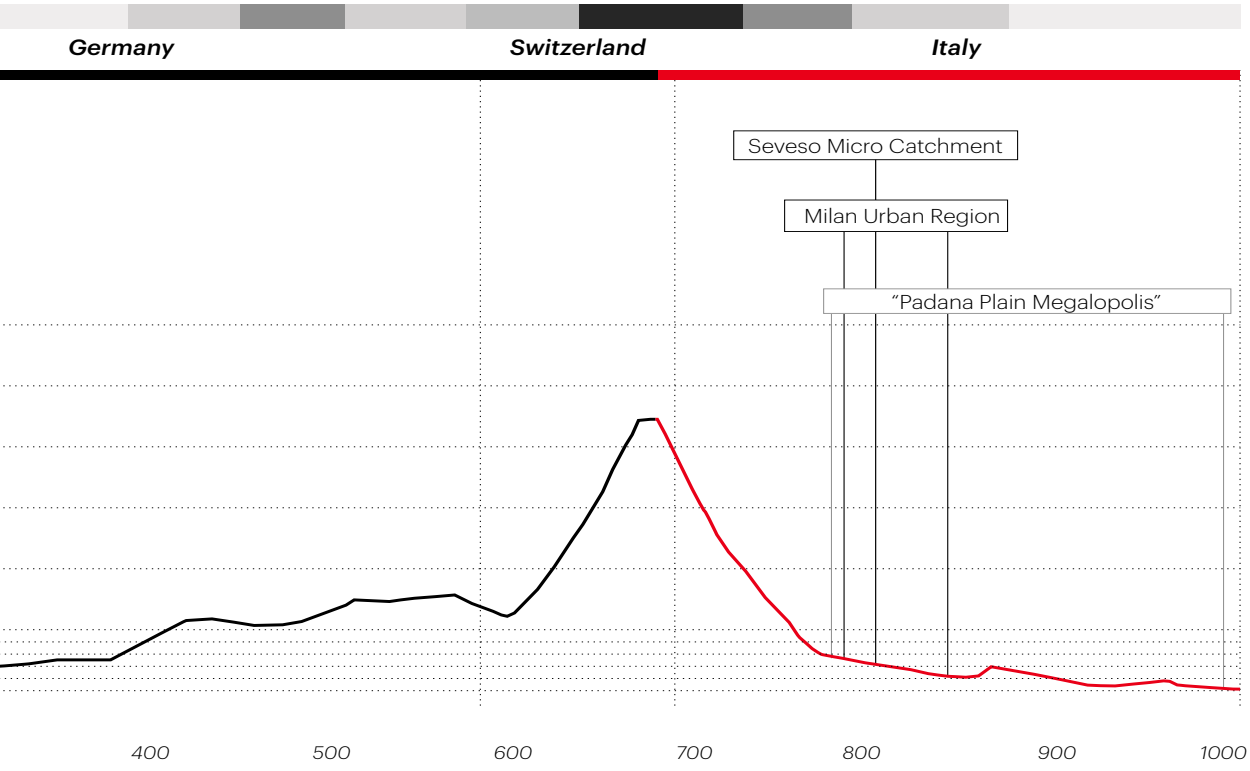
As a part of the Delta Urbanism research group assignment, territorial features and structural comparison between the dutch delta and its watershed and the Po river valley and its watershed were explored

The focus is thus on strucutral and qualitiative comparison betwen the two delta and the river systems analyzed in the dutch case by other students and the seveso river in Italy. Moreover it made me able compare The Po watershed, with the river Rhine watershed, as being part of the same hydrological unit but with consistent, governancem occupational and geomorphological carachteristics.

The aim of this section is to visualize differences between different geographical spatial conditions.







average annual precipitation,
1940 - 1995
Source: Own Elaboration based on European Environment Agency

500 - 800 mr
800 - 1.000
1.000 - 1.600
1.600 - 4.000

The Netherlands

Surface: 41,543 km2

Population: 17 mln

Population Density: 407,7/km2

12 Provinces
390 Municipalities

Lombardy

Surface: 24,000 km2

Population: 10 mln

Population Density: 419,14/km2

12 Provinces
1530 Municipalities

Overijssel

Surface: 3420 km2

Population: 1,13 mln

Population Density: 330/km2

25 municipalities

North of Milan

Surface: 2000 km2

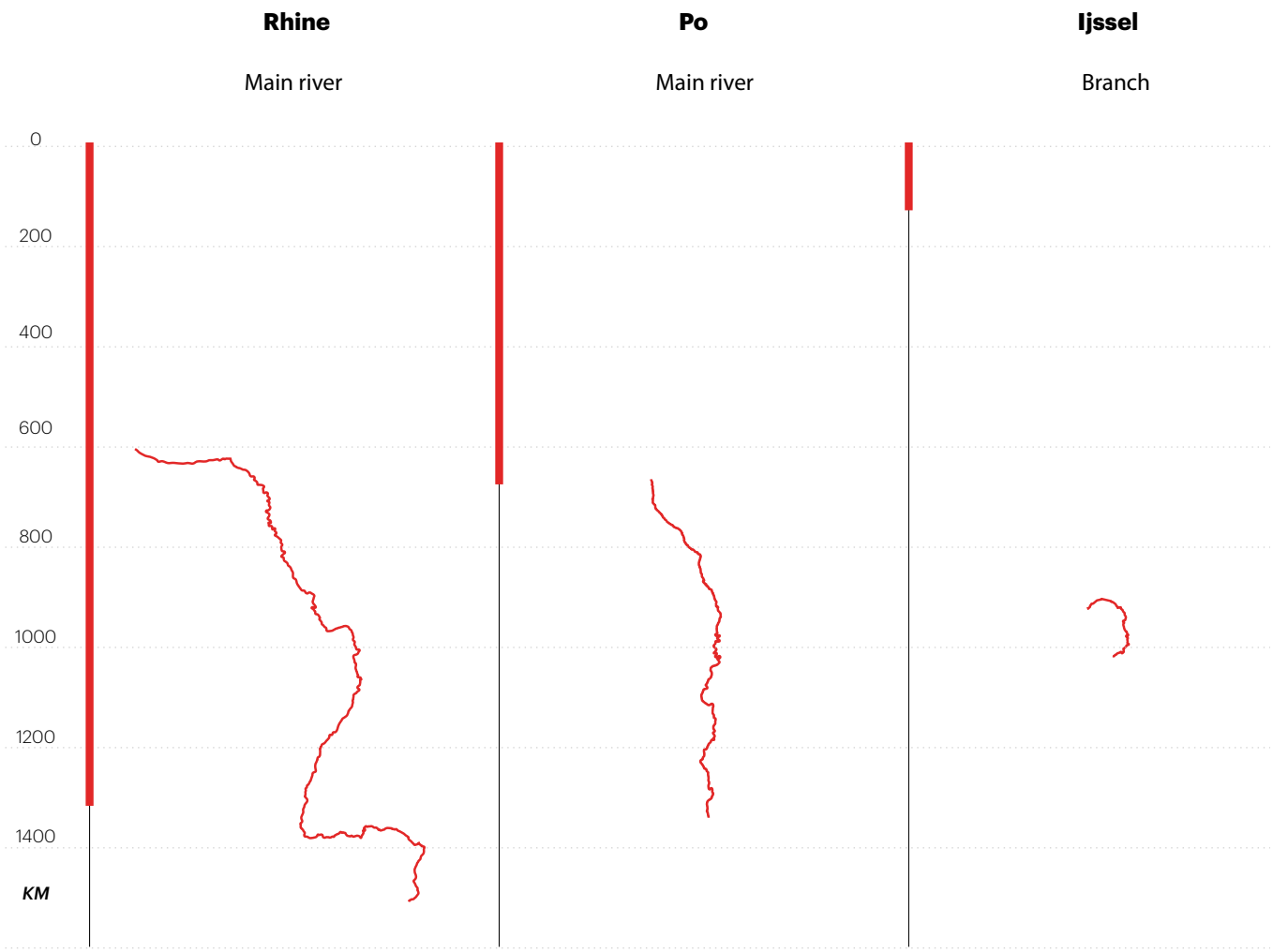
Population: 2 mln

Population Density: 2500/km2

200 municipalities

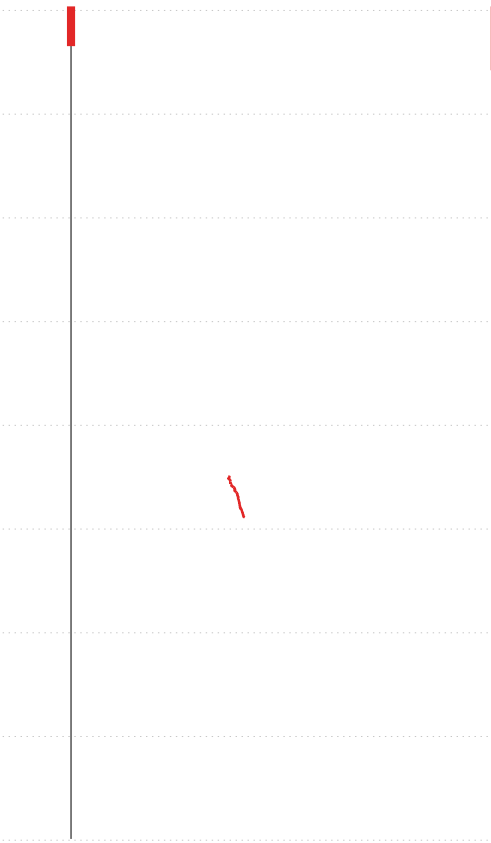
KM 50 100 150 200 250

N


Rhine
Main river
Po
Main river
Ijssel
Branch
0
200
400
600
800
1000
1200
1400
KM
Lenght: 1.326 km
Average reach: 2.200 m3/s
Watershed: 185.000 km2
Lenght: 652 km
Average reach: 1.540 m3/s
Watershed: 71.000 km2
Lenght: 126 km
Average reach: 340 m3/s

Seveso

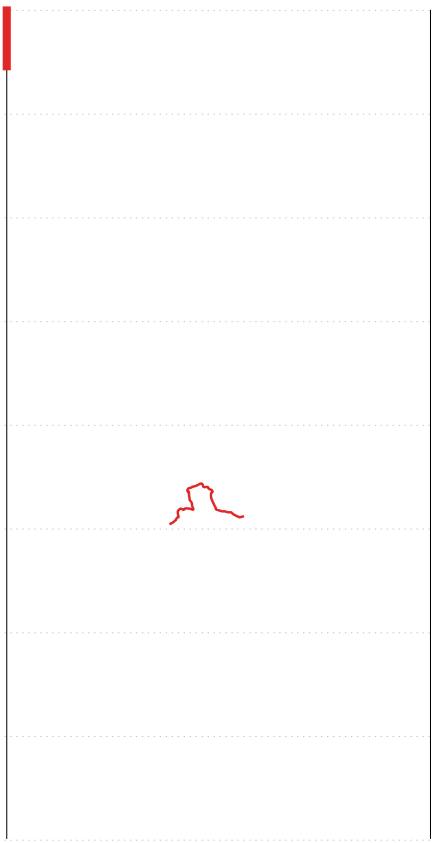
Tributary



Lenght: 54 km
Average reach: 1,8 m3/s
River Catchment: 930 km2

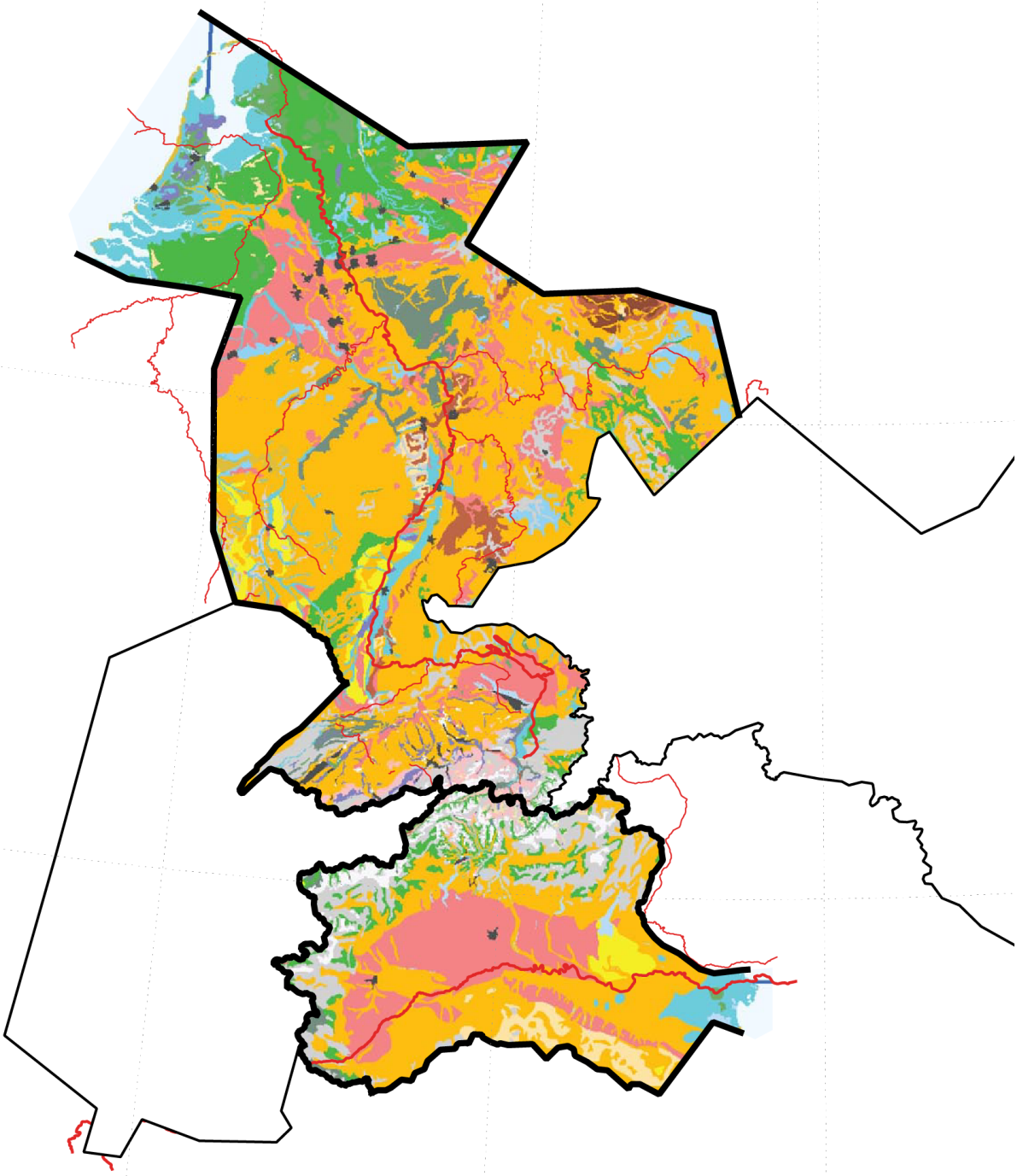
Wupper

Tributary



Lenght: 113 km
Average reach: 17 m3/s
River Catchment: 827 km2

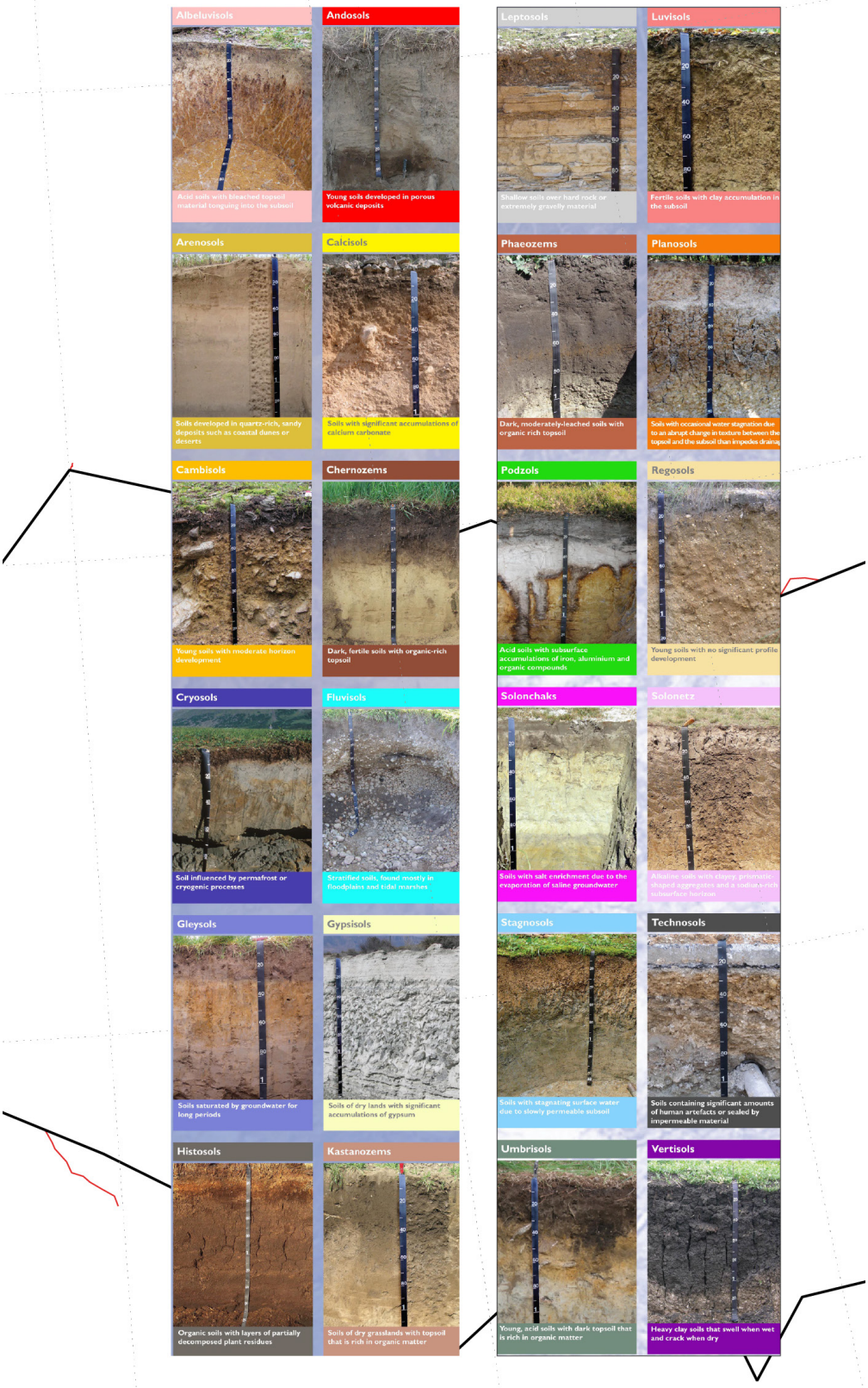
Major soil types in Europe



KM 50 100 150 200 250

N

Source: Own Elaboration based on European Environment agency


Albeluvisols
Acid soils with bleached topsoil material tonguing into the subsoil
Andosols
Young soils developed in porous volcanic deposits
Leptosols
Shallow soils over hard rock or extremely gravelly material
Luvisols
Fertile soils with clay accumulation in the subsoil
Arenosols
Soils developed in quartz-rich, sandy deposits such as coastal dunes or deserts
Calcisols
Soils with significant accumulations of calcium carbonate
Phaeozems
Dark, moderately-leached soils with organic rich topsoil
Planosols
Soils with occasional water stagnation due to an abrupt change in texture between the topsoil and the subsoil than impedes drainag
Cambisols
Young soils with moderate horizon development
Chernozems
Dark, fertile soils with organic-rich topsoil
Podzols
Acid soils with subsurface accumulations of iron, aluminium and organic compounds
Regosols
Young soils with no significant profile development
Cryosols
Soil influenced by permafrost or cryogenic processes
Fluvisols
Stratified soils, found mostly in floodplains and tidal marshes
Solonchaks
Soils with salt enrichment due to the evaporation of saline groundwater
Solonetz
Gleysols
Soils saturated by groundwater for long periods
Gypsisols
Soils of dry lands with significant accumulations of gypsum
Stagnosols
Soils with stagnating surface water due to slowly permeable subsoil
Technosols
Soils containing significant amounts of human artefacts or sealed by impermeable material
Histosols
Organic soils with layers of partially decomposed plant residues
Kastanozems
Soils of dry grasslands with topsoil that is rich in organic matter
Umbrisols
Young, acid soils with dark topsoil that is rich in organic matter
Vertisols
Heavy clay soils that swell when wet and crack when dry

References

In the following section of the apendix, the references that support and had inspired the project throughout are illustrated.
Here it follows a list and some visualizations on the work done by private practices and municipal programmes that relates to the graduation work in different scales

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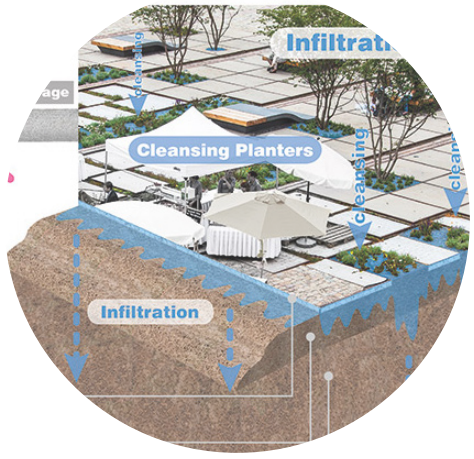
Base studio

Werker Arkitekter

Dland studio

SLA studio



Atelier Dreiseitl

SLA studio

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“Behind the territorial morphologies that come into view and are the object of multiple representations in photography and cartography, passing through drawing and painting, there are hidden - amongst other things - ways in which humans satisfy their needs.
Behind every territorial creation loom invisible pyramids of needs that we can suppose, but do not see. The visible does not give us the key to the invisible, and yet territory, as the result of the manipulation of eco-bio-anthropo-logics, is the most material expression there is of the needs of humans”.

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