Recycling Wasted Landscape

Circular perspectives and innovative approaches on landscape remediation

PhD Candidate | Valentina Vittiglio

To my beloved family

In the cover page
Graphic elaboration made by the author
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University of Naples Federico II
Department of Architecture | DiARC

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Coordinator of the PhD School
Professor Fabio Mangone

Tutor
Professor Michelangelo Russo | DiARC - Department of Architecture, Naples (IT)

Co-Tutors
Professor Maria Cerreta | DiARC - Department of Architecture, Naples (IT)
Professor Massimo Fagnano | Department of Agricultural Sciences, Naples (IT)
Professor Enrico Formato | DiARC - Department of Architecture, Naples (IT)
Ph.D Geol. Andrea Gigliuto | ERM - Environmental Resource Management, Milan (IT)
Professor Arjan van Timmeren | TU Delft University of Technology, Delft (NL)

Supervisor
Ph.D Libera Amenta | DiARC - Department of Architecture, Naples (IT)

PhD Candidate
Valentina Vittiglio

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“Resilient, sustainable cities are a better future for all of us.
But to get there we need to start with people and place”
(Rouchecouste G., Pearson L. J.,
Resilient Sustainable Cities. A future, 2014:50).

Wilhelminapark, Delft, Netherlands. Photo taken by the author, 2019

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Abstract

The research investigates issues related to the territories of abandonment and waste, named Wasted Landscape, in urban and metropolitan fringes, as spatial transpositions of the outputs of the linear and unsustainable metabolic processes of the cities. The cause-effect analysis carried out with respect to their condition of marginality and degradation, as well as contamination of their environmental matrices, proposes a re-reading of them as potential and innovative resources of the urban planning project. In this regard, recognising the identity and strategic value of existing capital, the research aims to put the emphasis on regeneration and reclamation mechanisms to be applied in crisis contexts as essential materials of the city project. The research therefore, starting from a conventional concept of remediation, intends to investigate how a transition from sectoral environmental remediation approaches to integrated and multiscale intervention models can be made. In this line of research, reclamation is considered as a complex intervention that requires tools to identify eco-innovative, nature-based, and shared strategies and solutions. The main aim is to develop an integrated connection model between the objectives and actions of the urban project and the treatment of environmental issues through interscalar and intersectoral approaches capable of being internalized in the process of participatory laboratories on the model of Living Labs. These fertile interaction contexts, with the involvement of different stakeholders, including the end user, allow us to intercept regenerative solutions based on the assessment of impacts with respect to urban and landscape dimensions, but also social, economic, and cultural contexts of belonging. Placing the reclamation of Wasted Landscape in a circular and sustainable dimension means increasing the resilience and adaptability of the urban and territorial project of latent metropolitan contexts compared to the environmental pressures that affect them, as well as activating public-participation processes which are useful to imagine new economies for their recovery. The proposed change of perspective therefore shows a potential double consequence of the reclamation processes: operational, as possible and new regeneration vectors open to the landscape scale, and programmatic, as drivers of proactive changes in practice and in planning tools. The theoretical-analytic dimension, which underlines the critical aspects currently attributable to the rehabilitation interventions, together with the definition of tactical-operational strategies allow them to be overturned positively. The spatial transposition of the effects of this approach is in fact realised in new and regenerative landscape conformations aimed at unfolding collective benefit and social inclusivity.

Keywords

Wasted Landscapes, polluted soils, sustainable remediation, urban metabolism, circular economy, living lab, eco-innovation, nature-based solutions.

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Acronyms and abbreviations

ARPAC	Agenzia Regionale per la Protezione Ambientale in Campania
BVs	Background Values
CSC	Contamination Threshold Concentration
CSR	Risk Threshold Concentration
EEA	European Environmental Agency
EIS	Eco - Innovative Solution
EPA	Environmental Protection Agency
LL	Living Lab
MAN	Metropolitan Area of Naples
NbS	Nature-based Solution
NIPS	National Interest Priority Sites
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Policlorobifenili
PCS	Potentially Contaminated Sites
PULL	Peri-Urban Living Lab
RECALL	REmediation by Cultivating Areas in Living Landscapes through phytotecnologies
REPAiR	REsource Management in Periurban AReas: Going Beyond Urban Metabolism
SIR	Siti di Interesse Regionale
SuRF	Sustainable Remediation Forum
ULL	Urban Living Lab
WL	Wasted Landscape

Introduction

BACKGROUND TO THE PROBLEM

The territory is the main support of all civil and active coexistence, of a rapidly changing society, of activities and institutions today deeply uncomfortable. Today the territory is no longer able to play its role, that is to build the material conditions in which social life can properly and profitably unfold.

(Author's translation from Italian - Secchi, B. Per un'agenda urbana e territoriale, 2014:5)

Metropolitan contexts imprint significant ecological footprints on the planet as the major vectors of devastating alterations on the entire environmental ecosystem. Rapid urbanisation, excessive anthropogenic exploitation of non-renewable resources, waste-related issues and mismanagement, together with the disposal of industrial plants and the abandonment of parts of cities, have had a significant impact on both the ecological and socio-economic dimension of urban systems. De-industrialisation, productive decentralisation, the halt of urban growth and the occupation of land around large cities (Secchi, 2011) have generated not only inequalities and discrimination in the social structure but also a legacy of fragile territories, with a lack of functional and morphological coherence, empty spaces and no identity. These are the peculiar and structuring features of the state of crisis that, by investing a global dimension, has helped to bring out the modest adaptability of the territories to the changes taking place. It emerges in fact, compared to the conditions of risk that undermine the urban scenarios, a poor resilience understood as a "measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973:14). The permitted value thresholds have been exceeded and the planet's physical and biological inability to tolerate the pervasive anthropic pressures shows signs of seemingly irreversible compromise. The state of emergence with which contemporary society is perpetually coexisting highlights the persistence of an action that operates on the edge, on the thin border that touches the threshold beyond which there is risk, degradation and social inequity (Worth, 2017). The spatial transposition of this critical condition of stasis takes concrete form in the proliferation of the ground of fragments of uncertain territory in which there are unexpected and suspended conditions, in which the greatest threats are hidden, especially environmental ones (Lerup, 2016). These contexts are considered to be waste, because conditions of neglect and contamination of the ecological matrices have completely obscured the identity, historical and cultural layers, compromising the value of use. They are the weak elements of the territorial pattern, the latent places of transition that in this dissertation will be labeled as Wasted Landscape (Amenta, 2015) identifiable in the

brownfields, derelict lands, drosscapes, polluted industrial landscapes, terrain vague, vacant land, friches, interscapes, under programmed areas, 'in-between' surfaces left over by the dominant economic forces of urbanisation, abandoned and/ or contaminated sites, degraded and interstitial entities, abandoned sites which have lost all their attractiveness and identity. […] abandoned or forgotten open spaces or buildings that are not used because of contamination or are at the end of their life-cycle. They form a part of cities and peri-urban hybrid landscapes.

[…] that shape landscapes all over the world. The formation of WL is a consequence of the transformation of the economical structure of the region that leads to two main processes that take place simultaneously and work in a cyclical way: city expansion/sprawl; shrinking/ deindustrialisation (Amenta, 2015: 33).

Wasted Landscapes are a dominant condition within contemporary metropolises. They therefore represent complex and dynamic socio-ecological systems deriving from the continuous interaction between the anthropic and natural dimensions, and therefore projections in spatial terms of society on the territory (Lefebvre, 2014). A tangible effect of this mutual dependence between the human and natural environment is the environmental contamination that in this dissertation will focus mainly on the soil matrix, as the common denominator of these latent places more exposed to exploitation, degradation and therefore erosion. Soil has always been considered as a support platform for human activity and "a field of erroneous or irresponsible decisions on its use and consumption [...] daughters of a very fragile awareness [...] of the relationship between man and nature, between man and resources" (Author's translation from the Italian - Pileri, 2016:11). The integrity of this non-renewable resource is undermined above all by its consumption, understood in a twofold sense, of artificialisation of natural surfaces and of the inactivity of residual areas that catalyze contamination that is sometimes irreversible. Issues related to ecological contamination are strongly rooted in contemporary national and international territorial contexts, representing the main objectives of the policies on the subject, which are not negligible. The imperative critical condition of stasis imposes in fact the decontamination of these fragile ecosystems (Palestino, 2015) and therefore the recourse to approaches of reclamation capable of restoring their new value and secure usability for the communities settled there, increasing their resilience. Unfortunately, the apparent and simple achievement of these goals contrasts with the current and limiting technical concept of remediation and reclamation rooted in planning practice. The traditional approaches, in fact, highlight critical points, including cultural ones, that characterise both operational and programmatic interventions (Robiglio, 2014). Contingencies require effective, sustainable regenerative interventions that, when implemented in the short term, can have long-term benefits. This line of action not only involves bureaucratic issues, which still make use of long and intricate authorisation procedures (Lanzani et al., 2013), but especially with regulatory instruments and rigid and ineffective plan forecasts in which the remediation measures still play a marginal role of a technical and sectoral nature. By definition, the sectoral approach precludes the use of integrated and inter-scalar perspectives that would be more suited to managing the complexity inherent in these contexts (Pavia, 2014). The result of this outdated concept of remediation is conventional, fragile and environmentally and economically unsustainable remediation solutions. In fact, over time, such approaches have contributed to restoring anonymous spaces to the city in which decontamination operations have acted without respect for any pre-existing identity, generating places that do not respond to social needs and are completely devoid of any spatial relationship with the territorial context in which they are located. From what has been said, the little attitude of the usual approaches of reclamation in managing the complexity of Wasted Landscapes emerges. Added to this is the inadequacy of the forms and instruments of governance in force on the territory that hinder the possibility of establishing a close interdependence between the restoration project and the wider one of cities and landscape. Therefore, the research attempts to propose a paradigm shift on multiple aspects. First of all, starting from the current negative meaning of Wasted Landscapes, it proposes their overturning, elevating them to potential resources for a profitable reactivation of the existing space capital. The locution “the dark side of change” (Lynch, 1990) implies precisely this opportunity to reflect on the environmental, economic and social potentials hidden in these places (Viganò, 1999). These “black holes” (Gasparrini, 2014) which pervade the mapping of metropolitan contexts could in fact be a pretext for launching innovative and sustainable experiments on the latent parts of cities. Secondly, in order to achieve this objective and combat the decay and risk conditions that are preferentially placed in these contexts, the research addresses issues relating to their remediation to ensure their adaptive reuse aimed at the reconstruction of a system of public space with high ecosystem value. Starting from a technical and regulatory analysis that defines the current inefficiency of the remediation approaches, the research highlights the main critical issues turning them into potential. In fact, these are significant inputs from which to start again to bridge the gap between the traditional conception of rehabilitation interventions and the demand for sustainable, circular, multiscale and intersectoral operating modes that the contingencies impose. Supporting the public value that a reclamation approach deploys as a precondition for the development of contexts in crisis and a preliminary step of the city project, the research proposes an application still unconventional in Campania, making use of virtuous experiences already conducted in Dutch contexts and based on the methodologies of the Living Lab (European Commission, 2008). Looking beyond the technical specificity of the approach, the main purpose that the dissertation aims to achieve is to explain the ways in which the remediation could be an original material and device for sustainability and innovation in the provisions of the plan and in the city plan. This condition, achieved in fertile contexts of interaction activated on the territory, leads not only to the definition of strategic development scenarios adapted to the human scale but also to the outline of new forms of governance, as well as public-private partnerships, aimed at new landscape conformations with strong social inclusiveness.

PROBLEM STATEMENT

With reference to the old meaning of the word crisis, the project in crisis an act of interpretation and choice. This is why it is important to stress the status of crisis. Our interest is not in emphasizing the evolution of a state of crisis or considering the crisis inevitable or permanent or even invoking blind decisionism. Our intention is to reflect on the project as a tool to interprete hidden and open conflicts, to investigate the new conditions in which a project for Europe and for the European city may be possible.

(Viganò, P. State of crisis and the project: the horizontal metropolis, 2015:29)

Wasted Landscapes can be considered as outcomes or, more properly, as waste produced by urban, agricultural and industrial linear metabolic processes in which the total absence of planning rules has further contributed to their exclusion from the growth mechanisms of contemporary metropolises. The metaphor of urban metabolism, as "the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste" (Kennedy et al., 2007: 44), allows us to theorize the city as a complex ecosystem, thus operating an analogy with the metabolic processes of living organisms (Benton & Short 2013). Currently linear reactors, cities are characterized by a metabolism in which the input of materials exceeds the output (Ferrão&Fernandez, 2013), with unlimited expenditure of non-renewable resources and in which the outcome of the metabolic system are in spatial terms, as mentioned above, precisely WL (Amenta & van Timmeren, 2018). Working within planetary boundaries, increasing the resilience of the urban system means promoting a proactive transition from an essentially linear to a circular metabolic system, in which through overturning the perspective, WL can be identified, from producers of spatial difference in value to potential contributors in terms of resource flows (Timmeren, 2014). In the field of spatial planning, discussing the urban metabolism of cities implies the use of the principles of circular economy. "The circular economy is an economic system rich in resources and an engine for innovation, bringing constant benefits to society, today and in the future. It is planned, cradle-to-cradle, for an infinite recirculation of clean technical and biological materials [...]. Essentially the circular economy returns resources" (Bompan & Brambilla, 2016). The principles of circular economy aim at the definition of a system that is regenerative and that, applied to the urban context, transmuted the concept of end-of-life in a process in which WL, in a closed and efficient system, are valued in relation to each component and re-entered in the life cycle of cities. In a circular perspective, therefore, the waste space placed on the edge of the consolidated city, in which there are the predominant characters of fatiscence, contamination and involution, becomes unlikely drivers of experimentation and innovation in which retrofit initiatives and especially reclamation are part of a wider project of landscape. The metabolic and circular approach presupposes the use of the reclamation of these spaces with their fragile essence. Their intrinsic complexity requires integrated and transcalar perspectives to restore ecological and social balances within urban contexts, increasing their resilience and adaptive capacity to environmental pressures, as well as promoting greater socio-economic cohesion and solidity. However, the above premise comes up against wrong and little sustainable conceptions of processes of environmental restoration still permeated from restrictive sectoral approaches that act on the latent contexts according to operating lines not or almost not integrated in the planning and regulatory provisions in force on the territory.

This results in aseptic environmental regeneration that restores to the soil contexts in which local communities find it difficult to identify themselves and which often prove to be particularly impactful from an environmental, economic and social point of view. It becomes imperative to look for criteria according to which a planning approach, and with a wider range of remediation, can assume the awareness to move in a world already configured orienting towards approaches that oppose "to any form of waste and able to progressively close cycles of matter now problematically open, to interweave with a new economy of recycling" (Lanzani, 2015:13). The suffix –inter to put before the concept of sectorality moves from the cognition that the existing capital, even if ecologically compromised, can constitute resource in support of the collective well-being, of the environmental and economic equilibrium of the investigated contexts (Lanzani, 2015). According to this premise, the research aims to analyse the conditions under which, by translating from a strongly sectoral dimension towards integrated approaches, reclamation can be placed in a circular dimension and can be configured as a potential driver of innovation in established planning practices. To this end, the research aims to deepen and define still unconventional operating modalities of definition of shared transformative strategies in which needs of mitigation of the risks enter in tension with planning aspects of landscape reconfiguration to also introduce a new dimension of urban plan as a catalyst for environmental innovation, economic, social and cultural (Pareglio&Vitillo, 2013).

RESEARCH OBJECTIVES

Wasted landscapes, with their condition of marginality and uncertain physical conformation, constitute a new geography of landscapes in which environmental damage paradoxically becomes a pretext for triggering regenerative practices and reclamation. Indeed, starting from the overturning of the hostile image they evoke, the research in question gives them a positive value by raising them to a preferential background in which to implement a reversal of sign with respect to the consideration of reclamation as a mere technical means for their regeneration. The main challenge that this research aims to achieve is to bring conceptual and operational innovation to the traditional vision of reclamation by intercepting unconventional nature-based and economically sustainable regenerative solutions. The research suggests, in order to achieve this goal, ways to delineate strategic scenarios of environmental rehabilitation through co-creation processes to be conducted within fertile fields of interaction, the Living Labs, among different stakeholders including end users. The proposed Living Lab methodology has two aims, in addition to the design one aimed at the rehabilitation of contexts in crisis, it also helps to promote a review of the current planning model and its tools. Raising remediation processes to effective means of achieving this additional objective, the Living Lab methodology, through systemic and multiscale approaches, allows us to set contingent spatial criticalities system with the needs of local communities by defining a new dimension in plan policies, which become more flexible. In short, in an attempt to encourage a renewed conception of reclamation, detached from strictly sectoral and precise logic, the research intends to act on two dimensions of operational-planning and programmatic-normative type.

With regard to the first issue, starting from an analysis of the problems intercepted within ecologically weak territories and a study of the remediation practices most used to eradicate their contamination, the search deepens the conditions and modalities according to which:
• remediation can be recognised as a complex process and operating tool capable of combining technical and environmental aspects with a view to the reconfiguration of the landscape, reaching beyond the mere sectoral dimension;
• remediation, placed in a holistic, multiscale and circular perspective, can be considered as a vector of innovation within the city project, outlining sustainable and adaptive strategies of action to deliver long-term benefit;
• remediation action can be attributed to public value considering it as a preliminary and essential step of the project of territorial regeneration for the creation of sustainable,

resilient and socially equitable ecosystems. With respect to the programmatic-normative dimension, the research, starting from the premises previously exposed, proposes a series of input to take in consideration in order to satisfy them. Specifically, they refer to the activation of integrated bottom-up and co-creation approaches as processes capable of implementing a semantic and structural change in planner tools and plan policies. In particular, the research aims to investigate how:

- remediation action, structuring itself from the bottom inside virtual laboratories of participatory planning in which converge different competences, can be configured like a flywheel of innovation in the transformation of the public space, becoming an integral part of the planning of territory and urban planning;
- remediation intervention can foreshadow territorial scenarios of tactical change aimed at introducing greater flexibility in the planning provisions and practices, still rooted in short-sighted and institutional logic;
- remediation, as a powerful, dynamic and organic material of the urban planning project, can initiate a new concept of planning, as a device capable of projecting strategic, ecological and innovative visions for a new urban condition in which communities can rediscover a sense of belonging.

Research therefore aims to highlight the potential dual value of remediation processes which, on the one hand, are drivers of proactive changes in practice and planning tools, and on the other hand as unpublished vectors of regeneration open to the landscape scale. The theoretical and analytical dimension aimed at the definition of the criticalities that currently characterise the reorganisation interventions together with the definition of tactical-operating strategies that allow a positive overturning, intersect with the spatial transposition of their effects.

In this regard, the research provides concrete examples of successful transitions in a European context, from conditions of marginalisation and ecological compromise to the creation of parts of cities with high public-environmental value. Using an overview of European cases, in the form of concise and agile cards, as tangible examples of the potential inherent in integrated remediation interventions, the research focuses on the Dutch and Italian context. Starting from a comparison with the regulatory framework of the two contexts, highlighting evolutionary and involutive conditions with respect to the wider European context, the research selects the Dutch case study as an effective example of existing best practice in which the outlined research objectives are effectively reflected.

On the basis of the Dutch model, the research focuses on the implementation of integrated and shared interventions of environmental rehabilitation and territorial regeneration on an Italian case selected as a demonstrator and developed within a wider European research project, financed under the Horizon 2020 framework. Both cases intercepted are application examples of how a remediation intervention, designed with a view to collectivity and sharing, and especially in a framework of sustainability, may have multiple spatial fallout. On the one hand, it allows us to address the Wasted Landscape towards a new life cycle, while on the other hand it helps to trigger new economies on the territory, a deeper sense of community belonging to the investigated places as well as being a device aimed at streamlining extremely rigid regulatory procedures and impositions for an innovative dimension of urban planning.

APPROACH AND STRUCTURE OF THE THESIS

Interdisciplinary and innovation.
The Living Lab methodology in industrial doctoral logic

Interdisciplinary knowledge strengthens connections between disciplines and in that process it weakens the division of labour in disciplines, exposes gaps, stimulates cross fertilisation and creates new field of focus for knowledge inquiry

(Klein, J.T. A Conceptual Vocabulary of Interdisciplinary Science, 2000:18)

The research is the result of a work financed within the "National Operational Programme Research and Innovation 2014-2020 – European Social Fund, Innovative Doctorates with industrial characterisation" and partly developed in the larger European research project Horizon 2020 entitled REPAiR (Grant Agremeent number 6889920). Compared to the traditional doctoral approach, the research has made use of interaction and integration of truly academic approaches with those more technical and application acquired during the enterprise experience. The research, lasting three years, and as summerized in the timeline proposed below (Fig. 1), was conducted mainly at the DiARC_Dipartimento di Architettura of Naples with periods of a little more than six months held at the TU Delft University of Technology and the enterprise ERM_ Environmental Resource Management[1] in Milan , which are particularly active in the field of sustainability related to remediation interventions. The holistic and interdisciplinary approach has characterized the entire doctoral path, from the structuring of the research activity to the development and practical application of the themes addressed. As mentioned above, research has been carried out partly within the ongoing European REPAiR project, of which the TU Delft is the leading partner. Within this project the doctoral research, starting from the study of the dynamics that generated the Wasted Landscape, their characteristics and the problems related to their regeneration, has focused on the interception of eco-innovative and nature-based solutions aimed at their decontamination and reclamation. The enterprise training, together with a collaboration with the Faculty of Agriculture of Naples, was decisive both in the preliminary phase of elaboration of the solution, thanks to the acquired technical knowledge, and both in the final phase to test its effectiveness and applicability to the territory of Campania Region, selected as a demonstration case. Against this background, the research activity has been structured using the Living Lab methodology, in which interdisciplinary experts, in this case from DiARC, TU Delft and ERM, have collaborated in a co-creation and co-evaluation context to develop and test place-specific solutions in sharing with stakeholders and communities of the local context investigated. The Living Labs, activated on the territory of Campania Region within the framework of the REPAiR project, are in fact considered as open ecosystems of innovation focused on the user, integrating research and innovation processes in a collaborative partnership (Public-Private-People). The methodological approach has two objectives: on the one hand, it has allowed all stakeholders to design solutions assessing their performance in terms of user needs taking into account all elements of the product's life cycle, in this case the Wasted Landscape, from design to recycling; on the other hand, it has constituted an experiential and exploratory environment in which users, enterprises and universities converge in a creative social space to design and experiment innovative actions in real life contexts. The interactive process, deriving from this methodology, is based on a very strong collaborative dimension that is expressed in the field of various competences and specificities attributable to the stakeholders involved in the process. The main innovation found in Living Labs is mainly related to the process, which uses a win-win logic typical of the Circular Economy and which allows the identification of strategic interventions aimed at meeting the needs of local communities. The co-creation process is therefore an integral part of the interaction between DiARC, TU Delft, ERM and local communities of the case study investigated. It constitutes one of the steps of the methodology proper to the Living Lab that the thesis path aims to implement in the selected case study in Campania Region and articulated in know/explore, co-designing/co-evaluating, testing phases.

Research design: an iterative process

The methodological approach of research has been articulated in several phases that, having borrowed an iterative process, have then intercepted in the wider framework of the Living Lab a practical confluence further justifying the iterative nature of the research as a constantly evolving process for the definition of adaptive solutions regarding emerging problems (Fig. 2). The preliminary phase of this design oriented methodology focused on the definition of a theoretical framework aimed at formulating the research problem, according to two preminent steps, the system understanding and the system mapping. The first includes the review of literature on in-depth topics, data collection related to the European context with particular focus on Dutch and Italian contexts. The revision of literature has been fundamental to the understanding of the main causes that have contributed to the proliferation of latent spaces in contemporary cities, of the dynamics that have caused their contamination and of the approaches that are currently most used for their remediation, also emphasizing the regulatory aspects that regulate them. The subsequent system mapping was useful to systematise the collected information, delineate the boundaries of the problem highlighting the malleable parts on intervening in the application phase with respect to the sample area of intervention identified in the Italian context, helping to bridge the gap between the theoretical and practical dimensions. The theoretical framework was therefore functional to the formulation of the general hypotheses which, subsequently, led to the collection of European examples, the deepening of a case study in the Dutch context as good practice on the basis of which to structure the Italian demonstration case, in an attempt to provide tangible answers to the questions raised. The theoretical framework is closely related to the process of identifying the questions with respect to which the research aims to provide answers defining policy and operational guidelines to guide the interventions of decontamination of Wasted Landscape towards sustainable, circular and innovative perspectives. Specifically, the methodology adopted is divided into four parts, each in depth and corresponding to the chapters that structure the dissertation.
Specifically:

- **Managing the complexity. The role of remediation within urban regenerative processes** offers a methodological support, based on literature reviewed, to define

RECYCLING WASTED LANDSCAPE

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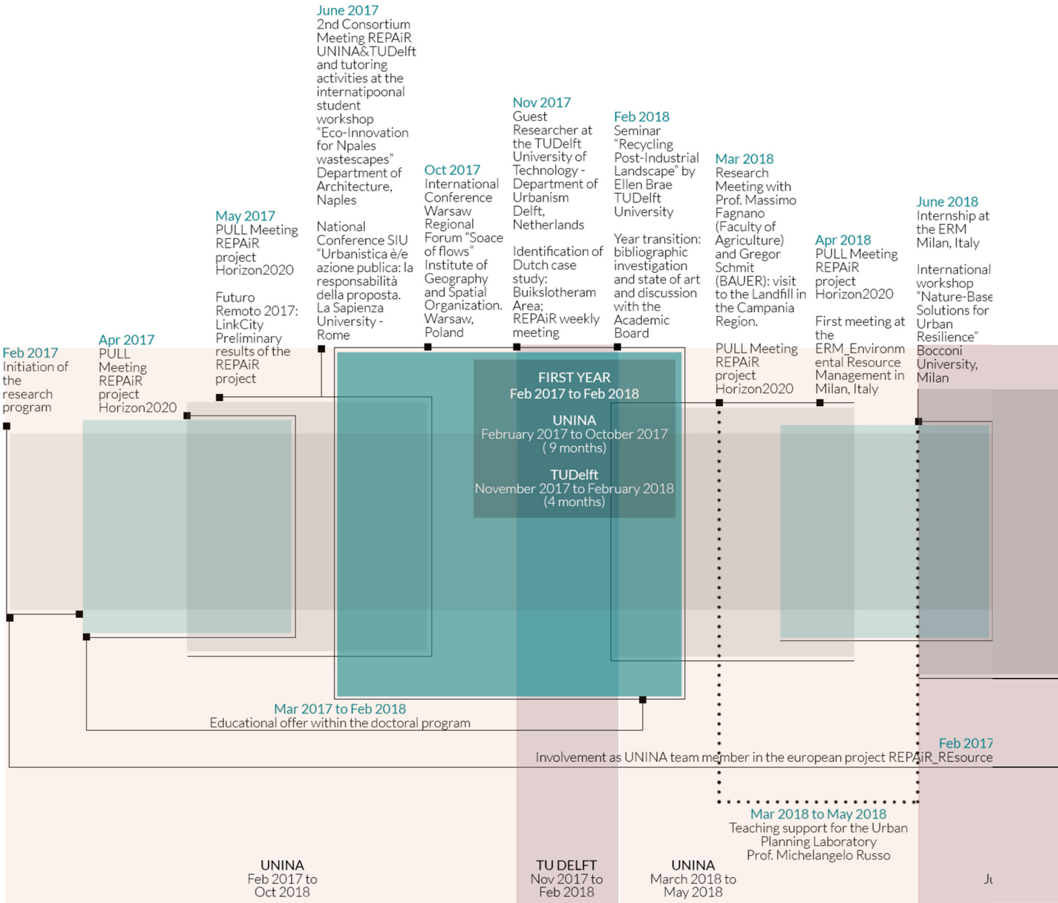
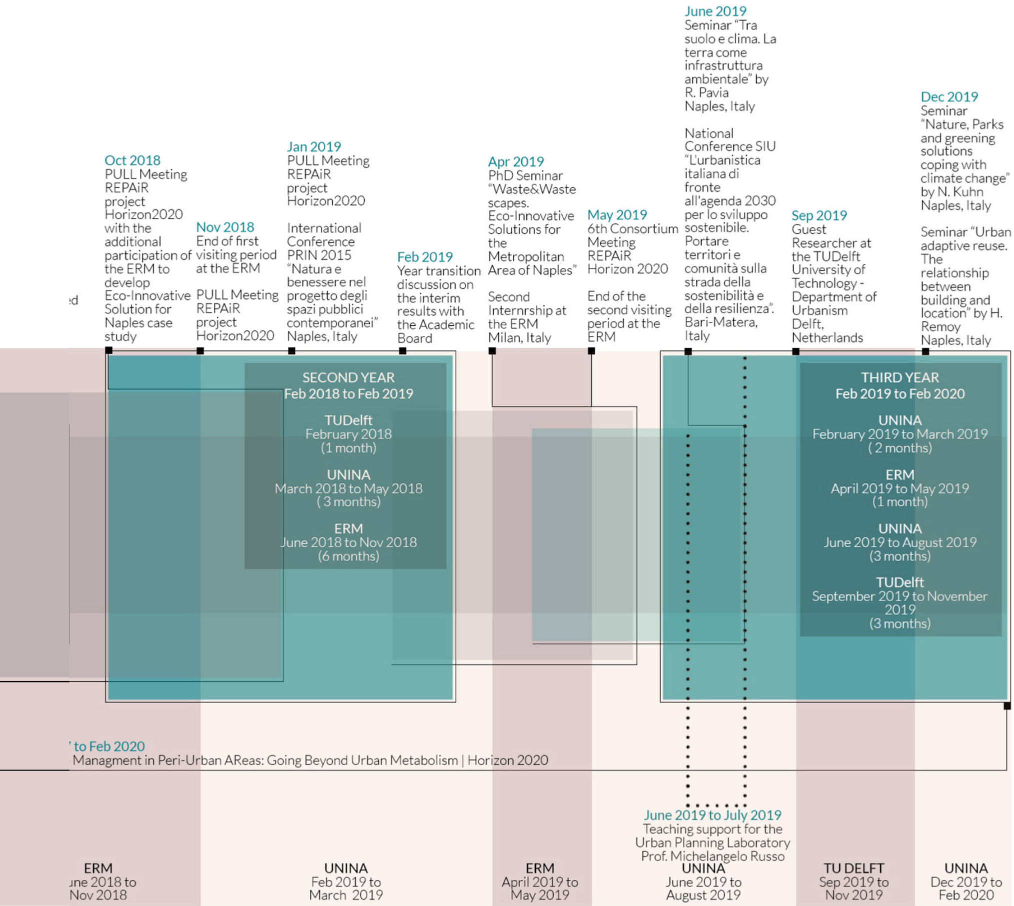
RESEARCH TIMELINE

Fig. 1

The timeline with the main activities carried out during the research. Graphic made by the author




June 2019
Seminar "Tra suolo e clima. La terra come infrastruttura ambientale" by R. Pavia
Naples, Italy
National Conference SIU "L'urbanistica italiana di fronte all'agenda 2030 per lo sviluppo sostenibile. Portare territori e comunità sulla strada della sostenibilità e della resilienza".
Bari-Matera, Italy
Dec 2019
Seminar "Nature, Parks and greening solutions coping with climate change" by N. Kuhn
Naples, Italy
Seminar "Urban adaptive reuse. The relationship between building and location" by H. Remoy
Naples, Italy
Oct 2018
PULL Meeting REPAiR project Horizon2020 with the additional participation of the ERM to develop Eco-Innovative Solution for Naples case study
Nov 2018
End of first visiting period at the ERM
PULL Meeting REPAiR project Horizon2020
Jan 2019
PULL Meeting REPAiR project Horizon2020
International Conference PRIN 2015 "Natura e benessere nel progetto degli spazi pubblici contemporanei"
Naples, Italy
Feb 2019
Year transition discussion on the interim results with the Academic Board
Apr 2019
PhD Seminar "Waste&Waste scapes. Eco-Innovative Solutions for the Metropolitan Area of Naples"
Second Internrship at the ERM
Milan, Italy
May 2019
6th Consortium Meeting REPAiR Horizon 2020
End of the second visiting period at the ERM
Sep 2019
Guest Researcher at the TUDelft University of Technology - Department of Urbanism
Delft, Netherlands
SECOND YEAR
Feb 2018 to Feb 2019
TUDelft
February 2018
(1 month)
UNINA
March 2018 to May 2018
(3 months)
ERM
June 2018 to Nov 2018
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THIRD YEAR
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UNINA
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TUDelft
September 2019 to November 2019
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Managment in Peri-Urban AReas: Going Beyond Urban Metabolism | Horizon 2020
June 2019 to July 2019
Teaching support for the Urban Planning Laboratory
Prof. Michelangelo Russo
ERM
une 2018 to Nov 2018
UNINA
Feb 2019 to March 2019
ERM
April 2019 to May 2019
UNINA
June 2019 to August 2019
TU DELFT
Sep 2019 to Nov 2019
UNINA
Dec 2019 to Feb 2020

the background of the problem through the description of causes and characteristics structuring the state of crisis in which contemporary metropolises find themselves; through the description of the flows crossing the conurbations and their unsustainable linear metabolisms of which the Wasted Landscape are spatial outcomes; through the understanding of the effects that an approach of environmental remediation can produce on the territories;

• **A walk through regulatory and planner policies. Current and possible future relations between reclamation and spatial planning tools** provides a comparative analysis of the European policies governing remediation measures with a particular focus on the Dutch and Italian context, highlighting strengths and weaknesses and outlining possible guidelines for more flexible regulatory frameworks;

• **On the remediation of Wasted Landscape. Useful insights for the identification of the problem** constitutes a more technical section through a data collection on the problem of contamination on a European, Dutch and Italian scale; through definitions useful for understanding and subsequent resolution of the problem; through an overview of technologies defined according to the type of contamination, from the most impactful to the most sustainable; through a set of indicators to assess their sustainability with regard to the environmental, economic and social dimension, and with respect to every phase of the remediation process;

• **New materials of the urban project. Remediation as a device of shared planning strategies** corresponds to the application, fieldwork and design phase, in which all the issues addressed meet finding practical feedback by activating Living Lab on the Campania territory in which eco-innovative and nature-based have been intercepted in sharing with local stakeholders;

• **A conclusive note** in the form of strategies to increase the resilience of contexts, promote sustainable development, to activate new economies and to strengthen the cohesion between the citizens and their sense of belonging to the place satisfying also requirements of reconfiguration landscape increasing the attractiveness of the contexts.

Structure of the thesis

The above premises lead to the formulation of the main research question useful to guide the study and to allow a more agile understanding of the proposed issues. In an attempt to achieve this objective, the research aims to investigate and provide comprehensive answers to the main research question:

In a sustainable and circular perspective, according to which approaches could the reclamation take the form of an integrated, operational and programmatic instrument of urban planning within the regeneration of Wasted Landscapes?

From the main research question arises the need to formulate a series of sub-questions in order to better investigate further and peculiar aspects directly related to its resolution. The research aims to explore issues related to latent spaces, their characteristics and potential opportunities for transformation and regeneration through sustainable and innovative remediation approaches, to restore their pivotal role and public value in urban contexts. This dissertation aims to extrapolate the remediation intervention from its sector context in order to place it in an integrated and circular perspective, analysing the modalities. The result is a consolidation operation that is less environmentally, economically and socially impactful, using the development of eco-innovative and nature-based solutions aimed at promoting a profitable reuse of marginal space in the long term. To achieve this objective, the research path is divided into four parts, corresponding to the same number of chapters that define its structure, each developed from questions on specific topics characterising the environmental restoration processes. The thesis consists of a total of five parts: introduction, four main chapters, conclusions.

The **INTRODUCTION** outlines the framework of intervention, critical issues concerning neglected metropolitan areas, the dynamics that have produced the contamination of the environmental matrices and the sterile and precise approaches so far adopted for their decontamination and regeneration, introducing the need for a change of perspective with respect to them. The introductory section also includes basic research demand and the resulting sub-questions in addition to the adopted research approach.

The **FIRST CHAPTER** is entitled *Managing the complexity. The role of remediation within urban regenerative processes*. It includes the theoretical framework in which the causes that have determined the state of ecological and socio-economic crisis of metropolitan contexts are investigated, of which the Wasted Landscape constitutes the spatial transposition. The chapter investigates the condition of fragility and contamination that affects these territories underlining the dynamics that have generated them and their lack of resilience to the changes taking place. Issues related to their metabolisms and inevitably to their remediation are analysed in relation to their poor adaptivity. The sub-questions which the chapter proposes to answer are:

- *What reversal is needed to counteract the serious effects of anthropisation on environmental balances?*
- *What operational strategies can be implemented with a view to land-use and landscape planning?*

In particular, the chapter focuses on the ineffectiveness of traditional approaches in favour of holistic, multi-scalar perspectives for the definition of sustainable and circular operational strategies, providing input for further analysis in this regard. The basis for the study of literature on the subject is then laid, to effect a change of paradigm in which the reclamation can be considered a privileged lens through which to target the territorial dynamics and the potentialities of the urban contexts, currently concealed from a state of latency.

The **SECOND CHAPTER** is entitled A *walk through regulatory and planner policies. Current and possible future relations between reclamation and spatial planning tools*. Through a comparison of the reference legal frameworks in force in the European context, and focusing in particular on the Dutch and Italian ones, the chapter investigates the criticalities and deficiencies, found mainly in Italy, which hinder the integration of remediation measures into the urban project and the plan provisions. The issues addressed in this chapter arise from the following sub-questions:

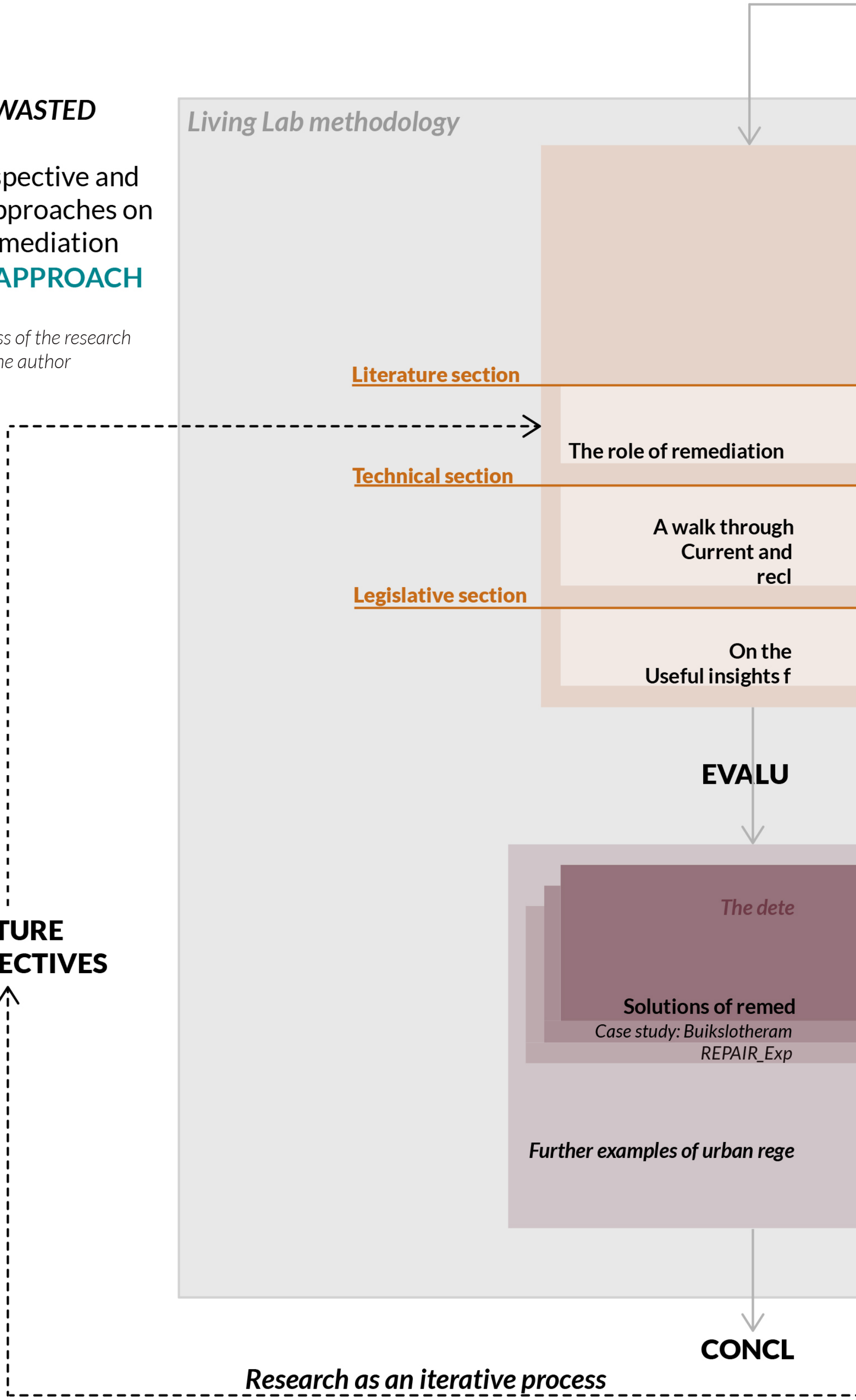
- *Which directions should be taken for a new remediation concept?*
- *What are the criteria for its integration into the planning policies?*

The chapter, starting from the existing gap in the regulatory framework, introduces the

RECYCLING WASTED LANDSCAPE
Circular perspective and innovative approaches on landscape remediation

RESEARCH APPROACH

Fig. 2
The iterative process of the research
Graphic made by the author




THEORY
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neration and sustainable reclamation
USION
DiARC
Dipartimento di Architettura
University of Naples "Federico II" Department of Architecture Naples, Italy
TUDelft
Delft University of Technology
TUDelft University of Technologyand Built Environment Department of Urbanism Delft, Netherlands
ERM
Environmental Resource Management Milan, Italy
Dipartimento di AGRARIA
University of Naples "Federico II" Department of Agricultural Sciences Naples, Italy
RE PAiR

need to revise planning tools and procedures, which is essential to eradicate the sectoral logic of restructuring interventions. The chapter explores the ways in which to initiate a renewed concept of reclamation by providing the necessary guidelines to promote a more flexible and adaptive dimension of city planning and design and whose guidelines are based on an iterative logic in line with the changing character of metropolitan contexts.

The **THIRD CHAPTER** is entitled *On the remediation of Wasted Landscape. Useful insights for the identification of the problem*. It provides a more technical framework in which, by defining the scale of the problem compared to the percentage of contaminated sites existing in European, Dutch and Italian contexts, an overview of the remediation technologies to be selected compared to the contamination present in the environmental matrix of the soil is reported. The analysis of technologies, from the most impactful to the most sustainable, is functional to promote a transition from sectoral and impacting approaches to more sustainable interventions to deploy ecological and social benefit.
The sub-questions that the chapter investigates are:
- *What are the mandatory issues that lead to a change of course about the traditional remediation approaches in favour of others that are more sustainable?*
- *On what indicators can their sustainability be assessed?*
- *Which of these approaches are also particularly suitable to meet the needs of landscape reconfiguration of contexts in crisis?*

In addition to providing useful definitions and addressing technical aspects, it also identifies a series of indicators to use in order to ascertain the sustainability both with respect to the selected technologies and with respect to each phase that characterises the remediation process.

The **FOURTH CHAPTER** is entitled *New materials of the urban project. Remediation as a device of shared planning strategies*. All the premisses and the deepenings previously investigated, find in this chapter an applicative confluence and planning.
Answering the sub-question:
- *How can reclamation be a guiding criterion and strategic material for redefining the role of these areas within the metropolitan context?*

the importance of the reclamation as a preliminary and essential phase of the land project is highlighted. The chapter investigates the concepts of eco-innovation and nature-based solutions to be applied to remediation as the only ones capable of placing it in a perspective of sustainability and circularity. Further sub-questions are then introduced:
- *Which methodology is most appropriate for their identification?*
- *What are the reliable urban scenarios that could be envisage in relation to these approaches, also in terms of landscape reconfiguration?*

The chapter, analysing the phases and characteristics, proposes the Living Lab methodology as effective to develop solutions that are socially, economically and ecologically acceptable, enabling its continuous implementation and integration within wider territorial strategies.
To this end, the chapter investigates the regeneration of the Buiksloterham area in the Netherlands as an important European-wide example of regeneration and remediation of a contaminated environment through the proposed methodology, and the application

case selected in Campania Region and developed within the European research project REPAiR. Both cases, reporting the results of field trials in co-creation with stakeholders and local users, demonstrate that the methodology identified is easily applicable and repeatable in a variety of contexts to develop innovative strategies and, over time, they also lead to dampening the rigidity of existing planning tools in the territories. Finally, the chapter provides, in the form of agile and synthetic cards, other reference cases as evidence of how a Wasted Landscape can again be considered a vital and dynamic node within metropolitan contexts.

The **CONCLUSION**, by putting all the information collected and the potential applicable operational strategies identified into the system, shows how necessary it is, in order to counter the serious effects produced by the crisis situation in metropolitan contexts and increase their resilience, to subvert the traditional operational, planning and territorial governance strategies. Conceived and placed in bottom-up action contexts, the concepts of regeneration and reclamation can be seen as innovative paradigms of urban planning, in a sustainable perspective and careful of the impacts of interventions with respect to the ecological, social and economic components of places. The final part therefore demonstrates the need to base Wasted Landscape reclamation interventions on integrated and multiscale design approaches for the elaboration of proactive and strategic visions in an iterative and never assertive perspective, which therefore allows us to intercept responses to problems that may emerge from time to time.

SCIENTIFIC RELEVANCE OF THE RESEARCH

REPAiR|REsource Management in Peri-Urban AReas: Going Beyond Urban Metabolism

The research has been partially developed, in particular with regard to the demonstration case applied on a selected sample area in Campania Region, within the European project REPAiR_REsource Management in Peri-Urban AReas: Going Beyond Urban Metabolism. The experimentation, still in course, has received funding from the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement No 688920) and it involves six partner countries[2] with their own research institutions, public and private bodies and universities. The field of investigation of the experimentation is the peri-urban territory, extreme point of the forms of abandonment and place of interaction between urban, natural, and rural components with different spatial peculiarities. Starting from the pilot cases of Amsterdam and Naples, and subsequently extending the methodology to the four follow-up countries, the common criteria for the definition of the peri-urban territory and waste streams with a higher incidence in Campania territory have been developed, specifically Organic Waste (OW) and Construction and Demolition Waste (CDW). Their identification and rationalisation is applied to the development of territorial, eco-innovative, and transferable strategies and solutions regeneration of WL, addressing specific local challenges in a circular economy perspective (REPAiR, 2019). By overturning the traditional negative meaning that characterises the term waste, REPAiR research proposes a rethinking in terms of resource evaluating its implications, compared to the territorial metabolisms, and plotting operational trajectories to manage the change in innovation and circular economy perspective. The translation from a cradle to grave to a cradle to cradle logic (McDonough&Braungart, 2003) covers both the classic types of waste established by the European Directive (EU 2014/955)[3] and the spatial component, extending the term waste to the built and open landscape, defined as Wastescape (REPAiR, 2015). Based on the integration of materials and environmental engineering techniques with those related to urban planning, European research is attempting to transpose certain waste-management-related issues into space, guided by the principles of sustainability. For this purpose, the methodology proposed within the project is based on an integration of models and mapping methods, in terms of software and participatory process, whose output consists in the above mentioned eco-innovative solutions. The models and methods of the interactive framework are represented by: Peri-Urban Living Labs (pulls), Geodesign System Support Environment (GDSE) and Life Cycle Assessment (LCA). The PULLs are the work sessions of collective seminars, in which co-planning is carried out through the steps guided by the GDSE platform (Arciniegas et al., 2019). This decision support system makes use of innovative methodological support for the decision-making process of Geodesign (Steinitz, 2012) based on recursive integration and interaction between analysis of spatial components, development of design and regenerative solutions, and evaluation of their impact on the territory. Specifically, Geodesign indicates an "approach to the project of development of natural and anthropized environments informed by criteria of environmental compatibility and, more generally, to principles of sustainability" (Campagna, 2013:134). This methodological approach, starting from the identification of possible alternatives aimed at stemming the problems encountered in local contexts and in urban planning practices (Campagna & Di Cesare, 2016), helps to underline the positive feedback of an integrated recycling process for each actor actively involved in the decision-making process (Formato et al., 2017), in a win-win logic. Starting from the methodological framework of Geodesign for the regeneration of the peri-urban territories present in the six different European realities, the main objective of REPAiR research is the implementation of an open source platform, called Geodesign Decision Support Environment (GDSE). It is "a tool to develop and comparatively assess alternative strategies in the field of material and waste management" (REPAiR, 2016:6), with respect to critical issues emerging from the spatial diagnosis. This tool, with respect to emerging issues from the spatial diagnosis, supports the identification of eco-innovative, integrated, and adaptive strategies of territorial development, addressing specific local challenges in a circular economy perspective (REPAiR, 2019). The platform is still tested and implemented in the PULL in order to promote an improvement of the metabolisms of the surveyed peri-urban contexts. The dissertation will examine in particular the interactive methodology of the PULLs and issues related to spatial and perceptual mapping of WL identified in the sample area of study. Contrary to this, there will be no further consideration of issues related to GDSE and LCA support as tools for mapping and assessing the environmental impact of identified waste streams (OW – CDW). WL, although considered as waste from urban metabolic processes, does not represent a mappable flow, therefore, in the REPAiR project, it constitutes the link between landscape-related issues and the considered material waste streams. WL are in fact the starting point for transformative processes, addressing problems of decontamination of environmental matrices and creating new soils through recycling of inert materials (CDW) and subsequent naturalisation of the soil, by soil improver produced on site (OW). The dissertation will explore issues related to WL reclamation, mentioning only the eco-innovative solutions related to OW and CDW identified, the result of two other doctoral research that are being carried out in parallel, as the overall framework in which the implementation strategy is placed. Eco-innovative solutions, developed in the PULL according to a recursive process, have dual value not only in regenerative capacities strongly lowered on the needs of the local community but also in countering phenomena of marginalisation by including the weakest user groups in the participatory processes. Therefore, from the point of view of the above, the Living Lab methodology, based on a type of procedural design, adaptive and open, contributes to give new meaning to wastescape, also through temporary reuse practices. "Reconverted through eco-innovation, they are returned to the established communities as common goods and spaces of the city, finding the reason for their transformation and maintenance in the daily practices that will animate and protect them with continuity, passing them on in the time" (Format et al., 2017:991).

Fig. 3
Map of partner countries included in the REPAiR Consortium
Source: REPAiR, 2015
Graphic readapted by the author

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Notes

1 Environmental Resources Management (ERM) is a leading company of international importance in the sector of sustainable services for the environment, health, safety, and risk. ERM has more than 150 offices in 42 countries, with approximately 5,000 multidisciplinary specialists able to provide services globally, ensuring professionalism and quality. It works with international chemical companies to effectively address the wide range of strategic and operational challenges, maximising efficiency and mitigating environmental, operational and social risks. ERM operates based on some important guiding values, which represent the foundation of the company's culture and the engine for the continuous search for better environmental performance in contemporary territories, through effective and sustainable management of goods, activities and services. ERM works in coherence with the principles of the UN Global Compact, respecting and promoting them in the different policy areas.Further information are available at https://www.erm.com/.
2 The six European countries that constitute the Consortium REPAiR are the pilot cases Amsterdam and Naples, Ghent in Belgium, Haarlemmermeer in North Holland, Pécs in Hungary, Łódź in Poland and Hamburg in Germany which represent the follow-up of the project. For further information, please see www.h2020repair.eu.
3 New list of waste: Decision of the European Commission of 18 December 2014 n. 955. For further information please see https://eur-lex.europa.eu/legal-content/IT/TXT/?uri=CELEX%3A32014D0955

01

Managing the complexity

Rethinking remediation within urban regenerative processes

A brief introduction

The twentieth century could be considered as the “great acceleration” era (Girardet, 2015: 4). The rapid urbanisation and all the anthropic dynamics that arise from it have entailed repercussions, unfortunately no longer transient, both on the ecological systems but also socio-economic of the cities, as structuring features of a deep global crisis. The metropolitan contexts, projection in spatial terms of the society on the territory (Lefebvre, 2014), are linked in double thread to this condition of rapid and negative mutation that imposes new reflective logics regarding the completely wrong paradigms that have dominated the last thirty years (Lanzani, 2015). Paradigms that not only refer to an uncontrolled growth and expansion of urban space, with an inevitable aggravation of social inequalities, but also to an excessive use of resources on a planet that is limited. Overcoming the planetary limits means running into conditions of fragility, indeterminacy, instability of the minimum safety, and habitability requirements of the territories (Russo, 2019). These conditions denounce the unsustainability of lifestyles conducted so far contributing to underlining the lack of resilience of metropolitan contexts to the changes taking place. The result, on the spatial level, is a proliferation of more and more uncertain local contexts, of waste, in which the stratification of identity traces, historical and cultural conditions have been almost completely annihilated by conditions of abandonment, degradation, and contamination which have compromised their value. **What reversal is needed to counteract the serious effects of anthropisation on environmental balances? What operational strategies can be put in place with a view to planning land and landscape?** These are the spaces with which the contemporary urban project is faced today, which require a sign of reversal, that is the impellent power to be able to hinder the expansion to start again from what is already rooted in the territory, right in the interstices, where the greatest threats, the environmental ones, are hidden (Lerup, 2016). To increase the resilience of the territories, to improve their adaptive capacities, means to act on the metabolisms of the city, to intervene on the inefficiency of the linear system production-consumption –waste in favour of a circular regenerative system, more in line with the laws of natural ecosystems (Girardet, 2015). In this circular perspective waste, in its spatial meaning, is configured as malleable, modifiable space, open to new perspectives of experimentation. Within these porous contexts retrofit and above all reclamation of the existing system find their place in a wider project of territory aimed at re-establishing sense and future use in crisis contexts (Secchi, 1984). The transition from linear to circular metabolic models also implies a revision of the policies and materials of the urban planning project, from which punctual and sectoral dimensions are placed in a more sustainable, holistic, and multi-scale perspective. The above-mentioned approach leads to the elaboration of long-term strategies in a shared vision of city and landscape planning. The metabolic approach implies the consideration of a contaminated site as the result of an overall process of territory, compared to the three dimensions, environmental, social and economic, structuring sustainable regenerative processes. From a sectoral instrument, with a strong technical connotation

Latent spaces. Photos taken by the author, 2018

in an iterative and procedural perspective, reclamation can be a privileged lens through which to understand the dynamics that have crossed the territories and that have constituted the cause of their decline. The reflection and the work on ecologically compromised spaces has ambivalent spatial consequences. On the one hand, it involves targeted actions to be taken on the site in question to eradicate its contamination, and on the other hand it provides triggers for more comprehensive visions, to underline the importance of the remediation process as a device to reconstruct and weave spatial and functional relationships between the site and the surrounding urban plots. This reflects the urgent need to define action plans "with a subtler grain" (Secchi, 1984) which, detaching itself from the strictly institutional logic, reinterpret the underlying potential of latent spaces in an unconventional but innovative, creative and adaptive way, emphasising their social essence.

1.1 BEYOND LIMITS
Spatial transposition of a planetary crisis

"The human world is beyond its limit" (Genske, 2003). Exceeding the allowed value thresholds, beyond which the planet manifests physical and biological inability of tolerance towards the consequences of the anthropic action, shows signs of seemingly irreversible global compromise. In accordance with the reductionist-mechanistic approach, in which the concept of nature as a machine at the service of man was in force (Madau, 2014), modern society places the human dimension outside the environmental sphere, legitimising any anthropic action on nature and outlining the traits of what is called Anthropocene (Crutzen & Stoermer, 2000). Compared to the 19th century, in which the concept of "metabolic split" between man and nature was already introduced by Karl Marx (Foster, 2000), in the 20th century the impacts on the environment shifted from a local scale to a global one. This dimensional snapshot involved a greater perception of planetary limits and considerable attention to the ecological dimension by converging into investigative approaches of the present condition based on a paradigm of complexity (Giordano, 2006), or on holistic criteria. The use of more complex analytical optics from different disciplines is justified by the heterogeneous matrix of issues that led to the environmental emergency. The state of crisis that had already been perfectly delineated in the past, as testified also from the report of the M.I.T of 1972[1] and successively from that Brundtland, today takes on a greater extent and magnitude because the effects on the environmental component, but also economic and social ones, are more devastating. The main vectors of this state of crisis must first be found in the phenomena of globalisation, industrialisation and rapid urban expansion, characterised by an unlimited exploitation of resources, and then, after about a century of uncontrolled growth, in episodes of contraction with critical spatial transpositions. De-industrialisation, productive decentralisation, the interruption of urban growth and the occupation of land around large cities (Secchi, 2011) have produced not only inequalities and discrimination in the social structure but also a legacy of fragile territories, with a lack of functional and morphological coherence, empty spaces, and dearth of identity. This demonstrates the ambivalent and contradictory character of the city, its being suspended between "an evolutionary and involutional condition" (Fusco Girard, 2006: 47), from a place generating economy to producer of risk and degradation conditions to which the weakest sections of society are inevitably exposed. These are the consequences of a degenerative industrial production that entrusts the territory, and in particular to contemporary society, with the difficult challenge of bringing human action within the planetary limits. It is about acting within a fair, sustainable, safe and regenerative space of Kate Raworth's doughnut (Raworth, 2017), aimed at restoring ecosystem, economic and social balances through effective territorial policies to break the deadlock and regression conditions (Fig. 4).

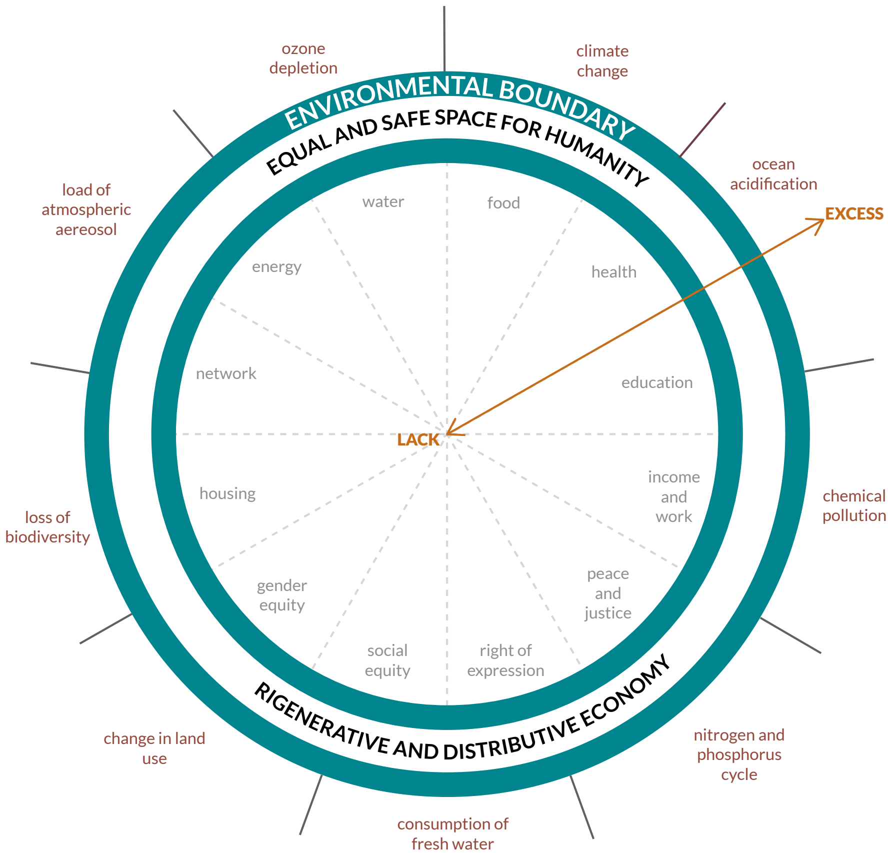

Fig. 4
The doughnut: a compass for the 21st century
Source: Kate Raworth, L'economia della ciambella, 2017
Graphic readapted by the author

The doughnut constitutes “a compass to orient humanity and that points towards a future that can satisfy the needs of every person while simultaneously safeguarding the living world on which it depends” (Author’s translation from Raworth, 2017: 66). In a sustainable and circular perspective, the doughnut defines two boundaries, one social and one environmental. Below the social boundary there are conditions of deprivation for humanity, beyond the ecological boundary there is degradation and pollution. In the middle, circumscribed between these two edges, there is an area in the shape of a doughnut, in which there is neither environmental risk nor even less social inequality. The image of the doughnut provides a clear strategic and operational line, directing action by emphasising how, at present, action is concentrated at the margin, on the limit that overlaps the threshold beyond which there is risk, degradation and deprivation. On the territorial scale, work on the boundary space (Zanini, 2010) it means operating in contexts rendered uncertain and unstable by the existence of a transitional condition in which different situations and dimensions of urban space coexist, “beyond the limits dissolves the habitable space, the balance that holds together parts of the city” (Russo, 2019). Exceeding the threshold involves in fact the inevitable comparison with complex dynamics that cross and characterise the waste contexts generated by the uncontrolled and linear urban metabolism. Spaces in which the state of crisis is perfectly matched, in which practices of unsuitable planning, or completely absent, have returned to the city empty fragments of landscape, devoid of perceptive and functional quality, considered little suitable for contemporaneity and therefore labeled as **Wasted Landscapes** (Amenta, 2015).

> *Hesitant spaces, without a function which is difficult to name. This set does not belong to either the territory of the shadow nor of the light […] Among these landscape fragments, no similarity of form. The only thing in common: everyone knows a territory of refuge for diversity. Everywhere, elsewhere, it is expelled.*
>
> *(Author’s translation from Gilles Clément, Source: Manifesto del Terzo Paesaggio 2004:16)*

Wasted Landscapes (WL) are the dominant condition within the contemporary city. Spaces of different dimensions are compromised, sometimes irreversibly, by the waste produced by urban but also agricultural and industrial metabolic processes. Places which are voluntarily excluded from the growth mechanisms of the cities and are marked by an almost total absence of planning provisions and policies, are in a state of suspension until it is given a new semantic value. From the scientific literature on the subject it emerges that it is impossible to attribute to these fragments a choral definition (Berger, 2006), some denominations in fact associated with the notion of WL include: *derelict land* (Oxenham, 1966), *urban desert* (Guttenberg, 1978), *wasted space* (Lynch, 1990a), *uninted landscapes* (Lynch, 1990a), *black sides* (Lynch, 1990b), *nameless space* (Boeri, Lanzani, and Marini 1993), *terrain vague* (De Solà Morales, 1995), *liminal space* (Endsjø, 2000), *brownfields* (BowmaN&Pagano, 2000), *free space* (Boffet & Rocca Serra, 2001), *tiers paysage* (Clément, 2004), *gapscape* (Hormigo & Morita, 2004), *industrial ruins* (Edensor 2005), *drosscape* (Berger, 2006), *nuove terre* (Marini, 2010), *edgeland* (Farley & Roberts, 2011), *unintentional landscape* (Gandy, 2016), *non luoghi* (Augè, 2018) and many more. Beyond their possible denotation, the relative point of departure to the analysis of these places are the theories elaborated by Lars Lerup and, later, taken by Kevin Lynch and Alan Berger. Lerup's deductions, in reference to the effects of deindustrialisation and Post-Fordism in the american context, are based on the conception of urbanised space as a union of two elements, stims in reference to places and components or programs that deploy public utility, dross in relation to abandoned landscapes dislocated among the stims (Lerup, 1995). Imagining the physical space of the city as a holey plane in which the cavities, sometimes idiosyncratic other times totally imperceptible, represent abandoned industrial landscapes, Lerup explores the relationship between landscape and urbanisation. The ultimate goal of his theory is expressed in the conceptualisation of the city as a living organism in which the productive and evolutionary processes of society inevitably attest themselves as generators of refuse landscapes which, in a forward-looking vision, represent a sort of "involuntary land banking for a new potential" (Lerup, 2016: 71). Returning Lerup's theories, Kevin Lynch labels as waste anything that does not deploy usefulness for human purposes if not subjected to treatment, including, in spatial terms, the disused sites and cataloguing them in four main categories: abandoned lands, derelict lands, abandoned infrastructures and other places of waste as landfills or incinerators. In line with the conceptualizations of Lerup, he recognizes these territories, relegated to the margins of the settlements and where there is no control whatsoever, as an inevitable consequence of the metropolitan growth and development but which, at the same time, require a commitment from society to be valued and exploited to the full (Lynch, 1990a). Finally, Alan Berger, assimilating the deductions of Lerup and Lynch and analyzed the landscape of the American territory, coined the term drosscape in reference to the latent spaces placed in the interstices of the urban fabric. In accordance with previous assumptions about the causes of these places, Berger carries out an interpretative study of an infocartographic and taxonomic nature, compared to their current conditions, to draw up a classification for their possible recovery. Isolating three main macro categories in which to place the different types of waste places, defines the landscape of obsolescence, referring to spaces planned to accommodate consumer waste such as landfills; landscape of contamination, considering the abandoned sites with compromised environmental matrices such as brownfield and, in the end, wasteful spaces with a transitory nature, oversised or characterised by slight under-utilisation such as infrastructures or parking lots (Berger, 2006). The outlined theories, in the contemporary debate on the subject, have been important input for further studies of the physical and contamination characteristics existing in these places and also impetus for the definition of possible action programs within urban policies, to counteract their marginalisation and promote their recovery and reuse. The discarding condition infact imposes a reflective and exploratory approach on the context, and more properly on the space it defines in the context, that which is enclosed between different situations, stressed and in the interlude of which fecundity is generated (Julien, 2014). Acting on the waste, and on the spatial dimension that it defines, means operating through unconventional and inventive visions aimed at their reinterpretation and attribution of important positions, triggering fruitful relations between urban space and society. The fragile essence that characterises the waste allows incremental transformations in the long term, in a never assertive but dynamic, flexible, evolutionary optical that


enclosed
SPACE
obsolete
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edgeland
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TIERS PAYSAGE
Fragile
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justifies the condition of incompleteness, of "intermediate natures" (Desvigne, 2012) overturning its biased and usual negative connotation. Acting on the most vulnerable and hybrid sectors of metropolitan contexts means resorting to an ecological perspective as the only one able to counteract their fragility (Pasqui, 2017) by operating a fair distribution of what unfolds good and public use and by proposing policies of awareness and behavioural review at all levels involved in the spatial planning process. In this perspective the WL are placed like spaces with emphasized biological potentialities, fragments of wild nature (Clement, 2004) (Fig. 5) in which actions to decontaminate and restore ecosystem services contribute significantly to the reduction of the ecological footprint of metropolitan contexts. The WL thus becomes a potential space, a device of urban planning aimed at restoring ecological and social balances in the transformative and regenerative dynamics of urban contexts to increase their resilience, in terms of the initiation of new metabolisms and at the same time to trace anthropic actions within given boundaries, planetary ones.

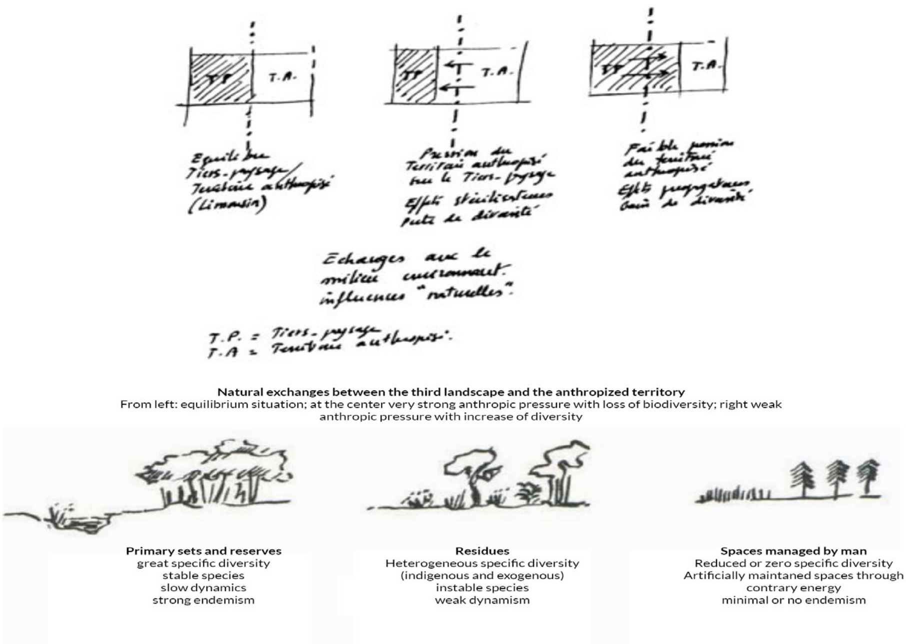

Fig. 5

Conceptualisation of the interaction between natural and anthropic environment.

Source: Gilles Clément, Manifesto del Terzo Paesaggio, 2004

Former Bourbon gunpowder factory, Scafati (Salerno)
Photo taken by the author, 2015

1.2 (IR)REVERSIBLE DYNAMICS
Protection and resilience: soil as a common resource

"The geography of fragile territories often returns a frightening risk map" (Pasqui, 2017:65 – Author's translation). The risk exists whenever non-renewable resources are eroded resulting in the alteration of their properties and thus the breakdown of ecosystem balances. The ecological question highlights the sometimes irreversible effects of this excessive corrosion with particular emphasis on soil resources (EU, 2006)[2]. As stated by the European Commission, soil "is essentially a non-renewable resource and a very dynamic system which performs many functions and delivers services vital to human activities and ecosystems survival" (EU, 2006)[3]. Considered for a long time as a mere platform to support anthropic activities on which to generate income, soil today imposes reflections and approaches that promote a reversal of course with respect to the usual mercantilistic optics in favour of concepts that raise it to an indispensable infrastructure for environmental balances (Pavia, 2019) and precious common good. The condition of non-renewability, of minimum or almost zero resilience to external pressures, resides in the long time it takes to reform itself if subjected to depletion: about 2.5 cm of soil settle in 500 years (Pileri, 2016). These are figures from which it is easy to deduce the imperative needed to safeguard it against the possible threats that undermine its integrity, first and foremost the consumption of land. Soil consumption means "the modification or loss of agricultural, natural, semi-natural or free land, as a result of artificial covering of the soil, by the construction, in and out of the ground, infrastructure and services or caused by actions, such as removal and waterproofing" (art.2, part b, 2018)[4]. In Europe, approximately 252 hectares of land are squandered daily (EU, 2012). To speak of land consumption means to refer to ecosystem alterations of the environmental matrix due both to the processes of artificialisation, as defined, but also widening the focus by incorporating contamination dynamics related to the production and consumption chain resulting in the release of unused residual areas, waste and pollutants on the territory, catalysts sometimes of irreversible implications. To contrast the consumption of soil, to put an end to the disintegration of its ecological functions enclosed in a thin layer of maximum 200 centimetres on which planetary balances depend, means to protect "the most important treasure of biodiversity as well as the biological engine of the Earth" (Pileri, 2016: 62), to stem or zero its waste and outline actions and measures for its correct use. The assessment in terms of limiting or stopping the consumption of land implies a reasoning on its design, on its planning and, in this sense, the Bernardo Secchi's reflections in 1984, on the soil project, appear more relevant than ever. Moving from the built space to the undeveloped space, reflection on the soil project should be directed towards the selection of operating modes that act on the existing urban fabric in a non-trivial or merely technical way, abdicating the clean slate approach. Soil, to be considered in its thickness, is therefore the turning point, the paradigm from which to start again in order to be able to redefine strategies of action inside of urban and environmental policies aimed at acting on the compromised contexts through various interpretative and operating approaches. To prevent further consumption of land means to promote interventions that, acting on the human scale and thus orienting the soil design towards a measure that is close to the

Land consumption
Source: https://www.pinterest.it - Last access October 2019

real needs of the inhabitants, operate on the palimpsest of metropolitan contexts in a regenerative key restoring the strategic value of the sites and increasing their resilience.

1.3 REMEDIATION AS A PRECONDITION
Innovative device of contemporary urban project

The interaction between the environment, urbanized space and society with the alteration of the stability of the ecological balance that follows, involves assessments to be carried out in terms of risk control processes resulting from this mutual influence. The prevention of impacts resulting from this interaction results, in spatial terms, in the implementation of strategies that act on the life cycles of contexts in transition. What said allows us to target the territory and its transformative potential through the lens of metabolism involving, in interventions of territorial regeneration, the use of the principles of the circular economy. Working within planetary limits, increasing the resilience of the urban system means promoting a proactive transition from an essentially linear to a circular metabolic system (Fig. 6). This shift in perspective means that WL can be identified, by producers of territorial differences, as potential contributors in terms of resource flows (Timmeren, 2014). In this regenerative and circular perspective the approaches on the heritage of latent spaces inevitably involve the delineation of strategies related to their reclamation as an undisputed precondition to successful future developments and device to reconstruct and weave spatial relationships between WL and surrounding urban plots. Currently, remediation approaches denounce a highly sectoral and technical matrix defined by automated regulatory provisions generating conventional and fragile as well as expensive solutions. The inefficiency of the sectoral approach is reflected both in the projection of intervention in the future and in its ultimate purpose. The sectorality is permeated in fact by a synchronic logic in which the remediation intervention is mainly aimed at the restoration of a natural primigenial condition. The complete indifference to the reading of background contextual as well as social needs, returns to the territory a site completely decontaminated but not related to a future use and therefore to a "soil design". The complexity of WL, on the contrary, completely rejects conventional solutions requiring transcalary strategies (Pavia, 2014) that adopt a diacronic logic, that is, aimed at the evolutionary organisation of the remediation intervention, both in terms of time and space. This condition is perfectly outlined by the concept of **adaptive remediation** (Robiglio, et al., 2014) (Fig. 7) in which the remediation intervention, detached from sectoral and punctual logic and placed in an integrated dimension, is a complex process in which to outline shared, sustainable and circular strategies of action aimed at deploying security and territorial value. Remediation of WL therefore has ambivalent spatial effects on the territorial project, of an operational and programmatic nature. From an operational point of view, the environmental rehabilitation, acting on latent spaces and reactivating their metabolism, helps to stem the consumption of land and the proliferation of territorial waste. From a programmatic point of view, its positioning in a more sustainable and circular perspective involves the reformulation of the urban instruments planners and the policies of plan. Reclamation therefore denounces a double valence, on the one hand it is configured as a change structuring the planning practice, on the other hand as unprecedented vector of regeneration open to the landscape scale. A privileged lens

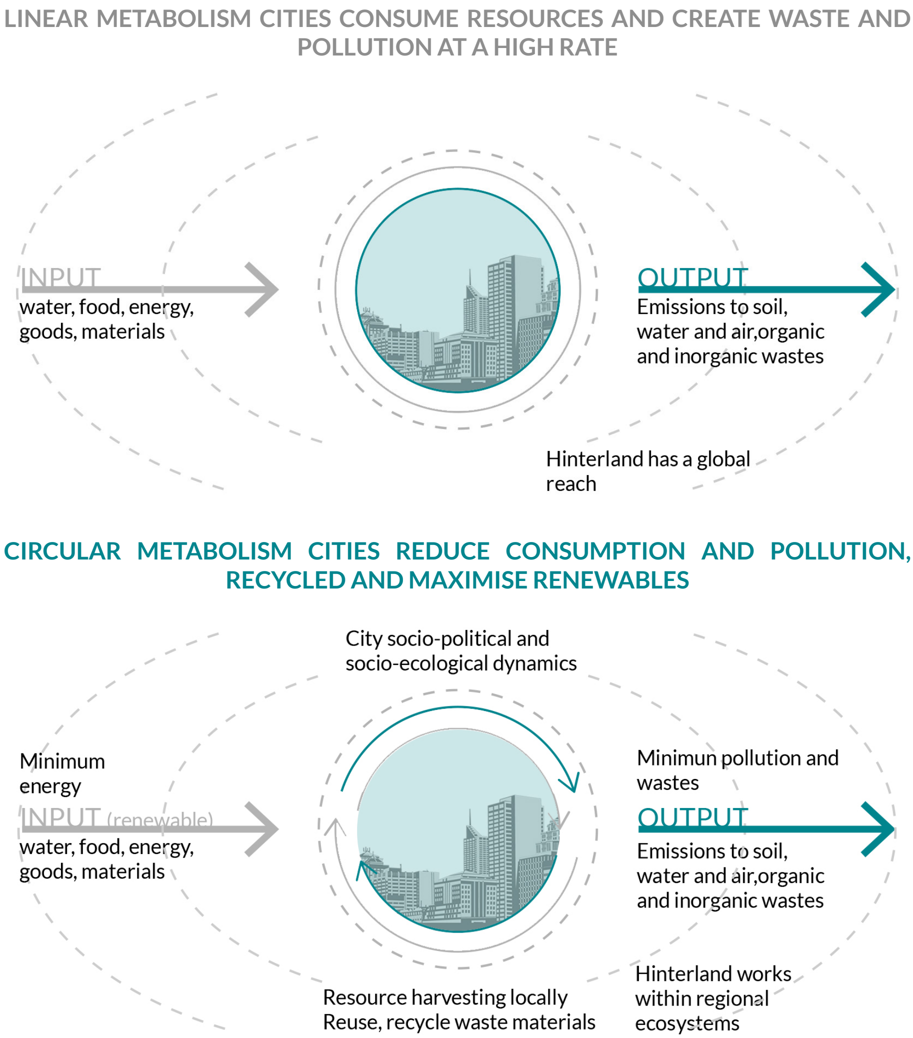

Fig. 5

The proactive transition from a linear to a circular and sustainable metabolism
Source: Girardet, H. 2014. Regenerative Cities.
Graphic made by the author

through which to intercept the components of contexts and to understand the catalytic territorial dynamics of contamination, reclamation becomes a means and a pretext for developing innovative solutions for the future reuse of the site. The interaction between technical and ecological components in fact outlines for the urban planning project an unprecedented dimension encouraging the triggering of more flexible operational and strategic logics (Hall, 2013) aimed at satisfying contingent questions. However, the intercepted remediation solutions are only effective and positive if "economically convenient, socially desirable as well as culturally stimulating" (Angrilli, 2014: 48).
This precondition implies the existence of the sustainable component in the reclamation project to be established through evaluation and deployment of the intervention

through temporal and functional scales in anticipation of future use. Operationally the above is realised, between a set of possible technologies, in the predilection of the ecological ones. In these kind of technical solutions, the synergic coexistence between the decontamination intervention and the circumstances of social re-appropriation of the urban space allows its regeneration through incremental actions deployed in the long term period. The reactivation of the existing natural capital takes place therefore through activation of temporary uses and processes of scaling up. This approach allows to manage the complexity of the WL regarding different scales and the progressive interaction between the environmental, cultural, economic and above all social dimensions (Gasparrini, 2014).

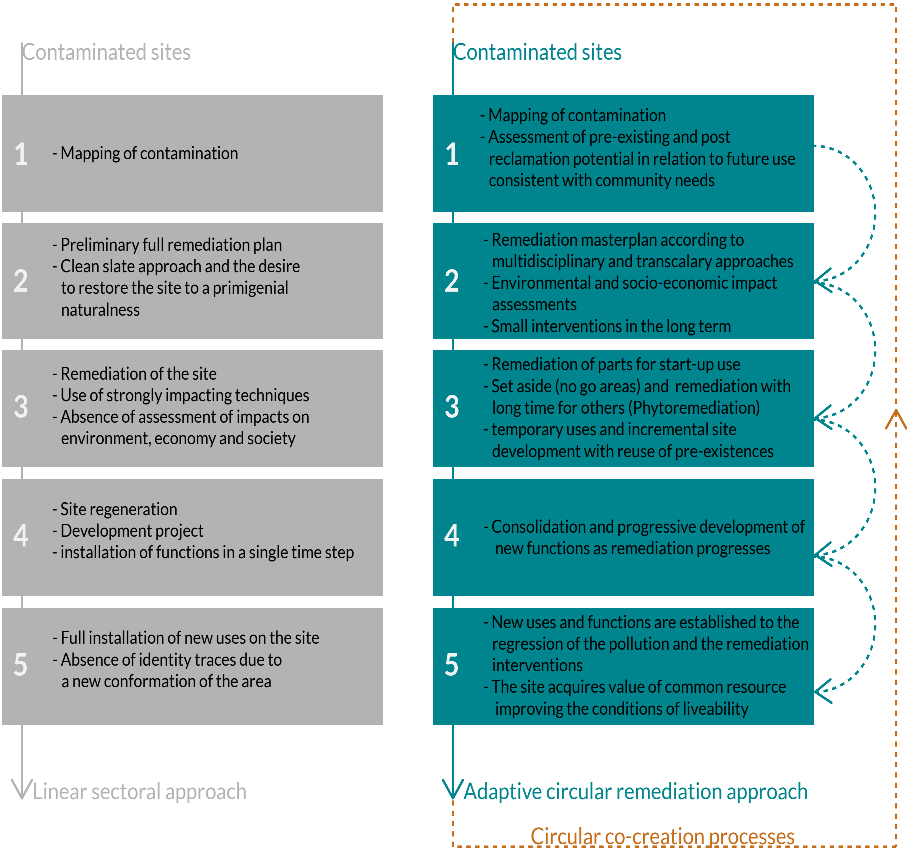

Fig. 7

Differences between a sectoral and an adaptive remediation approach
Source: Robiglio, M. 2015. Adaptive reuse. Bonifiche e rigenerazione urbana. Nuove strategie per un mercato in evoluzione
Readjustment of contents and graphic made by the author

In summary, remediation intervention placed in a wider landscape frame and as a precondition to the development of contexts in crisis, can be assimilated to "a territorial infrastructure" (Russo, 2006:108) able to prefigure scenarios of tactical evolution change and to restore the ecological balances of the places. Placed in a holistic perspective and considered as a fly-wheel of innovation in urban planning, remediation is configured also as a driver of triggering regenerative bottom up processes. Within them the reactivation of the latent heritage produces a translation of a way able to intercept sustainable and innovative solutions compatible with the territorial palimpsest. This reflects the urgent need to define action plans with a "finer grain" (Secchi, 1984) which, detaching itself from the strictly institutional logic, reinterpret the underlying potential of latent spaces in an unconventional way. In this sense, the elaboration of a remediation project should hinge on related operational plots but not subordinated to short-sighted forecasts contained in the town-planning plans. This approach allows for the pursuit of large-scale creative and adaptive objectives by encouraging the restoration of ecological processes and, at the same time, the formation of multifunctional landscapes aimed at promoting sustainable growth in the contexts in which they are located.

Conclusion

The city, as well as the landscape constitutes complex socio-ecological systems as well as spatial outcome of the interactions between anthropic and natural components distinguished, in the contemporary scenario, more and more from degraded conditions and instability. A labile state of equilibrium in which the complexity of the environmental and social circumstances, increasingly require action strategies based on cross-disciplinary approaches as the backbone of urban planning that can operate in terms of sustainability and resilience. In the recent debate around places considered marginal, in this context designated as Wasted Landscapes, the abandonment condition becomes a potential resource for regeneration and remediation of marginal contexts as effective catalysts for sustainable development through interception, at the local scale, of meaningful and creative solutions. In this sense, the delineation of long-term scenarios and visions through a territorial project that is iterative, flexible and susceptible to incremental implementations, becomes a fly-wheel for the definition of regenerative and self-sustaining spatial contexts. The regenerative actions aimed at the recovery of these places contribute to their reintegration within the urban metabolic mechanisms that from linear shift towards a more favourable and proactive condition of circularity. Within a metabolic, circular and ecological dimension, reclamation is configured as a potential new material of urban planning, an operative tool for mediation between technical, anthropic and natural aspects for the definition of an eco-polis, namely a city conceived as a sustainable, resilient and socially equitable ecosystem. This presupposes that the process of regeneration and territorial reclamation is structured from the bottom up, as a collective work, in order to be effective and to initiate a review of town planning policies and programs in which there is currently a little or no response. Emerging issues of the current planning model relate in fact to a marked asynchrony between the needs of local communities and what is sanctioned by the unresponsive and ineffective policies of plan. Within them remediation intervention still takes place focuses on a purely sectoral modus operandi and little adaptive to contextual peculiarities. Environmental and socio-spatial contingencies require therefore a review of the reclamation role and concept in the current planning tools. Environmental rehabilitation requires consideration of its place within the plan as a mean of outlining strategic, ecological and innovative visions, for a new urban condition in which communities can rediscover a sense of belonging.

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Notes

1 Massachussets Institute of Technology (M.I.T) in 1972 report, The limits to growth, wrote of the unsustainability of the linear economic model adopted by man, problems anticipated the previous year also by Barry Commoner in The closing cycle, text founding the political environmentalism. Subsequently, the Brundtland Report of 1987 introduced the concept of sustainable development as a path towards proper management of resources in relation to the three dimensions: environmental, economic and social. Sources http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf; http://netzwerk-n.org/wp-content/uploads/2017/04/0_Brundtland_Report-1987-Our_Common_Future.pdf

2 Soil erosion is one of the eight threats identified by the 2006 European Community Soil Thematic Strategy. Further information are available at the website https://eur-lex.europa.eu/legal-content/IT/ALL/?uri=CELEX%3A52006DC0231

3 Proposal for a Directive of the Parliament and of the Council- COM (2006) 232 definitive - establishing a framework for the protection of soil and amending Directive 2004/35/CE. Available at: http://eur-lex.europa.eu/legal-content/it/ALL/?uri=CELEX%3A52006PC0232

4 Senate of the Republic – Draft Law n. 164. Provisions for the cessation of land use, the reuse of built-up land and the protection of the landscape. Further information are available at the website: http://www.senato.it/service/PDF/PDFServer/BGT/01069004.pdf

02

A walk through regulatory and planner policies

Current and possible future relations
between reclamation and spatial planning tools

A brief introduction

“Cities are centres of innovation, humanity’s cultural playgrounds”(Girardet, 2015:4). Metropolitan contexts have always been fertile space laboratories in which to outline operational and adaptive strategies with respect to the sudden and even critical changes that can be seen in them. This natural propensity of cities is currently undermined by a condition of converging instability in a deeper state of crisis that refers to well-known ecological and socio-social issues but it is also a cultural dimension in which the revision of planning practice and its regulatory instruments becomes imperative. The current urban crisis, together with the development of intervention strategies for the regeneration and management of latent geographies, has therefore involved not only rethinking the deep-rooted and sectoral concept of reclamation but also a review of the traditional systems and instruments of government of the territory, have proven to be rigid and ineffective in the light of the environmental and socio-economic changes taking place. On the basis of an evolutionary and comparative analysis of the existing legislative frameworks in the European context, particularly in Italy and the Netherlands, the reflections below intend to place emphasis on the labile or completely absent relationship between the remediation interventions and the town-planning discipline, with particular emphasis on the degree of obsolescence of its instruments. **What directions should be taken for a renewed clean-up concept? What criteria should be followed for its integration into the planning policies?** The complexity of a regenerating intervention, and more specifically reclamation, that goes beyond the technical sphere to meet needs of different matrix, presupposes the assumption of perspectives that in territorial governance trace the resolving component (Robiglio et al., 2014). A remediation approach operating in a framework of sustainability inevitably activates processes in which different sectors and actors, public and private, converge for the definition of common objectives and visions aimed at the environmental, social, economic, and cultural improvement of the urban contexts. The collectivisation of the choices and the overcoming of the sectoral logic in the reclamation proceedings constitutes the turning point in order to smooth the paralysis of the town-planning action and to overturn the traditional postulates of a planning of rationalist matrix (Talia, 2016). In this perspective, the plan takes on a more organic dimension in which the linearity of interventions gives way to dynamic approaches in which solutions to problems are placed in an experimental and iterative loop that is well adapted to the changing character of cities, its actors and the conditions that from time to time could be revealed. Reclamation thus becomes a driver of innovation in the town planning discipline and in particular in the plan provisions that require greater flexibility and adaptability compared to contingencies for the development of strategies town planning to enable resources to be mobilised, new economies and tactics of partnership and participatory management (Gasparrini&Savino, 2016).

Tactical scaling-up processes
Map source: REPAiR- Naples case study_Focus and Sample Area_UNINA Team, 2018
Photo source: @Ph Alessandro Capozzoli, 2018
Graphic adapted by the author

2.1 EVOLUTIONARY PATHS OF THE LEGISLATION ON RECLAMATION

European, Italian and Dutch policies by comparison

2.1.1 Europe and the four political generations

In Europe, the evolution of legislation on soil protection, in terms of productivity and conservation, and by extension on contaminated sites, can be summarised, from the 80s to today, in four macro sections (Doberl&Muller, 2013). These four generations of environmental policies, accompanied by the parallel evolution of European research projects, have highlighted various problems related to soil resources and their contamination by imposing, towards the end, transitions from traditionally strongly impactful approaches to more sustainable strategies for action (Fig. 8).

The **first generation** of measures taken in the 1980s in the field of soil protection and reclamation had a dual purpose. The first objective of these legislative measures was to promote greater awareness and cooperation on the subject between Member States. In this sense, the first measures to achieve this aim were the *World Soil Charter* (FAO 1982), later updated to 2015, and the *World Soil Policy* (UNEP, 1982), the latter already based on a sustainable approach; in 1992 it led to the framing of Agenda 21. Among the main international instruments, the *Lugano Convention* (1988) played a priority role in terms of uniformity and completeness with regard to civil liability for environmental damage. This was followed by several conventions aimed at the conservation of biodiversity and the promotion of sustainable land use, as well as the establishment of specialised centres and forums for the study of the environmental matrix; these included the *European Topic Centre on Soils* (ETCS), of 1996, and the *European Soil Forum* (ESF), of 1999. The intention behind the training of these deepening and dissemination centres was mainly to increase knowledge on these topics while promoting, at the same time, a transition of the issue from techno-scientific and political-administrative cooperation based on closer cooperation between the different Member States. The second focus on which the initiatives developed in these years were related to the delineation of the first remediation approaches aimed at decontamination of soils compromised, considered as such merely because a single threshold value was exceeded in a table. The contamination, established by this method, entailed reflections, based on the principle of zero tolerance, on the first actions to be taken in terms of control and minimisation of the environmental risk aimed at restitution, in the urban context, of completely clean sites that can be reused according to a multifunctional logic (Pozzi et al., 2016).

The **second generation** of policies is that interclused over the 90's time frame based on tabular or risk based levels of soil quality. In particular, during these years two threshold values were developed, and that of contamination which established the degree of compromise precisely of the site, and of intervention by which the contamination threshold was exceeded required remediation (Pozzi et al., 2016). The direct consequences of the definition of these two values were the exponential

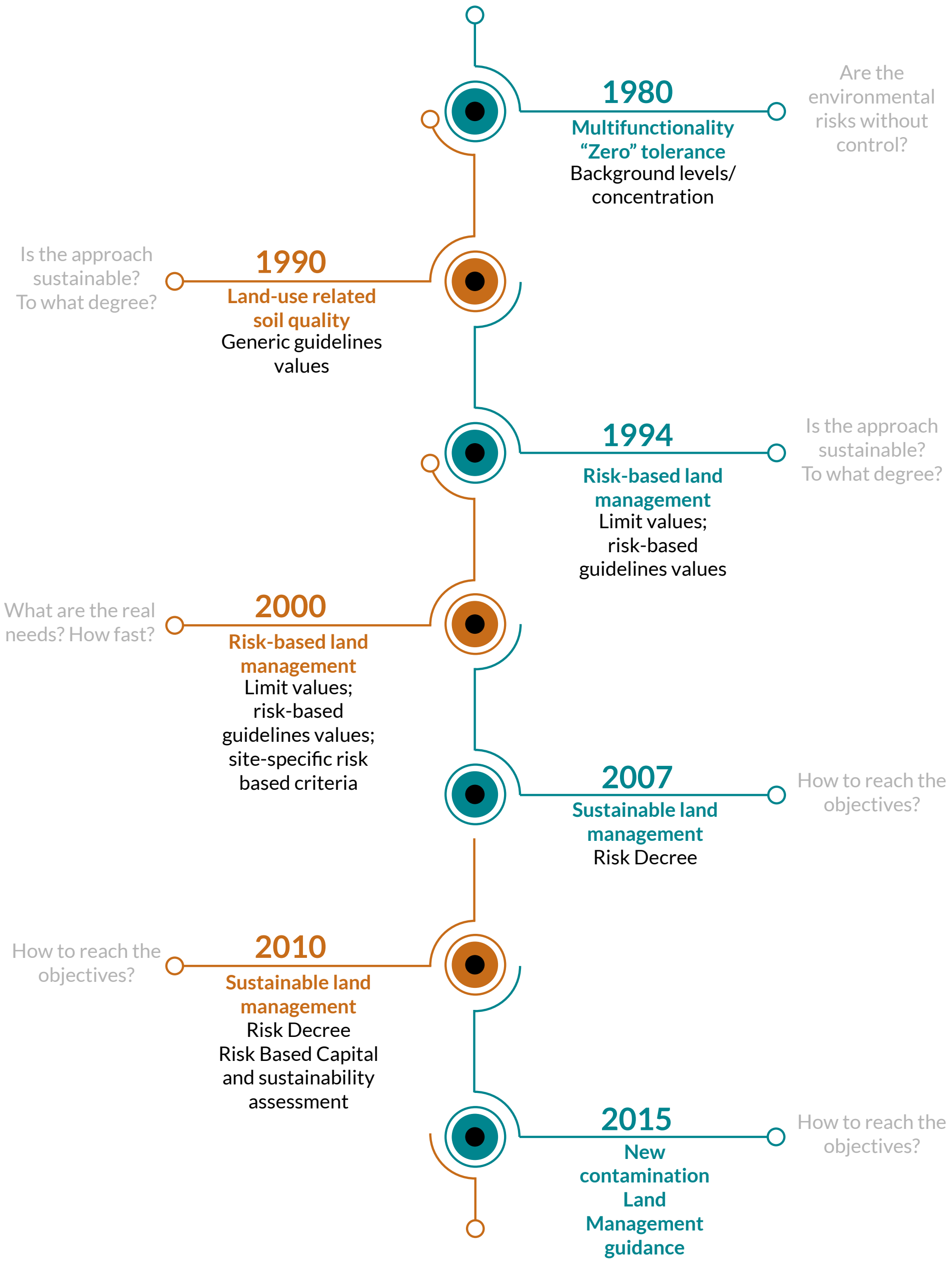

Fig. 8
Generation of soil remediation policies
Source: Döberl, G. and D. Müller. 2013. Elements for evolution of policy frameworks towards a fourth generation of legislation
Graphic readapted by the author

interception of contaminated sites on a European scale and the demand for large sums of money for their rehabilitation. The difficulties encountered in the management of the extension of the problem entailed a stalemate which was tried to be remedied by adopting functional reclamations, replacing the multifunctional ones of the 80's, the development of a specific use for the area in question to be achieved following specific site risk analysis. The first experiments on Risk Assessment, in relation to the impacts on the anthropic and environmental dimension, were conducted in 1996 within the community project *Concerted Action on Risk Assessment on Contaminated Sites* – CARACAS[1](Ferguson, 1999) culminated in the drafting of guidelines on the assessment and management of contamination risk (Fig. 9).

The **third generation**, from the late 90s to about 2010, has been characterised by considerations diametrically opposed to those until then carried out also in relation to the will to place the interventions in a framework of sustainability. In the presence of a contaminated site, the operating procedures were based on its future development, depending on the destination of the use, but in a long-term perspective with progressive reduction of contamination to be achieved through holistic approaches, lead to the dual consideration of the contaminated site both as a condition to remedy but also as an investment opportunity. Between 1998 and 2001, the *Contaminated Land Rehabilitation Network for Environmental Technologies* – CLARINET[2] (Kasamas, H. et al., 2011) which, through integration of environmental, economic, and social aspects, allowed not only the risk assessment but also its management through the Risk Base Land Management model. The project therefore had the task of testing, on the basis of a range of possible technical and design alternatives, the suitability of the intended land use identified, the validity of the actions proposed by the different persons involved in the remediation process and the feasibility of the same in the long term. In addition to CLARINET, other EU funded projects also developed in this time fragment and the following have been reported as those that have most influenced the management of contaminated sites and the European regulatory framework. From 2001 to 2004 the European project called *Concerted Action on Brownfield and Economic Regeneration Network* – CABERNET[2] was developed. This multidisciplinary network, identifying brownfields as a preferential field of application, provided an initial technical feedback of the Risk Base Land Management, identified by CLARINET, but underlining the limits to the development of the approach mainly due to the different forms of reception in the individual European contexts and the lack of specific technical expertise. The project identified a number of tools to guide intervention policies on contaminated sites by providing criteria for classifying historical contamination and placing interventions on them in more planning logic wide in which to add tension to the various parts of the planning process with the interests of the involved parts (Pozzi et al., 2016). The European project *Water Environment, Landscape Management at contaminated Megasites* - WELCOME (Rugner et al., 2004) was instead launched in 2002. Considering megasites as complex areas for extension, management and fruition distributed among different subjects as well as for constraining issues, the primary purpose of the European project was to provide an analytical tool for the integrated management of soil and water contamination on these sites, the Integrated Management System, starting from the previous Risk Base Land Management and implementing it. Dating back to 2003, the project *Network for Industrially Contaminated Land in Europe* – NICOLE[4] (Bardos et al., 2018; Heasman, I. et al., 2011). In addition to interventions related to the definition of the risk existing in a given site with the interception of innovative techniques of rehabilitation, the merit of the project was found on several fronts. First, the project was particularly influential on the definition of Risk-Based Land management remediation processes. Secondly, other merits were intercepted in the establishment of discussion tables which, besides to promote the collectivisation of information among the different stakeholders, draw attention to issues related to the sustainability of interventions, with important repercussions on what then constituted the fourth generation of policies on contaminated sites. *Sustainable management of soil and groundwater under the pressure of pollution and contamination* – SNOWMAN[5] (Bulck, 2013), was instead a European initiative of 2004, looking for tools to apply sustainability principles to remediation projects, such as *Life Cycle Assessment* (LCA) and the E*cological Risk Assessment* (ERA) to be used separately as calibrated on different spatial and temporal scales, thus assessing the most cost-effective impacts. *Sustainable Use of Former and Abandoned Landfills* – SUFALNET (SULFANET, 2012) was a European project developed from 2005 to 2008 to implement the Risk Based Land Management on former landfills and on the dynamics of restoration of new functions to be assessed according to the key principles of sustainability. Also in the same year the project *Human Health and ecological Risk Assessment for Contaminated lands in EU member States* – HERACLES was launched (Carlon, 2007) by the Joint Research Centre which has tried to establish homogeneity in the approaches to ecological and health risk analysis of contaminated sites.

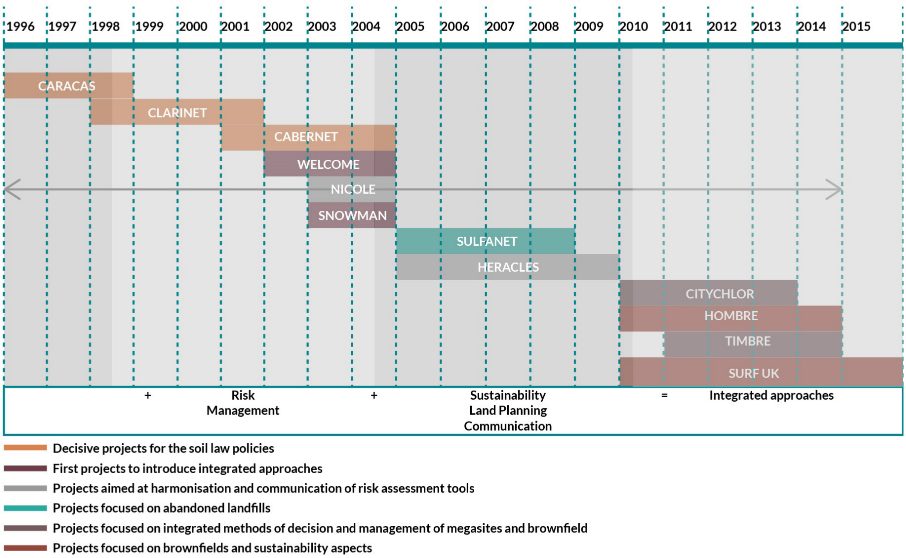

Fig. 9

Classification of European projects by topic and area of intervention
Source: Pozzi, C., Quadri, G., & Bizzotto, E. 2016). La sostenibilità quale criterio guida per il risanamento della contaminazione storica: Principi Comunitari.
Graphic readapted by the author

The **fourth and last generation** was finally the one from 2010 to the present day. This phase is the one in which the sustainable component is more strongly present also with respect to a greater and widespread awareness of the risks produced by the contamination and the anthropic pressure on the ecosystems. In this sense, the use of more sustainable interventions requires integrated approaches to maximise net benefit in relation to the anthropic, ecological and economic dimensions; optimisation of resource use and provision of more flexible decision-support tools than traditional ones, and which involve the involvement of different stakeholders during each phase of the remediation process. Compared to the previous regulatory generations, the latter is also characterised by the desire to report the remediation action, not only to the site under consideration, but also by assessing the suitability of the future destination of use with respect to spatial relations with the surrounding context. The selection of the most appropriate intervention method and technology is now based on cost/benefit and site specific risk analysis carried out on an incremental interventions and not on the basis of a single tabular reference threshold value, as previously, but with respect to multiple threshold values based on different levels of risk and therefore on attention thresholds (Pozzi et al., 2016) on the basis of which to assess the need for remediation or further analysis. Four European projects belong to this regulatory phase, the first of which is the *Integrated approach for urban development* – CITYCHLOR[6] (CITYCHLOR, 2012). The merit of the project was the integration of the sustainable component into the dynamics of spatial planning by promoting integrated approaches in which to involve all stakeholders and needs-oriented closely linked to the site, in relation to its spatial relations with the surrounding context. The project also placed emphasis on the problem of communication between components from different sectors, environmental, social and economic, making the language accessible to all parties involved. The second European project is the *Holistic Management of Brownfield Regeneration* – HOMBRE[7] (Ashmore, 2014) that, together with the project *Tailored Improvement of Brownfield Regeneration in Europe* – TIMBRE (Bartke et al., 2012; Klusacek et al., 2013) but both have been promoters of sustainable shared solutions for the recovery of brownfield through matrix of revival opportunities. TIMBER, instead, through the Site Assessment Tool and the Priorisation Tool embodies a system of support to the decisions. The first instrument shall holistically assess, in a remediation process, recovery costs, economic benefits, and the sustainability of the scenarios in a long-term perspective; the second is based on prioritisation of remediation actions to be carried out on compromised sites based on decisions taken on the basis of multi-criteria analysis and evaluation of areas by means of indicators. The latest project is *Sustainable Urban Brownfield Regeneration: Integrated Management* - SUBR:IM[8] which developed a methodology to assess the impacts of remediation technologies in decision making. Through multi-criteria analysis and life cycle impact analysis of an area, the methodology allows us to assess future benefits, especially environmental impacts and an appropriate time scale of interventions. With a view to the concrete and real application of the principles of sustainability to the remediation processes of contaminated sites, however, an important contribution was certainly made by the *Sustainable Remediation Forum* in the USA and UK– SURF USA and SURF UK (Ellis & Hadley, 2009), supported by the European project *Contaminated Land applications in Real environments* - CL:AIRE (CLAIRE, 2008). The contribution of these projects has resulted not only in the drafting of indicators useful for assessing the suitability and sustainability of remediation measures (Bardos et al., 2011) but above all on the definition of two phases necessary for the implementation of decisions to be undertaken with respect to sustainability. The first phase concerns planning at the regional, provincial, or local level; while the second phase is purely project-based and it is aimed at the selection of appropriate technologies to be evaluated, with respect to the environmental and socio-economic dimension, in order to direct intervention strategies both from a spatial and temporal point of view.

European research projects have underlined the existence of a strong synergy between the political and scientific dimensions aimed at providing operational tools increasingly oriented towards the design of sustainable strategies within rehabilitation processes. In contrast, with regard to the previous four generations of policies on contaminated soils, in respect of which there has been a parallel development of the projects referred to above, two significant aspects have been intercepted within European environmental legislation. The first one concerns the approach used in the presence of contamination of the environmental matrix. The transition from the tabular approach of the 80's to the functional approach of the 90s has highlighted the need to develop other methods of risk assessment and management analysis that would lead to a more sustainable dimension of the interventions, typical of the fourth generation. The second aspect, on the other hand, underlines the lack of uniformity in the evolution of the regulations with respect to the different Member States, which can be placed in different generational moments. For example, as will be shown in the following with respect to more in-depth legislative frameworks, Italy, from the regulatory point of view, can be placed in the second generation moment, unlike the Netherlands, which can be traced back to the fourth generation, therefore characterised by a greater propensity to sustainability and innovation.

2.1.2 The inadequacy of the Italian regulative framework

In contrast to European trends, the Italian national system of remediation, despite slight improvements in legislative provisions, still lags behind the application of holistic and sustainable approaches to contaminated sites, preferring radical, sectoral and impact solutions, with devastating effects on the territorial contexts from the environmental and socio-economic point of view (SuRF Italy, 2014). The evolution of the Italian legislation on contaminated sites has been marked by a first phase of total fragmentation of the discipline which, only in 1997, flowed into the more concrete provisions of Legislative Decree n. 22 of 5 February, better known as *Ronchi's Decree.* The Decree, in an attempt to make improvements and promote the protection of compromised natural ecosystems (Benozzo, 2014), enshrined the obligation to clean up contaminated sites for those responsible for environmental damage, contained in the imperative principle "who pollutes, pays", as well as the definition of the duties of local authorities in the event of non-compliance of obliged parties. In general, the Decree promoted the complete removal of contamination in order to obtain high levels of protection of environmental matrices according to the established intended use (Benozzo, 2014). But it was with its implementing regulation, *Ministerial Decree n. 471 of 1999*[9], that a greater uniformity organicity of regulations was achieved in the matter of contaminated sites. However, despite improvements in national legislation, this Decree appeared retrograde from the outset compared to what was already in force at international level. Based on the determination of contamination with reference to the tabular limit values, those of contamination threshold concentration (CSC) established according to the intended use of the individual site, and giving a marginal role to the Risk Analysis procedure, it was replaced in 2006 by *Legislative Decree n. 152 of 3 April* [10], later supplemented by that n. 4 of 2008. Known as *Environmental Consolidation Act - Testo Unico Ambientale*, it maintained all the legal provisions enshrined in the old decree on civil liability for environmental damage, with the exception of a number of amendments made to Part IV, Title V (Fig. 10). Compared to the previous legislation, the restorative purposes are reversed, the attention from the environmental protection shifts to the anthropic component, preparing interventions aimed at eliminating only unacceptable risks to human health (Benozzo, 2014). Contrary to what was established by the previous provision, in fact, a central role was attributed to the Risk Analysis procedure, making it a more flexible and specific site, and subordinating the finding of contamination of a site to the exceeding of the risk threshold concentrations (CSR)[11]. The Environmental Consolidation Act - Testo Unico Ambientale also defined the criteria for the identification, by decree of the Ministry of the Environment for the Protection of Land and Sea in agreement with the regions concerned, of portions of land characterised by significant contamination and constituting a risk to environmental ecosystems and human health, called National Interest Priority Sites (NIPS). With respect to these areas of national importance, art. 251 of the same law sanctioned the elaboration, by the regions, of the registry of the sites to be subjected to the reclamation procedure, identifying the subjects to which this was the responsibility as well as the public bodies to which to refer in the event of non-compliance by the obligated subjects. With respect to the regulatory evolution concerning the NIPS, progress has been made also with reference to the rehabilitation measures, through simplification of the techno-administrative procedures, made in the form of agile guidelines, and greater interaction between the public-private sector with the involvement of municipalities and regions in the decision-making processes (ARPAE, 2017). At regional level, with particular reference to the case of Campania, the problem of contaminated sites, together with the presence of NIPS, is one of the major problems. Large portions of the territory are undermined by the presence of areas significantly compromised by degradation and contamination, also due to illegal spillage of waste in large portions of the territory. With respect to these cumbersome presences, the *Regional Remediation Plan*, approved in 2005, elaborated a systematisation of these sites with respect to the main causes of contamination and prioritisation of interventions, in accordance with the provisions of Legislative Decree 152/2006 (Vito et al., 2008). In essence, despite small and incremental improvements that have mainly resulted in a slight flexibility of the procedures, it is still evident that the condition of the current and cumbersome legal framework is regressive compared to different perspectives. The first critical point refers to the sectoral conception of the reclamation intervention, which is still strongly rooted in the Italian regulatory apparatus and which contrasts with what is currently required of the urban planning instruments, and in a broader sense to the territorial planning. The provisions contained first in Ministerial Decree 471/1999 and then in the Environmental Consolidated Act – Testo Unico Ambientale 152/2006

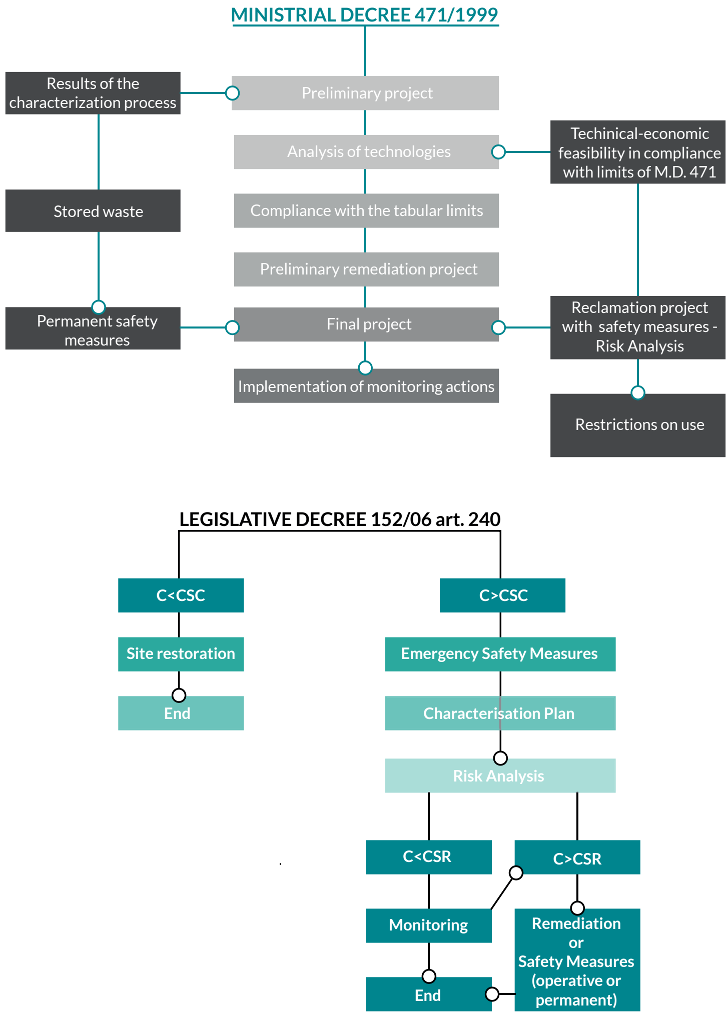

Fig. 10

Main differences between Ministrial Decree 471/1999 and the Legislative Decree 152/2006
Source: Quadro normativo e indicazioni per la caratterizzazione dei siti contaminati, ISPRA 2009
Graphic readapted by the author

showed the will to establish compatibility with the provisions contained in the Municipal Urban Plans while at the same time making it clear the condition of subordination of the same to the recovery intervention. The demonstration of what has been said can be found in comma 7 of Article n. 242 of the Consolidated Act in which "the authorisation to implement the operational project of reclamation is a variant of urban planning and involves a declaration of public utility, urgency and indifference of the works".
With respect to what is reported in the first cited article, we are witnessing a reversal of the roles in which the Plan, as regulatory instrument par excellence, is subject to the

sectorality of the reclamation intervention, covering a marginal position in the orientation of the urban project (Russo, 2006). On the other hand, the second critical point refers to the stalemate in which most of the sites located in the territory find themselves. This condition concerns in particular the sites considered to be of national interest and it can be traced back to the condition of perpetual uncertainty regarding the identification of those responsible for the pollution, invalidating in no small way the principle of the “polluter pays”, enshrined in the aforementioned Decrees. This leads to an exponential proliferation of degradation and exposure to risk for ecosystems but also for settled communities, conditions on which the long bureaucratic procedures for the approval of interventions, as well as the high costs to be incurred to stem the damage, do not have a positive impact. Finally, the last problematic issue refers to the complete absence of integrated and sustainable prospects for the management of contaminated sites, where the predominant technique of reclamation is the excavation and subsequent landfilling of contaminated portions of soil, without any assessment of potential impacts on the territory. Once again, therefore, emphasis is placed on a vision of reclamation placed in a purely technical dimension and strongly rooted within sectoral and specialist logic aimed at the mechanical return of sites completely decontaminated and without spatial relations with the contexts in which they are located. A timid first step in the perspective of an ecosystem-based approach has been made by the recent publication of Decree 46 of March 1, 2019, published on the Official Gazette n.132, June 7, 2019, regarding the *Regulation of remediation, reclamation and safety measurements of agricultural areas*, in which it is explicitly reported, within the Annex 4, that: “…… protection of landscape and of agricultural vocation of an area remain one of the strategic objectives of land management and planning” and “they will be preferred actions of bio and phytoremediation with poliannual crops that have many advantages respect to physic-chemical treatments: landscape quality improvement; soil fertility improvement; impediment to non-agricultural land use (such as new buildings)”. From these precise and anonymous territorial effects, conditions of urban planning emerge that are completely alien and detached from the real development needs of the contexts and in which the possibility of interaction with local communities and the integration of multidisciplinary approaches in the decision-making processes play an increasingly marginal role.

2.1.3 The Dutch legal model as a pioneer of inclusivity and innovation

Contrary to the Italian legal framework, the Dutch one currently appears more flexible and inclined towards sustainable and strategic perspectives with respect to the problem of contaminated sites, even if it comes from legislative approaches initially based, as in the Italian case, on the principle of the total elimination of contamination in order to achieve high quality standards of compromised environmental matrices. In the Dutch case, the protection of soil resources has always played a prominent role in the national environmental framework as evidenced by the dated laws of 1983, the *Interim Soil Remediation Act*, and 1987, the *Soil Protection Act*, which established the limit values for which a site was contaminated and the responsibilities of those involved in the process of pollution. But the regulatory act that already at that time was a precursor of sustainable prospects in the remediation measures was the *National Environmental Policy Plan*, a law promulgated in 1989 and which was last updated in 1994. This law already laid down provisions in which the sustainable component of environmental rehabilitation and the prevention of the risk from contamination was clearly covered. The introductions to the legislation included new obligations for private parties, owners of the sites on which the contamination insisted, which was obliged to carry out analyses and possible remediation in the event of exceedances of the permissible limit values and to inform the competent authorities of all measures necessary to eradicate pollution. This law also provided for a decentralisation of administrative power. The leading role, in terms of authorising emissions for the initiation of remediation and updating of site inventories on the basis of data provided by local authorities, was entrusted to the provinces, also responsible for changes in the use of areas, as set out in the *Spatial Planning Act* (Landi&Montini, 1999). The body of the law also contained the qualitative standards to be achieved in order to contain the risks as well as the methodological steps to be applied on each site to decree the urgency of the reclamation (Swartjes et al., 2012). In 1995, however, a measure was introduced whereby the *Soil Clean-up Centre*, a public centre acting as an intermediary in remediation processes, had to issue a certificate to the owner that attested the safe future of the site. In 1998 important reconsiderations were carried out on the objectives of the laws in force to integrate the reclamation operations with the socio-economic dimension, through approaches aimed at a suitable and specific destination of use, at the expense of a more expensive multifunctionality of uses (Nijkamp et al., 2002). The sustainable component was enhanced to a greater extent by more recent legislative provisions, such as the *Soil Quality Decree* of 2008. It not only revealed a careful assessment of potential impacts on the environmental and anthropogenic dimension, but even a circular approach in reclamation processes where soil, affected by mild contamination, could be reused for other purposes contributing to stem economic and social problems. In the Dutch case, the procedures and provisions of the law went through a sudden phase of development, preferring approaches and lines of action that, oriented towards risk assessment, were part of a legislative framework characterised by greater flexibility and propensity towards innovative lines of action than in the Italian case. In the Netherlands, the definition of actions to be taken on contaminated sites is currently carried out in accordance with a classification of soils based on the level of contamination found during the analytical steps undertaken on site. The first category includes soils in which there is no pollution and which can therefore be reused instantaneously; the second category, which is of major interest to national policies, covers soils in which there is a slight degree of contamination and in which the soil can be reused; finally, the third one includes all the severely compromised sites where remediation is urgently needed (Nijkamp et al., 2002). The Dutch legal framework largely justifies the privileged position occupied by the nation in fourth-generation European policies, as already stated above, more attentive to the ambitious challenges posed by the contemporary world. The interesting aspects that emerge, in addition to those closely related to the technical methods of remediation, relate to the forward-looking vision that the Dutch government implements with respect to contaminated sites, seeing the potential underlying not only in terms of ecological, economic and social benefits. This perspicacious strategy of action is concretised through the structuring of a consensual process to more levels based on the consolidated model polder [13], that has led to the beginning of innovative forms of urban reactivation on the territory. The Dutch government, involving also municipal bodies, has always shown an open and tolerant nature towards forms of participatory planning for the regeneration of compromised sites, of which the Buiksloterham area, explained below, is an emblematic example. The Dutch government has been given a pretext to envisage resources in what could be regarded as a mere catalyst for risk and degradation by means of public-private partnerships and funding. The possibility of satisfying the needs of environmental regeneration by foreseeing positive impacts also on the socio-economic side has made it possible to respond to the practical needs of employment and inclusion of communities in the decision-making processes, for the reactivation of the compromised territorial heritage and the restoration of their sense of belonging to local contexts.

2.2 RECLAMATION AS A PORTION OF THE TERRITORIAL PROJECT

Possible directions for new forms of policies

The comparison between the international and national legal frameworks inevitably highlights the regression in which the guidelines and regulatory instruments in force in the Italian context find themselves compared to the Dutch and, more broadly, European condition. All the critical aspects, previously identified, converge towards a single common denominator attributable to the limiting vision, compared to other potential and more stimulating perspectives, in which a reclamation intervention is currently located. The strong sectoral connotation, of which before, is indeed reflected in the fact that the remediation actions seem to act in a framework of full technical and regulatory autonomy, as separate phases in the life cycle of a contaminated site (Robiglio, 2014). The mere subordination to parametric factors and procedural steps leads to the conception of the area under treatment as a sterile piece of a spatial mosaic, in which to make a tabula rasa of the past uses, of identity values without any prediction of possible future functions that could weave profitable contextual and social relations and trigger new forms of economy on the territory. The sectoral logic that permeates the restoration actions is clear that currently it seems to act according to extraneous lines of conduct and parallel to the provisions of the urban planning tools, and not at all integrated in the design process of territorial and landscape reconfiguration, increasingly limited to a small number of actors. These extremely restrictive operative modalities, if not effectively oriented, could be reduced to short-sighted regeneration of territorial contexts as fruitless containers of clean spatial fragments, but not at all responding to the needs of the communities that will find it difficult to identify with them. The restitution of pieces of aseptic soil in the territory, a direct result of decontamination limited to the mere technical sphere, has underlined not only the lack of consideration of these interventions in the regulatory and design sphere, but above all has brought out a cultural problem. The low importance given to the soil, its contamination and the procedures for eradicating it, leads to the observation of misinformation, a lack of knowledge on the irreversible consequences that could occur and which, above all, do not allow innovation to be brought to the sector. As preconditions for the future reuse of latent contexts, issues related to soil remediation could be turning points to

Regeneration urban strategies
Source: REPAiR UNINA Team, 2018
Graphic readapted by the author

implement innovative reflections from a technical, methodological-normative and also cultural point of view recognizing the remediation interventions as "an indispensable substratum of a more comprehensive project of ecologically oriented landscape" (Gasparrini, 2014:57). Translating a markedly sectoral dimension to integrated approaches leads to a widening of the focal, defining profitable transformative inter-scalar and inter-sectoral contexts in which risk mitigation needs come into tension with landscape reconfiguration project aspects consistent with the forecasts contained in the plan. In this perspective, reclamation becomes a potential driver of innovation within the established planning practices not only in operational terms but also in terms of interpretation. Starting from conditions of environmental compromise, it acts on latent spatial portions, reinterpreting them in function of their underlying potential, allocating them to new uses and thus deploying collective benefits, from an environmental, social and economic point of view. The start of new life cycles, of profitable transitions towards balances no longer precarious for contexts in crisis, often involves a timely and incremental implementation of remediation measures to stem unforeseen contingencies. This is the case of the temporary uses, outlining unprecedented dimensions for urban planning tools, which are required to be more flexible than short-sighted provisions. The reclamation becomes therefore an occasion for the questioning of the rationalist and traditionalist plant of urban planning and its tools of management and control of the territory imposing their revision aimed at the delineation strategic guidelines able to activate resources on the territory. Adapting the plan forecasts to the current needs of contemporary contexts that increasingly call for strategic sustainable development approaches means acting in a transcalar dimension. In this sense, the local scale is a fertile starting point for profitable and inclusive micro-transformative processes in which citizens, administrations and other stakeholders can develop synergistically shared and innovative territorial projects to recognise value in what seems to not have value and to activate radical changes at larger scales. A strategic approach, including tactical and also temporary re-use of the places regarding situations of abandonment and degradation obviously often contrasts with the discipline of the urban plan characterised by predetermined interventions and is little prone to change. It is necessary therefore to operate a reversal in which the reclamation becomes planning and normative pretext in order to define uniform and strategic legislative frameworks of reference aimed at the redefinition of the relationships between the various subjects involved in the process of reorganisation in collaborative forms that allow to simplify the intricate and long bureaucratic processes and authorisations (Lanzani et al., 2013). First of all, this implies the recognition of reclamation as an essential prelude to the urban and landscape project with a strong public value in which the community, as a direct user of the spatial context, plays a leading role (Russo, 2006). In redefining the addresses and ways in which the reclamation can be efficiently placed in the plan, the attention should therefore be placed on the possibility of triggering new forms of collaborative confrontation between the government of the territory and the citizens to outline creative and new scenarios of regeneration of urban contexts. This aspect, based on the renewed concept of reclamation as a public project, inevitably involves the provision of forms of public funding-private sector initiatives to develop regenerative models that encourage the creation of strategic frameworks, including at a national level, to be pursued with a view to sustainability. The result is a reformed vision of urban planning as a tool to combine regenerative and adaptive design approaches, in a circular perspective of reuse of contaminated sites with a strong and underlying public value. The remediation operation, attenuating the purely technological character of its original matrix and placing itself in a multisectoral dimension, thus allows a new dimension to be introduced to the town-planning project and the plan, which from a technical instrument, often aimed at the pursuit of corrupt political interests, becomes a catalyst for environmental, economic, social and cultural innovation(Pareglio&Vitillo, 2013).

Conclusions

The comparison between the evolution of legal frameworks in the European and in particular Dutch and Italian contexts, in addition to highlighting the regression condition in which Italian legislation exists in relation to issues emerging from the treatment of contaminated sites, stresses the lack of a uniform legislative frame of reference where contemporary challenges can be met. The degree of uncertainty and inequality that governs the choices of decontamination and transformation of latent contexts, the lack of sustainability of interventions together with the still rooted concept of reclamation as a specialist and sectoral tool, requires reconsideration of its operating methods and their integration into urban dynamics. To implement this paradigm shift it is necessary to recognise the public value that deploys a rehabilitation approach, its relevance as a preliminary step of the urban planning project and precondition for the development of metropolitan contexts. This renewed demand inevitably entails a revision of the regulatory framework, its management and control instruments, their structural, prescriptive, and substantial rigidity in favour of flexible and adaptive provisions in relation to contextual peculiarities and social needs. Contemporary contingencies therefore demand a shift from traditionalist regulatory instruments, based on the irreversibility of transformative processes and the imposition of restrictive rules on potential and future uses, to new forms of more agile territorial governance that envisage innovative multiactorial strategies of recovery and public management projected over the long term. From this perspective, the reclamation interventions appear to be particularly performing in order to implement a reversibility of uses for various reasons. In fact, looking beyond the technical specificity of the approach, environmental restoration is a potential opportunity to experiment with incremental and temporary solutions that lend themselves well to the long timeframes provided by urban planning tools, preparing the basis for profitable socio-economic practices, public-private partnerships and for the social acceptability of the proposed strategies. According to this perspective, the reclamation and the urban planning project can be considered as strictly interdependent phases that in the proposed renewed conception of planning, and its operational tools, find a suitable and exhaustive place. In an operational summary therefore, as will be better illustrated in the next chapter, a reclamation approach that acts beyond the restrictive margins of the sector, placing itself, moreover, in a framework of sustainability, will have a collective benefit. This condition will be expressed through the introduction of new forms of governance which, in latent contexts, will intercept not only public value but also potential reference entities for new landscape configurations with a marked social inclusiveness.

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Notes

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3 Further information and a synthesis framework on the Concerted Action on Brownfield and Economic Regeneration Network – CABERNET are available at http://www.eugris.info/displayproject.asp?Projectid=4415
4 Further information and a synthesis framework on the Network for Industrially Contaminated Land in Europe – NICOLE are available at http://www.nicole.org/pagina/19/Workshop_Reports.html
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10 Legislative Decree n. 152 of 3 April 2006 Testo Unico Ambientale. Further information are available at http://www.bosettiegatti.eu/info/norme/statali/2006_0152.htm
11 Transition from Decree of Ministry 471/99 to Legislative Decree 152/2006: main differences. Decree of Ministry of the Environment 471/1999 was a very ambitious decree aimed at initiating incremental progress in national legislation on contaminated sites, revealing the pros and cons of its implementation. Following the decree, the application of the "limit values" was introduced, which provided for comparison with predefined tabular values on the basis of which to compare those found on the site, before ascertaining the actual contamination and the remediation action to be taken. On the basis of this decree, civil liability for environmental damage was also established according to the "polluter pays" principle, specifically defining the role of the various actors potentially involved and the related administrative procedures to be achieved. Apparently, the table logic appeared to be easy to apply and, together with the simplified administrative procedures, as well as the clear definition of responsibilities and implications at all levels of governance, contributed to the launch of multiple remediation procedures in Italy with the execution of interventions. But the criticalities did not take long to emerge and in fact the same table logic showed the first flaws in relation to the lack of flexibility in the discharge of contamination and some forgetfulness with respect to the definition of threshold values of some contaminants, including heavy metals. From an administrative point of view, despite the fact that the procedures had been simplified, the time taken to implement the remediation procedure appeared to be long. From an economic point of view, instead, the pre-established tabular values relating to the soil matrix led to improved findings in terms of contamination, thus requiring ex situ operations of remediation with techniques that had an impact and were economically unsustainable. Legislative Decree 152/2006 made changes to the previous provisions on several fronts by introducing intervention principles based on an actual risk identified on the site and for which remediation action seemed necessary. The first finding, compared to the previous decree, referred to the replacement of the rigid tabular approach in favour of a risk-based approach. The above approach, in fact, established that exceeding the tabular limits (CSC), set by the previous decree, were not sufficient to determine the contamination, which is why it was considered necessary to entrust the process of Risk Analyses a central role establishing the contamination in relation to CSR and also helped to promote greater flexibility in procedures, even with respect to time, and a more appropriate management of public and private resources, even if only for areas of small size. In reality, however, even in this case, there were slowdowns in relation to the lack of knowledge on the application tools of Risk Analysis and their spatial impacts, as well as their failure to apply on some territories, as well as the interruption of delegation in administrative functions, from regional to municipal. Sources: https://www.necsi.it/files/read/2423-master-ambiente-06.pdf; http://www.isprambiente.gov.it/contentfiles/00003900/3947-c2738-m1-u1.pdf; http://www.giuristiambientali.it/documenti/20071119ab.pdf.
12 In the Italian legislative framework it is called Ministero dell'Ambiente della Tutela del Territorio e del Mare – MATTM.
13 The Polder model is an expression used for the first time in 1990 by Dutch politician Ina Brouwer in her article "Het socialisme als poldermodel?" and it is currently being used to indicate a process of consensus-building in the political sphere.. Source: Prak, M., van Zanden, J.L. 2014. The Netherlands and the Polder Model: A Response. Low Countries Historical Review 129(1): 125-133

03

On the remediation of Wasted Landscape

Useful insights for the identification of the problem

A brief introduction

Cities produce devastating alterations on the entire environmental ecosystem. The two contexts, cities and natural environment, in apparent antithesis between them in relation to the different matrices of belonging, anthropic and natural, are in reality complementary and in strong synergy. However, this close interdependence has only recently been noted and supported, that is when, within the urban planning, the environmental dimension and its protection has ceased to be regarded as an action extraneous to the policies and practices of territorial intervention. In the contemporary debate, the city is now considered as a complex ecological system in which the interrelations with the natural dimension are also linked to the economic and social dimensions. Tangible exemplification of this mutual dependence between the human and natural environment are also the environmental contamination, over all that of the soil is the main source of risk for the ecosystem and human health. Intensive anthropic exploitation, the exorbitant use of non-renewable resources, the illegal dumping of waste or its mismanagement as well as the disposal of industrial plants are considered to be the most important vectors of contamination of environmental matrices in European territorial realities. The paradigm shifts with respect to the traditional conception of soil as a mere support platform for excessive exploitation that caused the incremental decay, imposes strategic and regenerative actions that, currently, constitute the fulcrum around which gravitates the attention of the parties directly involved in the reclamation processes, in a framework of multiscalarity. The problem of contaminated areas is firmly rooted in national and international territorial contexts and it is an objective that is no means negligible, both for spatial extension and for environmental, social, and economic implications, by European risk management and monitoring policies. The principles of sustainable approaches and those that form the basis of the latest circular logic, despite the critical issues that still undermine its full implementation, require a rethink on the re-use of fragile and compromised contexts in terms of the prefiguration of innovative and strategic scenarios aimed at re-establishing the identifying values of these places. The natural inclination of sites, with an unstable functional and environmental character, to radical changes, although consistent with the peculiarities found on site, represents an opportunity for redemption for all those areas irretrievably compromised by short-sighted and irresponsible procedures and approaches, to be achieved through the implementation of targeted, effective, and sustainable remediation interventions, to provide the greatest possible benefit to ecosystems and communities. With regard to the problem of degraded areas characterised by contamination of the soil environmental matrix, **what are the mandatory issues that lead to a change of course about the traditional remediation approaches in favour of others that are more sustainable? On what indicators can their sustainability be assessed? Which of these approaches are also particularly suitable to meet the needs of landscape reconfiguration of contexts in crisis?** In this sense, the chapter, starting from the problem of contamination, at a European level investigates, through an overview

Dead factory.
https://commons.wikimedia.org/wiki/File:Abandoned_factory.jpg. AlexanderKaiser.
Last access September 2019.

have led to a transition towards more sustainable approaches, while also providing favourable conditions for the development of experimental and innovation contexts.

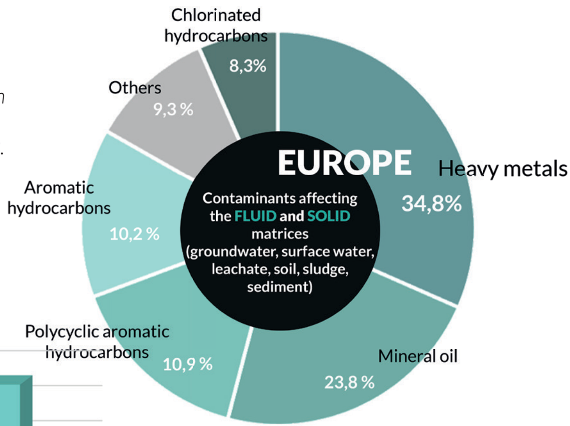
3.1 THE SCALE OF MATTERS

An overview: state of art and main causes of contamination in Europe, Italy and the Netherlands

The most recent European Environmental Agency (EEA) [1] estimates report relevant data on the presence of contaminated sites among the Member States of the European Union. Latter surveys among **European countries** have allowed a data extraction on the current situation linked to the contamination problems and their remediation. Specifically, 2.800.000 sites have been estimated where polluting activities took or are taking place, among them 648.964 sites have been registered. Where there is a clear suspicion of contamination, the survey also revealed that sites in need of investigation are 170.215, while those under investigation are 67.839. Currently, sites that have been investigated but no remediation needed is 78.193. Definitely in Europe, where contamination is mainly caused by heavy metals, both for solid and fluid matrices, verified during the characterisation phase (Fig. 11), effectively contaminated sites are 45.420, those potentially contaminated are 80.304, sites under remediation are 14.155 while those already remediated are 63.089 (JRC, 2018). In **Italy**, in particular, data on polluted sites reveals a no less critical outline of the situation, 29.700 sites have been registered. Monitoring of the contaminated areas, conducted during the period between 2001 and 2016, allowed a comparison such that the percentage of sites affected by polluting activities was increased by 54,4%. The main source of pollution, besides problems linked to waste treatment and disposal, can be easily attributed to the industrial and commercial activities and their repercussions on the territory materialize into 16.335 sites under still ongoing proceeding, whose 4.043 effectively contaminated sites, 4.788 potentially contaminated areas, of which 590 only in Campania Region, and 13.365 already remediated. The above information concern cognitive survey on Sites of Regional Interest - SIR (ISPRA, 2018) do not include data on *Sites of National Interest* – SIN, considered as *seriously polluted areas with a high health risk. Sites of National Interest, for the purpose of remediation under the competence of the Ministry of the Environment and Protection of Land and Marine Resources* - MATTM, *are identifiable in relation to the characteristics of the site, the quantities of dangerousness of the present pollutants, the importance of the impact on the surrounding environment in terms of health and ecological risks, as well as of prejudice for cultural and environmental goods* (Art. 252, paragraph 1 of Legislative Decree n. 152/06). Recovering a total area of 171.268 ha, they make up about the 0.57% of the Italian territory surface. Until now, the overall amount of the SIN is 41 (ISPRA, 2018) more than a half of which falls in Lombardy, Piedmont, Tuscany, Puglia and Sicily, for a total of 21 sites. Instead, in Campania region there are 6 SIN: East Area of Naples, Bagnoli – Coroglio, Domitian – Phlegrean Coast, the area of the Vesuvian Coast, the hydrographical basin of River Sarno and the district of Pianura in Naples. On the entire surface of 38 SIN out a characterisation phase was carried out and for the 15% of these SIN, 50% of the overall areas have undergone a safety or remediation project approved by Decree. In the **Netherlands** the main cause of contamination is derived from the service sector

(Fig. 12). On the basis of information collected by the Joint Research Center[2], polluting activities took place on 1.455 sites of which 466 with a potential contamination, and 807 damaged by an effective contamination. Areas already reclaimed were found to be 176, the remaining part is under investigation (JRC, 2018). Contrary to Italy, the progress in the management of contaminated sites in the Netherlands has triggered positive responses; indeed, during the period between 2001 and 2016, a stunning decrease of 99,7% has been identified related to the registered site with the presence of polluting activities and of 99,2% for sites in need of risk reduction measures. Currently, this is the emergent scenario of the European, Italian and Dutch contexts in which, despite more or less critical realities, the impending need is outlined for regenerative interventions for safety purpose and to mitigate the risks caused by contaminants in order to obstruct the most alarming long-term assumptions which, until 2025, require an almost tripling of the figures related to the sites with an environmental matrix considerably compromised.

Fig. 11
Percentage of contaminants within fluid and solid matrices.
Source: EEA 2014, last modifies 2019.
Graphic made by the author



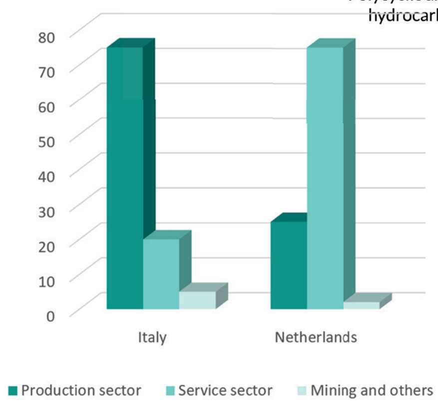
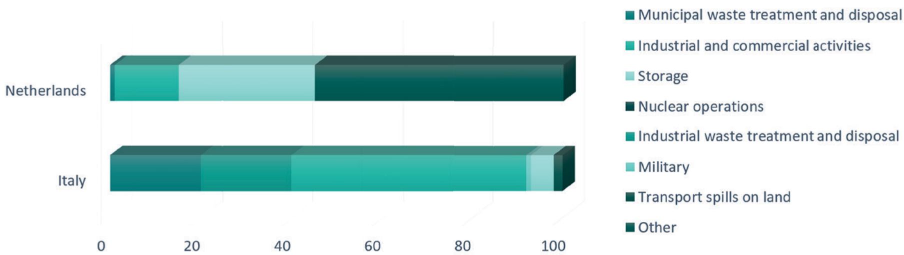


Fig. 12
Harmful activities in comparison
Source: EEA 2014, last modifies 2019.
Graphic made by the author



3.2 TOWARD REMEDIATION

A technical focus: definitions and approaches

To identify the entity of contamination in the environmental matrices[3] and the corrective actions to adopt for regenerative purposes to reinstate the value in use to the WL and their secure availability within the urban contexts, specific administrative procedures were provided into the documents related to the legislation in force with regard to the potentially and effectively contaminated sites or, more generally, to the remediation targets. Considering soil contamination as a process divided into different phases, a considerable precondition must be made on the relativity and the different connotation and worth of the concept of contamination among the different European countries (Fagnano, 2018) and the assertion of a site as polluted (Fig. 13). For instance, relative to the level of contamination in the environmental matrices, comparing some values listed in the European regulations, despite some differences in the use classification, it is clear that the Italian values are lower than the other countries (Fagnano, 2018). First of all, within the troublesome procedure of soil contamination, a distinction on the actual or potential contamination of a site is applied on the basis of results derived from samplings and chemical analysis, whose outcomes are then compared with the thresholds, laid down on land use, set by Legislative Decree 152/06. In the Annex 5, Title V, Part IV of the same Decree, thresholds are named as **Contamination Threshold Concentration** (CSC) and they are delineated as the l*evels of contamination of environmental matrices that constitute values above which the characterisation of the site and the site-specific risk analysis are required. In the case in which the potentially contaminated site is located in an area affected by anthropic or natural phenomena that have led to the exceedance of one or more CSC, the latter are assumed equal to the existing baseline value for all the exceeded parameters*. In general, as defined in the article 240 of Lgs. D. 152/2006, a **Potentially Contaminated Site** (PCS) is a site i*n which one or more values of the pollutant concentrations found in the environmental matrices are higher than the CSC, prior to carrying out characterization and of site-specific health and environmental risk analysis which allow the contamination status to be determined on the basis of CSR*. A site can be defined potentially contaminated after a preliminary investigation. The same definition was also provided by Joint Research Centre (JRC), accorded with the European Environmental Agency (EEA), identifying it as a potentially contaminated site where *unacceptable soil contamination is suspected but not verified, and where detailed investigations need to be carried out to verify whether there is an unacceptable risk of adverse impacts on receptors* (JRC, 2018). The status of potential contamination requires the subsistence of three main conditions. First of all the presence of a source of contamination, defined as primary if it implicates the potential pollution (waste), secondary if it involves contaminated environmental compartments, for example soil surrounding the source of contamination; one or more paths of migration, involving underground or surface water, air and soil, considered as transport carriers of pollutants to the environment; some receptors intercepted by paths of migrationand threatened by pollutants, among them human population, animals, plants, environmental and economic resources (buildings, infrastructures...).

Notwithstanding, only the excess of the CSC value is not entirely exhaustive to demonstrate the presence of contamination in a given area but it is a preliminary step to conduct other investigations on the site as characterisation plan and a risk analysis. In the case of overrun of CSC value, another essential parameter is contemplated during the assessment contamination process, the **Background Values** (BVs), that may be either natural or anthropic. In the light of the above, sometimes the excess of lawful limits cannot be associated only to human actions or pollution since in nature some phenomenon could be constitute a serious risk to human health. In particular, some geological conditions involve the presence or enrichment of mineral substances with toxicological properties. Unlike anthropic pollution circumstances, that needed to be immediately remedied, law allows an overcoming of CSC for soil and water provided that it is established and has proved the natural matrix of the surplus concentrations[4] . In the event that the values of a certain site are higher than the CSC but lower than BV, the area is not contaminated (Fagnano, 2018). Conversely, a site in which the contamination detected in the environmental matrix is lower than the CSC or, if greater, is nonetheless lower than the CSR determined by site-specific health and environmental risk analysis, is defined by the Legislative Decree as non-contaminated site and, in this case, only an **environmental restoration** is provided and it *includes all the actions of environmental and landscaping restoration, also complementary to remediation or permanent safety measures*, that the Characterisation Plan is the basic level of technical in-depth investigation in the remediation process.l

PTEs	AUT	BE(F)	BE(V)	CZE	DNK	FIN	ITA	NLD	POL	SVC	UK
As	50	110	300	70	20	50	20	55	22.5	50	20
Be				20			2	30		30	
Cd	10	6	30	20	5	10	2	12	5.5	20	2
Co				300		100	20	240	45	300	
Cr	250		520	500	1000	200	150	380	170	800	130
Cu	600	400	290	600	1000	150	120	190	100	500	
Hg	10	15	56	10	3	2	1	10	4	10	8
Pb	500	700	700	300	400	200	100	530	150	600	450
Ni	140	470	300	250	30	100	120	210	75	500	
Sb	5			40		10	10	15			
Se							3	100		20	35
Sn				300			1	900	40	300	
Tl	10						1	15			
V				450		150	90	250		500	
Zn		1000	710	2500	1000	250	150	720	325	3000	

Fig. 13

Screening values (in Italy CSC) to define potentially unacceptable risk for residential use
Source: Carlon C, 2007. Graphic made by author

AUT- Austria, BEF - Belgium Wallon, CZE-Czech Republic, DNK-Denmark, FIN-Finland, ITA-Italy, NLD-Netherlands, POL-Poland, SVC-Slovakia, UK-United Kingdom

It is articulated through consecutive phases with an increasing detail to retrace the story of the site both in respect of its geological and hydrogeological features both in respect of land uses with close attention paid to the location and expansion of the possible contamination (APAT, 2008b). The main outcome of the Plan is the development of a conceptual model of the site which best addresses the investigations to be undertaken with economic implications too. The plan consists of three fundamental parts, each one divided in sub-sections. The first one, collection and systematisation of existing data, concerns the retrieval of information on the history of the site in terms of land uses, company history, raw materials used with indication of their loading, unloading, storage and disposal areas, waste management, presence of tanks, their composition and contents, water supply, waste water treatment, asbestos-containing materials, preliminary and/or previous investigations. The second part, site characterisation and preliminary draft of the conceptual model, which includes in its investigations carried out on the geological and hydrogeological order as well as the identification of areas of potential interest for the purposes of the contamination and start of safety measures actions as surface area, emptying tanks, collecting spilled liquids, fencing installations, drainage, covering or temporary sealing of contaminated soils and sludge. The last step of this second part is the drafting of a preliminary conceptual model of the site that, based on the information previously collected, provides a first identification of potential targets of a possible contamination. The third and last phase, the initial investigation plan and final conceptual model of the site, involves preliminary activities such as weed removal, surveys of existing manholes and wells and verification of the stability of buildings, drafting of the management and disposal plan for asbestos, waste management plan, detection of interstitial gases, execution of surveys and piezometers, land survey, collection of soil and water samples and chemical, geotechnical analysis with a subsequent synthesis of the results achieved. From the integration of the results derived from chemical and physical analyses and other investigations previously carried out, the conclusive conceptual model of the site shall be drawn up and it includes information about present or past sources of contamination; pollutants present in the different environmental components affected by the site; the toxicity and relevant physico-chemical characteristics of the substances in the environmental matrices (solubility, volatility, biodegradability, bioavailability); the dominant characteristics of the environment with which the site interacts, what type of surface aquifer, depth of the main aquifer, proximity of water courses, meteorological characteristics; the presence of wells in the site or surrounding area and the uses of water taken; relevant spatial elements, such as distribution and population density in the surrounding area, proximity of sensitive elements (e.g. schools and hospitals); means of target exposure (dermal contact with contaminated matrices, ingestion, inhalation). The aim is to collect all the elements needed to define the extent of the area to be reclaimed, the volumes of contaminated soil, the relevant characteristics of the natural and built environment, the degree of pollution of the various environmental matrices, the routes of exposure and the characteristics of the population on which the effects of pollution may occur. The knowledge acquired through the steps described above will allow us to assess, within the plan, the feasibility of an intervention identifying possible alternatives of safety and remediation in relation to the technical aspects and their environmental compatibility by developing a cost-benefit analysis for each alternative. The compatibility of the choices made and the effectiveness of the rehabilitation action are ensured through continuous monitoring and control phases until the completion of the intervention. As outlined in the previous rows, on the basis of the outcomes derived from the characterisation process, the following step is the **Risk Analysis** procedure on the site to identify the concentration of risk threshold (CSR). Risk Anlysis is a crucial decision-making support tool in the management of contaminated sites and it consists, in accordance with Lgs. D. 152/2006, of a *site-specific analyses aimed to evaluate the effects on the environment and human health derived from lasting exposure to substances present in concentration above the limits imposed by legal regulations for the specific land-use of the site (CSC) and within the involved environmental matrices (soil, subsoil and groundwater)*. The starting point for the application of this type of analysis is the above Conceptual Model of the Site based on the identification and parameterisation of three main elements: source of contamination, pollutant migration pathways through environmental matrices and targets or receptors of contamination in and around the site. The risk to human health exists only if, in a given area, the three components are present and linked together. The source of contamination is subdivided into primary, if it intercepts the element that causes pollution, and secondary, if it is identified with the environmental compartment being contaminated. The source of secondary contamination can be traced in two environmental compartments discernible in an unsaturated zone, which can be classified into surface soil (a depth of between 0 and 1 m) and deep soil (with depth greater than 1 m from the country plan), and a saturation zone or groundwater. The risk analysis procedure should only be applied to the secondary source of contamination. The limit of one or more sources of contamination in the superficial and deep soil occurs by the identification of influence polygons determining the spatial continuity of the sources going as far as the adjacent areas. The source is definitively delimited considering the set of all polygons for which there has been the exceedance of the CSR for at least one contaminant and which have spatial continuity. The risk analysis can be applied directly (forward) estimating the risk associated with the contamination status detected at the site, or inversely (backward) based on the risk acceptability criteria for the determination of acceptable contamination levels and remediation targets for the site under consideration (APAT, 2008a). As legislated in the Annex 3, Title V, Part IV art 242 of Lgs. D. 152/2006, following the Risk Analysis if the concentration contaminant does not exceed the value of CSR is only necessary the monitoring of the site, while on the other hand, if the CSR value is greater than the concentration of contaminant, the remediation or temporary or operative or permanent safety measures are required on the site. **Remediation** means *all the measures appropriate to eliminate the sources of pollution and the pollutants or to reducing their concentration in the soil, subsoil and groundwater to a level equal or lower than the CSR value*. Sometimes, remediation activities may be replaced by other types of provisions aimed to restore security and the usability of the place. Specifically, the definition of **temporary safety measures** includes *all the actions used to prevent the dissemination of pollutants from contaminated site during the remediation processes requiring a longer time or when there is a need for a protracted period of monitoring for assessing the qualitative state of the site and its interferences with the surrounding environment*; **operative safety measures** involves *all the actions performed in a site which is still active aimed at ensuring an adequate level of safety for people and the environment, prior to further permanent safety measures or remediation being carried* *out on cessation of activity.* This also includes contamination containment measures to be carried out until execution of the remediation or until permanent safety measures, in order to prevent the spread of contamination within the same matrix or between different matrices. In such cases appropriate plans for monitoring and control must be prepared to allow the effectiveness of the adopted solutions to be verified. Lastly, **permanent safety measures** are instead all the actions appropriate to permanently isolating the polluted sources with respect to the surrounding environmental matrices and to ensure a definitive, high level of safety for people and the environment. In such cases plans must be provided for monitoring and control and limitations in use with respect to technical forecasts.

3.3 BEYOND SECTOR-BASED DYNAMICS
From consolidated remediation technologies toward sustainable perspectives

The contamination of the soil is a deep-rooted problem within our territorial realities. The strongly exponential attention to the causes of contamination both natural and anthropic, represents an important focus of reflection, both in the community and national framework, involving different competences, scientific, administrative and institutional, for the definition of operational strategies aimed at the regeneration of territorial contexts in crisis. By definition, as already stated in the previous paragraph, reclamation is a complex process that requires a deep knowledge of the intervention context and whose ultimate goal is the improvement of environmental quality, the protection of human health and the incremental growth of the thresholds for the well-being and safety of local communities. In recent decades, the dynamics of decontamination related to the compromised environmental matrices have posed important issues related to their own complexity. Among the most difficult assumptions within the management of a polluted sites, there is, for example, the constant research for the right balance between the desire to protect the environment and human health from exposure to contamination and the scarcity of available natural resources, to ensure, in a long-term perspective and by minimizing impacts, an efficient management from the socio-economic point of view as well as the optimal usability of the site. The effectiveness of a remediation process and, consequently, the cautious choice of practicable techniques, requires the identification and implementation of site-specific interventions, both for issues related to the environmental and morphological characteristics of the area under consideration and for the different heterogeneity of the soil matrix, whose chemical composition-physical and microbiological is susceptible to change within a few metreers. In the light of the above, the priority step preceding the start of a remediation process is the meticulous analysis of the structural characteristics of the soil, particularly those that affect the behaviour of contaminants in the matrix such as water movement, infiltration capacity, and permeability conditions (Petruzzelli, 2016). In general, an adequate choice of remediation technique (Fig. 14) allows the desired level of environmental protection to be met, including the management and monitoring of costs. Substantially, the combination of techniques aimed at the decontamination of environmental compartments differs in terms of methods of application, environmental impact[5], costs

Chernobyl power plant, Ukraine.

and process completion times. From a technical point of view, remediation technologies can be identified in two main groups, ex situ and in situ processes. Specifically, **ex situ processes** involve *all technologies which require a preliminary removal of contaminated soil and a subsequent treatment nearby the area undergo remediation (on-site) or in an external treatment plant (off-site)*. They are applied to excavated soil. The main advantage of ex situ treatment is that it generally requires shorter time periods than in situ treatment, and there is more certainty about the uniformity of treatment because of the ability to homogenize, screen, and continuously mix the soil. However, ex situ treatment requires excavation of soils, leading to increased costs and engineering for equipment, possibility permitting, material handling/worker exposure considerations as well as the complete destruction of soil ecosystem services[6] , and in some cases the soil itself, implying their application only where later construction is planned (FRTR, 2017)[7] ; in **situ processes** *are directly applicable to the polluted site without movement of contaminated matrix minimizing the environmental impacts*. The main advantage of in situ treatment is that it allows soil to be treated without being excavated and transported, resulting in potentially significant cost savings. However, in situ treatment generally requires longer time periods, and there is less certainty about the uniformity of treatment because of the heterogeneity of the soil and aquifer characteristics and because the efficacy of the process is more difficult to verify (FRTR, 2017). To overcome this problem, if it is necessary to have a detailed Characterisation Plan of the site and to determine the contaminant properties and behaviour in that specific site (FRTR, 2017). However, the condition that the decontamination of a site requires the combination of multiple treatments to achieve the remediation objectives may emerge. As a result of a first classification regarding the placement of the intervention, it follows a further subdivision inherent to the different categories of treatment that it is possible to implement on the site, among them many labeled as traditional can be widely impactful and therefore particularly damaging to the ecosystem and expensive from the economic point of view, with the exception of biological treatments. Specifically, the four macro-typologies in which reclamation operations are conventionally grouped are physical, chemical, biological and thermal treatments. **Physical treatments** involve a change in the physical state of pollutants by predicting their transfer between the different phases of the soil, isolating or concentrating them (Sofo, Tamborrino, 2013). This type of process does not destroy the contaminant and infact it is often used as a first approach during the remediation process to which additional ones are associated. Physical treatments include solidification and stabilisation that can be performed both in situ and ex situ. The process involves the merger of the contaminants inside a stabilised mass, with low permeability with respect to the solid soil matrix (solidification) or the induction of chemical reactions between the stabilising agent and contaminants resulting in reduced mobility (stabilisation) (FRTR, 2017). **Chemical treatments** are capable of destroying, removing pollutants or changing their structure to have a lower impact on the environment through chemical reactions between the pollutant in the soil and the introduced chemical agent. They concern the transformation of the chemical status of pollutants to produce substances with less toxicity or reduced mobility. Chemical treatments to be carried out in situ including the chemical oxidation, by injection into the contaminated matrix of a mixture consisting of pure oxidising agent and involving the complete transformation of the polluting organic substance into carbon dioxide and

Cokerie D’Ougrèe, Belgium.
Courtesy of ©2004-2019 by UrbEx.nl and AndreJoose.nl

water resulting in partial detoxification; soil flushing involves the transfer of contaminants from a solid to a liquid soil phase by means of leaching agents in order to extract a leachate tanned to undergo surface treatment; the soil vapour extractor is a reclamation technology in which a vacuum is applied to the ground, through extraction wells, to induce the controlled flow of air and remove volatile and semi-volatile contaminants from the soil. The gas coming out of the ground can be treated to recover or destroy contaminants, according to local and state regulations on the exhaust air. Ex situ chemical treatments include chemical extraction for the separation of dangerous contaminants from soils by chemical products, sludge and sediment, reducing the volume of hazardous waste to be treated later; chemical reduction and oxidation involves converting hazardous contaminants into less dangerous and more stable toxic compounds, less mobile and/or inert by the use of chemical reducing agents (hydrogen, chlorine, ozone…); the process of separation detaches contaminants from the matrix to facilitate the creation of relatively uncontaminated soil fractions; soil washing acts by separating contaminants from the soil by dissolving or suspending them in a washing solution, using a reagent, or through their concentration in a smaller volume of soil by particle size separation and friction scrubbing (FRTR, 2017). **Thermal treatments** destroy the main part of organic pollutants present in the soil and they are based on incineration, gasification or pyrolysis involving, in any case and under different temperature conditions, the volatilisation of pollutants and their rapid oxidation with formation of inorganic compounds. This category also includes the fusion of the soil at high temperatures (1000-1700 °C) with the consequent formation of an amorphous solid matrix in which the pollutants which do not fly (vitrification) are concentrated. The vitrification process immobilizes inorganics and destroys some organic compounds. Among the technologies included in this type of treatment there are hot decontamination gas which provides an increase in the temperature of the contaminated material to about 260 °C for a specified period of time. The gaseous effluent of the material is treated in a post-combustion system to destroy volatilised contaminants. The procedure involves the reuse and disposal of waste as non-hazardous materials. The contaminants are completely destroyed; the incineration involves the combustion, in presence of oxygen, at high temperatures (870-1200°C) of organic components transforming them into hazardous waste; pyrolysis is formally defined as chemical decomposition induced in organic materials by heat in the absence of oxygen. Pyrolysis transforms hazardous organic materials into gaseous components, small amounts of liquid and a solid residue (coke) containing fixed carbon and ash. Pyrolysis of organic materials produces combustible gases, including carbon monoxide, hydrogen and methane and other hydrocarbons. If the exhaust gases are cooled, liquids condense to produce a residue of oil/ tar and contaminated water. Pyrolysis usually occurs under pressure and at operating temperatures above 430°C. Pyrolysis gases require further treatment. The exhaust gases can be treated in a secondary combustion chamber, they are flared and partially condensed; thermal desorption is a physical separation process by which the waste is heated to volatilise water and organic contaminants, it is not designed to destroy organic products. Finally, landfill cap technologies are used to minimise the impact of waste deposition on the surface of the soil matrix, to prevent the vertical infiltration of water into the waste repository that could produce contaminated leachate, to contain waste during treatment and control its gas emissions as well as to create a land surface that supports vegetation and/or is used for other purposes.

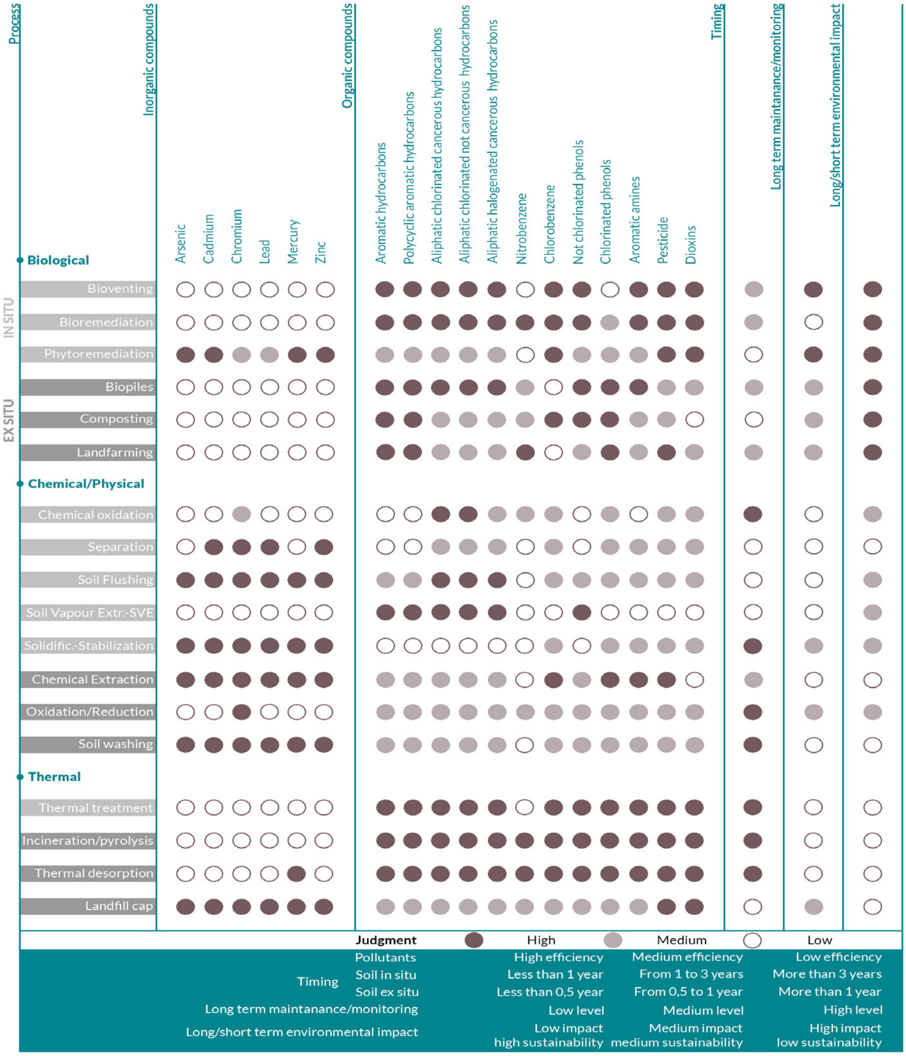


Fig. 14

Screening matrix of remediation technologies.
Source: ISPRA, 2010
Graphic made by the author

Treatment is the most common form of remediation both for the low costs and for the ability to contain the risks to the ecosystem and human health (FRTR, 2017). In closing, **biologic treatments** are based on the metabolic ability of micro-organisms, naturally present in the soil, to degrade the molecules of organics pollutants and utilise them as source of nutrition. Generally, it is necessary to ensure the presence of substances necessary to sustain bacterial activity and adequate environmental conditions, such as PH and temperatures, to ensure the speed of a process that would otherwise be slow. Within this category converge all those processes aimed at the concentration of pollutants within biotic matrices, algae or plants, and which are often used for the removal of inorganic pollutants such as heavy metals that are easily absorbed by plants by the root system. Among the biological treatments in situ we find the biovening process in which the oxygen is delivered to unsaturated soils contaminated by forced movement of the air (extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation; the enhanced bioremediation in which the activity of microbes is stimulated by water-based solutions injected into contaminated soils to improve the biological degradation of organic contaminants or the immobilisation of inorganic contaminants; phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. The mechanisms of phytoremediation include enhanced rhizosphere biodegradation, phyto-extraction (also called phyto-accumulation), phyto-degradation, and phyto-stabilisation. Enhanced Rhizosphere Biodegradation takes place in the soil immediately surrounding plant roots. Natural substances released by plant roots supply nutrients to microorganisms, which enhances their biological activities. Plant roots also loosen the soil and then die, leaving paths for transport of water and aeration. This process tends to pull water to the surface zone and dry the lower saturated zones. The most commonly used flora in phytoremediation projects are poplar trees, primarily because the trees are fastgrowing and can survive in a broad range of climates. In addition, poplar trees can draw large amounts of water (relative to other plant species) as it passes through soil or directly from an aquifer. This may draw greater amounts of dissolved pollutants from contaminated media and reduce the amount of water that may pass through soil or an aquifer, thereby reducing the amount of contaminant leaching toward groundwater (Fagnano, 2018). Phyto-accumulation is the uptake of contaminants by plant roots and the translocation/accumulation (phytoextraction) of contaminants into plant shoots and leaves. Phyto-degradation is the metabolism of contaminants within plant tissues. Plants produce enzymes, such as dehalogenase and oxygenase, that help catalyze degradation. Investigations are proceeding to determine if both aromatic and chlorinated aliphatic compounds are amenable to phyto-degradation. Phyto-stabilisation is the phenomenon of production of chemical compounds by plant to immobilize contaminants at the interface of roots and soil. The use of dense ecological structures such as can fields of permanent meadows aimed to exclude contaminant movements toward other environmental compartments (i.e. air and groundwater) can be considered techniques of Phyto-stabilisation for temporary securing of contaminated sites. Conversely, the technologies ex situ involve the biopiles, where excavation soils are mixed and placed on a treatment area equipped with leachate collection systems and ventilation systems as well as a waterproof system to minimise leaching and contaminants in the soil. It is a system used more often to reduce the petroleum components in soils excavated by

Portello Park, Milan, Italy.
Photo taken by the author, 2019

biodegradation; composting is a process by which organic contaminants are converted from micro-organisms into harmless and stabilised by-products. Soils are excavated and mixed with bulking agents and organic amendments, such as wood chips, animal, and vegetative wastes, to enhance the porosity of the mixture to be decomposed. Maximum degradation efficiency is achieved through maintaining oxygenation (e.g., daily windrow turning), irrigation as necessary, and closely monitoring moisture content, and temperature and, finally, landfarming which includes excavation of contaminated soils or sludge and subsequently placed on lined beds and periodically inverted or processed to aerate waste and control leaching of contaminants (FRTR, 2017).

3.3.1 Toward shared strategies. Integrating sustainability and clean-up approaches

The high level of attention given to the remediation sector has led, also within Community policies, to the need to converge synergistically remediation environmental actions within fragile urban contexts, issues related to the ecological, social and economic dimension, assessing their possible impacts during each phase of the project, while promoting the re-use of the soil strongly. The line of conduct thus defined fosters a proactive shift towards more sustainable approaches, which, even in a circular economy framework, allow the development of appropriate, corrective and site-specific actions, consistent with the expected future use of the area as well as a number of measures to minimise impacts, such as on-site soil treatment and reuse, in addition to other heterogeneous materials, for any filling or reconfiguration of the landscape. The antecedent concept of green remediation, defined as the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions (US EPA, 2008) and which, by definition, merely provides for a high focus on environmental components, has been implemented through incorporation within it of the sustainable dimension which, as mentioned above, implies the close interdependence between the environment, economy and society in the application contexts. The two approaches are, however, comparable and complementary to the strategic line that defines their complexity (Hurst, 2010). Both, in fact, base their approaches on the minimisation of the use of renewable energies that has less impact in environmental terms, thus promoting the maintenance of ecosystem functions. Containing impact on the ecosystem also results in a drastic reduction in waste generation and, economically, in a decrease of costs with consequent increment of the competitiveness and an increased market penetration and therefore greater employment. Last but not least, the achievement and inclusion of green practices within remediation interventions promotes the re-use of the site and therefore important implications in terms of social acceptability (Ellis & Hadley, 2009; USEPA, 2008). In spite of the many definitions and different operations that distinguish the concept of sustainability, internationally, the most quoted statement is certainly the one introduced by the Brundland Report at the World Commission on Environment and Development in 1987 , according to which the ultimate goal of a sustainable approach is meeting the needs of the present without compromising the ability of the future generations to meet their own needs setting itself up as an indefinite condition that does not suffer progressive decrease of the qualities in which the process operates (Simion,

Wilhelminapark, Delft, Netherlands.
Photo taken by the author, 2019

2011). Applying the definition of sustainability to the remediation sector, the following assumption emerges: "*sustainable remediation means a management process and remediation of a polluted site aimed to identify the best solution that maximises benefits of its execution from an environmental, economic and social point of view, through a decision-making process shared with stakeholders*" (SuRF Italy 2014:28). In general, the substantial difference between traditional and sustainable approaches, even compared to the above, lies in the fact that the former focus more on the internalities of an approach, that are made concrete in the more general objectives of reclamation, on the system performance and on the impacts of the plan to local level while the sustainable strategies widen the focus considering the implications also at regional and global level[8] (Ellis & Hadley, 2009) including, during the planning and implementation phases of the rehabilitation, the opinions of stakeholders directly or indirectly involved at all levels.
The participation of stakeholders is the most important and delicate phase within a remediation process but also the most innovative and interactive with the dual aim of consolidating the decision-making process, during the entire process phase, but also address the interception of the best alternative suitable for the environmental rehabilitation of a site (SuRF Italy, 2014). Stakeholders, appropriately identified through mapping of the range of influence or impact, are valuable catalysts of sustainability in assessing possible options for action, also being configured like facilitators of the authorisation canal of the same plan preventing the collateral impacts of the restoration also in relation to the needs of the community. The analysis and evaluation of compliance with the sustainability principles is important to be carried out during all phases of the project[9] to monitor the effects of each step of the process compared to the three key dimensions of sustainability. Conventionally, the positive and negative implications of a remediation process and the most appropriate technologies to be used, are intercepted by means of indicators which also provide measures relating to the present and future needs and expectations of a community. An indicator is a parameter that provides guidance on a given phenomenon (OECD, 2008)[10] and, recognised as a partial reflection of complex and changing reality (Pileri 2002, 39), it is an essential tool in participatory and decision-making planning processes as an effective and simplified synthesis of complex data aimed at collectivising information and reducing the degree of uncertainty, to target planning policies and actions in a sustainability framework. The return of the present state of an area on the basis of which to address strategies of action is the ultimate goal of these evaluation instruments that also underlie a will of protection and recovery of what from the community is considered as a value (Bossel, 1999)[11] . The importance of the implementation of sustainable practices and strategies is now a consolidated finding.

Conclusions

However, many critical issues remain and this type of approach is still strongly hampered precisely in relation to the three domains of sustainability. From a technical, economic, and social point of view, many gaps still arise, despite attempts to do so. On the technical side, the lack of well-defined criteria that can justify the choices is the main cause of the weak integration of the sustainable matrix in remediation projects. Flexible consolidation and standardisation of procedures and metrics for the assessment of the most suitable alternative to be selected, has negative implications both with regard to the training of those involved in the process of reclamation but also in relation to the acceptance of technologies with less impact by the markets and protocols still faithful to the more traditional approaches. The above-mentioned critical issues are bound to spill over into the social sphere, with particular emphasis on the portion of communities most exposed to contamination (Bardos et al., 2018). In particular, the obstacles inherent in the involvement of society in remediation processes are most reflected in the lack of knowledge of the principles of sustainability and their translation into reliable and transparent strategies which allow a clear comparison of the pros and cons of the different alternatives to be considered. Inadequate information also leads to misgivings about the economic viability of sustainable interventions. In addition to the lack of financial incentives to promote innovation in the sector, there is also a lack of analytical approaches which, through cost-comparison benefits, demonstrate that the high initial costs of an innovative technology can be cushioned in the long term by potential savings (Ellis & Hadley, 2009). Sustainable remediation is therefore an innovative approach which, despite the fact that there are still imperfections in the analytical and evaluation procedures and tools, is a valid opportunity, in the field of design and urban planning, for the recovery and reconfiguration of areas greatly compromised so that the potential underlying them can be restored by reconfiguring an image of the city as a vital node in entangled networks of flows of technology, socio-physical processes and socio-economic relations (Benton&Short 2013, 2).

ANNEX A

The content of the appendix provides a selection of indicators, identified by SuRF[1]UK, to be considered in the remediation process in order to assess its sustainability in relation to its own three domains, environmental, economic and social. The importance of indicators in the decision-making process, aimed at comparing and intercepting the best alternative approach is also underlined within the definition of sustainable remediation as "the practice of demonstrating, in terms of environmental, social and economic indicators, that the benefit of the remediation action is greater than the impact of the action itself and that the optimal remediation solution is selected through a balanced decision path" (CL:AIRE 2010)[2]. An indicator must be measurable, by metrics, or at least comparable, in order to be effective in the evaluation of alternatives. In relation to the domains mentioned above, indicators can be quantitative, as in the environmental context, if expressed with a measurement scale; qualitative if measured by a quality scale compared to the different levels of impacts, as for socio-economic domains. A further and more specific classification of the indicators has been proposed by the European Environmental Agency (EEA, 2009), according to the model (Determinants/Pressure/State/Impact/Response). Determinants are indicators which provide information about environmental pressures and their extent; those of pressure intercept anthropic actions particularly influential on the environment; those of state describe the quality of the environmental components and, finally, impact and response if they refer to actions taken to resolve a given environmental problem with particular emphasis on its impact. While impact and pressure indicators are particularly useful in comparing the performance of different remediation techniques, the response indicators allow monitoring of the effectiveness of the technique during the implementation phase of intervention. Feedback on the effects of a remediation operation provided by each indicator must be given in a simple and comprehensible form and must be able to be applied uniformly to different contexts (SuRF Italy, 2015). The evaluation of each indicator, with respect to the level of accuracy desired as well as the phase of the remediation process to be evaluated, can be done according to the use of different tools, in the form of commentary, checklists and scores, contradictory from particular immediacy, or measurements, much more precise. On the other hand, the evaluation of intercepted options with respect to the various indicators can be carried out in a simple form using qualitative categories, such as "better-equal-worse" (SuRF Italy, 2015). The appendix proposes the categories of indicators that make up the SuRF UK Indicator Set for Sustainable Remediation Assessment (SuRFUK, 2010) able to cover the most common problems in remediation processes and that can be selected by different stakeholders, during the participatory design processes, on the basis of their suitability for the analyses to be carried out in order to achieve previously intercepted objectives.

US EPA | United States Environmental Protection Agency (2010)

Analysis of sustainable principles during a remediation process. Adapted by the author

PROCESS	ENVIRONMENT	SOCIETY	ECONOMY
CHARACTERIZATION	▪ Collect of data to address the treatment and management on-site with an evaluation of risks related to the treatment and aimed to the reduction of contaminated matrices; ▪ Identification of methods to reduce the quantiy of waste and minimise the impacts; ▪ Use of approaches and technologies for field surveys to characterize the site without multiple mobilisations; ▪ Reuse and recycle of materials ▪ Identification of methods to reduce the impacts on the ecosystem; ▪ Develop and improve the conceptual model of the site to identify all exposure paths; ▪ Reduction of movements to and from the site.	▪ Lead an informational campain on the environmental status of the site and on the will to reclaim and reuse it; ▪ Create a list of key contact to facilitate the comunication; ▪ Identification of restored elements of the habitat and other options to reuse the site.	▪ Use of field technologies to reduce the mobilisation of the samples; ▪ Maximise the use of local resource and manpower; ▪ Identify potential incentives for the development of the site.
EVALUATION AND SELECTION OF REMEDIATION TECHNOLOGIES	▪ Evaluation of lower impact on site/in site technologies; ▪ Estimation of the energy use and polluting emissions to compare the performance of alternative technologies; ▪ Verification of the possibility to recovery/create habitat; ▪ Investigate the recycling options for materials generating during the remediation process; ▪ Organize riunions on the project and utilise an electronic report.	▪ Inform the local community on the remediation options and their effectiveness in terms of reduction of the risk.	▪ Determine the cost in the long/short term of each alternatives considerating local community and environmental benefits; ▪ Create wealth for the community (parks, habitat etc…) or link the remediation process to the community economic development plan; ▪ Plan a remediation approch based on the future use of the site.
PLANNING	▪ Identification of low emission technologies and tools that require a lower use of water and energy; ▪ Minimize the impacts on the local natural resources and habitat; ▪ Optimize the use of renewable energy and fuel; ▪ Minimize the transport of polluted materials off site; ▪ Identification of the recycled options of generated materials; ▪ Utilize an approach on site both for the treatment and containment; ▪ Plan a remote monitoring and optimisation systems for long term treatment;	▪ Explain to the stakeholders the remediation process; ▪ Involvement of the authorities in order to evaluate the impact of the options.	▪ Utilize an on site approach to management the contamination to reduce the remediation costs and possible contentious related to the off site approach; ▪ Massimize the reuse of the site, including buildings;
EXECUTION	▪ Minimise operative stand-by; ▪ Controll and reduce the emission of odors, dust, noise and luminous impact; ▪ Activate a monitoring of each cited elements above; ▪ Establish a programm on the waste and materials recycle on site; ▪ Selection of machines and energy sources to minimise the emissions.	▪ Define an esecutive sequence of the works to minimise the impact of the traffic on the local community; ▪ Organise with the local community meetings on the work progresses.	▪ Economic evaluation considering possible benefits for local community; ▪ Maximise the use of local operators for the provision of goods and services.
OPERATIVENESS MANAGEMENT AND MONITORING	▪ Utilise the telemetry to collect data in remote mode to minimise the mobilisation from the site; ▪ Recycle sampling waste; ▪ Identify the minimisation measures of the waste; ▪ Minimise/eliminate the stand-by; ▪ Utilise low power tools, more efficient in terms of consumption; ▪ Utilise local or closed landfills.	▪ Utilise web or other public communication media to involve the stakeholders; ▪ Maximise the use of local goods and services; ▪ Evaluate the acceptance and satisfaction levels of the community.	▪ Utilise an energy efficienty approach to reduce costs; ▪ Utilise field screening systems to reduce transport and laboratory costs; ▪ Implement electronic files.
OPTIMIZING	▪ Maximise the effectiveness and optimise the existing systems to reduce the environmental footprint and in particular the impact on the resource consumption; ▪ Identify efficient and alternative methods or technologies but less consuming in terms of energy and resources.	▪ Show the results to the stakeholders; ▪ Comunicate the achievement of a positive net impact as result of an achieved optimisation.	▪ Maximise the efficency of a system to reduce the energy use, times and operative/maintaining cots.
CLOSING WORK	▪ Ensure the effectiveness of the remediation project through the continuous adaptation of the management practices; ▪ Ensure a correct and proper distribution of main importan information on the project; ▪ Utilise telemetry to transmit data of possible monitorings; ▪ Set an electronic file; ▪ Ensure that the conceptual model and receptord don't change in the time; ▪ Recycle materials and tools remoced from the site.	▪ Preserve the level of dialogue obtained with the stakeholders; ▪ Reconsider regularly community needs in terms of information and possible access to the site; ▪ Report the main important experiences accrued during the project; ▪ Maximise the use of local good and services.	▪ Utilise local staff for monitoring the site after the closure of the project; ▪ Implement the electronic reports; ▪ Utilise field methods and screening to reduce costs related waste; ▪ Utilise an energy efficient approach to reduce costs.

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https://www.eea.europa.eu/it/publications/la-strategia-dell2019agenzia-europea-dell2019ambiente-200920132013-programma-di-lavoro-pluriennale/at_download/file

SuRF Italy. 2015. *La sostenibilità nelle bonifiche.*
http://www.reconnet.net/Docs/SuRF_Italy_Libro_Bianco_rev_Ottobre2015.pdf

Notes

1. SuRF – Sustainable Remediation Forum is a spontaneous group of bodies and companies interested in promoting the use of sustainable practices during the investigation, remediation and subsequent monitoring of contaminated sites. The aim is to balance economic viability with the preservation of biodiversity and the well-being of local communities. The concept of sustainability is applied to the remediation through the involvement of stakeholders in the decision-making process, the uniformity of guidelines and implementation tools, sharing of good practices and finally support for updating the legislation.
Further information are available at https://www.sustainableremediation.org/

2. CL:AIRE (Contaminated Land: Application in Real Environments) is a non-governmental organisation that gathers academics, industry and control bodies related to the issue of remediation of contaminated sites, Surf UK was founded on the site.

SuRF | Sustainable Remediation Forum UK (2011)

Economic Indicator set for sustainable remediation assessment. Source: www.claire.co.uk.

Category		Issues that you may need to consider	Cross-reference to other Indicators
ECON 1	**Direct Economic Costs & Benefits**	• Direct financial costs and benefits of remediation for organisation • Consequences of capital and operation costs, and sensitivity to alteration e.g.: ○ Costs associated with the works (incl. operation and any ongoing monitoring, regulator costs, planning, permits licences) ○ Uplift in site value to facilitate future development or divestment ○ Liability discharge	None
ECON 2	**Indirect Economic Costs & Benefits**	• Long term or indirect costs and benefits, e.g.: ○ Financing debt ○ Allocation of financial resources internally ○ Changes in site/local land/property values ○ Fines and punitive damages (e.g. following legal action, so includes solicitor and technical costs during defence) ○ Financial consequences of impact on corporate reputation ○ Consequences of an area's economic performance ○ Tax implications	**SOC 4** for compliance with local policies/spatial planning objectives
ECON 3	**Employment & Employment Capital**	• Job creation • Employment levels (short and long term) • Skill levels before and after • Opportunities for education and training • Innovation and new skills	None
ECON 4	**Induced Economic Costs & Benefits**	• Creating opportunities for inward investment • Use of funding schemes, ability to affect other projects in the area/by client (e.g. Cluster) to enhance economic value	None
ECON 5	**Project Lifespan & Flexibility**	• Duration of the risk management (remediation) benefit, e.g. fixed in time for a containment system) • Factors affecting chances of success of the remediation works and issues that may affect works, incl. community, contractual, environmental, procurement and technological risks • Ability of project to respond to changing circumstances, including discovery of additional contamination, different soil materials, or timescales • Ability to respond to changing regulation or its implementation • Robustness of solution to climate change effects • Robustness of solution to altering economic circumstances • Requirements for ongoing institutional controls	None

SuRF | Sustainable Remediation Forum UK (2011)

Social Indicator set for sustainable remediation assessment. Source: www.claire.co.uk.

	Category	Issues that you may need to consider	Cross-reference to other Indicators
SOC 1	**Human Health & Safety**	• Risk management performance of the project (long term) in terms of delivery of mitigation of unacceptable human health risks • Risk management performance of project (short term) in terms of duration of remediation works, incl. consideration of: ○ Site workers, site neighbours and the public ○ Remediation works and ancillary operations (incl. process emissions such as bioaerosols, allergens, PM10, impacts from operating machinery/traffic movements, excavations, etc) • Consider both chronic and acute risks	**ENV 1** for issues related to e.g. dust which do not relate to effect on humans **SOC 3** for issues affecting humans (not related to health concerns e.g. amenity)
SOC 2	**Ethics & Equality**	• How is social justice and/or equality addressed? • Is spirit of 'polluter pays principle' upheld with regard to distribution of impacts/benefits? • Are the impacts/benefits of works unreasonably disproportionate to particular groups? • What is the duration of remedial works and are there issues of intergenerational equity (e.g. avoidable transfer of contamination impacts to future generations)? • Are the businesses involved operating ethically (e.g. sustainability of supply chains for inputs to remediation work, lack of transparency in procurement processes)? • Does the treatment approach raise any ethical concerns for stakeholders (e.g. use of genetically modified organisms, illegal labour, bribery or corruption issues)?	None
SOC 3	**Neighbourhood & Locality**	• Impacts/benefits to local areas (tangible amenity changes), including: ○ Effects from dust, light, noise, odour and vibrations during works and associated with traffic, including both working-day and night-time/weekend operations • Wider effects of changes in site usage by local communities (e.g. reduction in antisocial activities on a derelict site) • Changes in the built environment, architectural conservation, conservation of archaeological resources	**ENV 1** for issues related to e.g. dust which do not relate to humans **ENV 4** for impacts of light, noise & vibration on ecology **SOC 1** for anything related to human health considerations **SOC 4** for changes to way community functions & services they can access
SOC 4	**Communities & Community Involvement**	• Changes in the way the community functions and the services they can access (all sectors – commercial, residential, educational, leisure, amenity) • Quality of communications plan • Effect of the project on local culture and vitality • Inclusivity and engagement in decision making process • Transparency & involvement of community, directly or through representative bodies • Compliance with local policies/spatial planning objectives	**SOC 3** for tangible changes to neighbourhoods & regions **ECON 2** for compliance with national policies, legislation, regulatory standards, best practice
SOC 5	**Uncertainty & Evidence**	• Robustness of sustainability appraisal for each option considered • Quality of investigations, assessments (incl. sustainability) and plans, and their ability to cope with variation. Accuracy of record taking and storage • Requirements for validation/verification • Degree to which robust site-specific risk-based remedial criteria are established (*justified* & realistic CSM versus *unnecessarily* conservative and/or precautionary assumptions/data)	None

SuRF | Sustainable Remediation Forum UK (2011)

Environmental Indicator set for sustainable remediation assessment. Source: www.claire.co.uk.

Category		Issues that you may need to consider	Cross-reference to other Indicators
ENV 1	**Air**	• Emissions that may affect climate change or air quality, or considerations that may allow overall reduction in impact on climate change, e.g.: ○ Greenhouse gases (e.g. CO_2, CH_4, N_2O, O_3, VOCs, ozone depleting substances, etc.) ○ NO_X, SO_X ○ Particulates (especially PM5 and PM10)	**SOC 1** for issues associated with human health **SOC 3** for issues affecting humans (not related to health concerns)
ENV 2	**Soil & Ground Conditions**	• Changes in physical, chemical, biological soil condition that affects the ecosystem function, goods or services provided by soils (these may be improvements OR deteriorations). May include: ○ Soil quality (chemistry) ○ Water filtration and purification processes (incl. sediment generation or reduction) ○ Soil structure and/or organic matter content or quality ○ Erosion and soil stability (incl. drainage) ○ Geotechnical properties (incl. compaction) ○ Impact/benefits to sites of special geological interest e.g. SSSIs and geoparks	**ENV 4** for Ecology within this ecosystem
ENV 3	**Groundwater & Surface Water**	• Changes in the release of contaminants (including nutrients), dissolved organic carbon and/or silt/particulates (these may be improvements OR deteriorations), affecting: ○ Suitability of water for potable or other uses (based on long-term protection of available water resources) ○ Legally binding environmental objectives e.g. Water Framework Directive ○ Biological function (aquatic ecosystems) and chemical function ○ Mobilisation of dissolved substances ○ Marine, brackish/transitional, freshwater waters • Effects/benefits of water abstraction resulting from the remediation process or its outcome, e.g. Changing river levels or water tables • Issues associated with flooding (e.g. increase risk of, or protection from, flooding	**ENV 4** for Ecology within this ecosystem **ENV 5** for any water abstraction use or disposal issues
ENV 4	**Ecology**	• Effects on ecology (excluding ecological impacts considered in ENV 2 and 3), including effects on the following (these may be benefits OR impacts): ○ Flora, fauna and food chains (esp. protected species, biodiversity, SSSIs, alien species) ○ Significant changes in ecological community structure or function ○ Effects of disturbance (e.g., light, noise and vibration) on ecology ○ Use of equipment that affects/protects fauna (e.g. bird/bat flight, or animal migration)	**ENV 2** & **ENV 3** for soil and aquatic ecosystems **SOC 3** for impacts of light, noise & vibration on humans
ENV 5	**Natural Resources & Waste**	• Impacts/benefits for: ○ Land and waste resources ○ Use of primary resources and substitution of primary resources within the project or external to it (including raw and recycled aggregates) ○ Use of energy/fuels taking into account their type/origin and the possibility of generating renewable energy by the project ○ Handling of materials on-site, off-site and waste disposal resources ○ Water abstraction, use and disposal	**ENV 3** for issues associated with Groundwater and Surface Water not linked to abstraction use or disposal

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Notes

1 European Environmental Agency (EEA) is an European Union Agency responsible for collecting reliable and independent information on the environment. The provision of data and information allow the EU the Member states to best focus the economic – environmental policies to a more sustainable approach. For further information see the EEA website available at https://www.eea.europa.eufall
2 Joint Research Center (JRC) is the Commission's in-house science service which provides scientific and technical support to the planning, development, realisation and supervision on the European policies. JRC has seven research centers located in five Member States of the Union (Belgium, Germany, Italy, Netherlands, Spain). For further information see the JRC website available at https://ec.europa.eu/
3 The Environmental Matrix identifies the distinctive features of the landscape and environment. The environmental components, also defined Environmental Matrices, are categories of elements clearly identifiable making up the environment. They are aimed to provide to the evaluator necessary information to characterise natural, social, landscape and economic environment. They represent the totality of complex structures of the states of matter, gaseous, soild and liquid. Definition available in italian version at hwww.arpa.piemonte.it/approfondimenti/glossario/matricie-ambientale
4 Test Protocol for determining the Background Value of metals and metalloids in the soil of Site of National Interest is available in italian version at http://www.isprambiente.gov.it/files/temi/tec-valori-di-fondo.pdf while the italian definition is available at https://www.arpal.gov.it/homepage/suolo/bonifiche/valore-di-fondo-naturale.html
5 Environmental impact, according to the definition involved in the Lgs. D. 152/2006 art.5 c.1, c (mod. from the art. 2, c. 2, lgs. D. n. 128 del 2010) means the qualitative and/or quantitative alteration, direct and indirect, short and long-term, permanent and temporary, single and cumulative, positive and negative of the environment, understood as system of relationships between anthropic, naturalistic, physico-chemical, climatic, landscape, architectural, cultural, agricultural and economic factors, as a result of the actualisation on the territory of plans or programs or projects at the different stages of their implementation, management and disposal, as well as any malfunction.
6 Ecosystem services are, according to the Millennium Ecosystem Assessment (MA, 2005), the multiple benefits provided by ecosystems to mankind. The Millennium Ecosystem Assessment describes four main categories of ecosystem services, life support (such as nutrient cycle, soil formation and primary production); supply (such as food production, drinking water, materials or fuel); regulation (such as climate and tidal regulation, water purification, pollination and pest control); cultural values (including aesthetic, spiritual, educational and recreational).
7 Federal Remediation Technologies Roundtable (FRTR) was established in 1990 and it works to build a collaborative atmosphere among federal agencies involved in hazardous waste site cleanup and it collaborates with the U.S. Environmental Protection Agency (EPA). Further information are available to https://frtr.gov
8 In 2004, European policies have also helped to encourage the use of these approaches through a series of initiatives such as the Environmental Technology Action Plan and the European Coordination Action for Demonstration of Efficient Soil and Groundwater Remediation, with the main objective of promoting cooperation, exchanges of experience, identification of objectives and development of common strategies. The first measure is designed to encourage greater use of environmental technologies, while the second one, also known as EURODEMO, is a field-based technology demonstration platform for soil and water management and it is an important vehicle for achieving shared European sustainability objectives. In short, the two initiatives aim to identify and develop actions to enable the European Union to achieve a long-term improvement in the quality of life through the creation of sustainable communities. The ultimate aim is for European communities to be able to manage and use resources efficiently, exploit the potential for ecological and social innovation within the economy and ensure ownership, environmental protection and cohesion. (EU, 2019) Further information are available at the web site https://ec.europa.eu/environment/eussd/.
9 For further information, see Appendix A containing the table Analysis of sustainability principles during a remediation process, elaborated by the United States Environmental Protection Agency-US EPA in 2010 and adapted by the author.
10 For further information, see Appendix A containing the table Analysis of sustainability principles during a remediation process, elaborated by the United States Environmental Protection Agency– US EPA in 2010 and adapted by the author.
11 For an in-depth consultation of the indicators selected in the context of a remediation process, see Appendix B, which contains the Economic Indicator set for Sustainable Remediation Assessment retrieved at: https://www.claire.co.uk and adapted by the author.

04

Experiments of Eco-Innovation

Solutions of remediation developed in co-creation

A brief introduction

Just over 3% is the footprint of cities on the planet (UNO, 2018). A seemingly insignificant percentage in relation to the global earth surface. Yet cities are responsible, according to a recent report made by UNO, World Urbanisation Prospects[1], for 76% of global energy consumption and 71% of global CO_2 emissions. These numbers are relevant to focusing on urban space as an important inflection point to implement a radical change involving a transition from a linear city models - understood as a waste producer - to circular metabolic patterns and therefore more sustainable. By extension of meaning, the term waste, in reference to the current, amorphous and chaotic city shape, also includes all those fragile, vulnerable, degraded and contaminated spaces interspersed in the urban and peri-urban fabric of most conurbations, exactly WL. With regard to these areas and their possible conversion into a circular recycling perspective, reclamation is a preliminary and indispensable phase of the landscape project, as the only action capable of enabling the future safe use of the site considered to be contaminated. Compared with the strategies of prefigurable action to restore value of use and traces of identity in fragments of more marginal cities, **how can reclamation be a guiding criterion and strategic material for redefining the role of these areas within the metropolitan context?** Actually, taking action on the roughest parts of cities, where contamination of environmental matrices has precluded all development, implies a reflection on remediation approaches. Going beyond the traditional sectoral logic, remediation strategies need to be placed in a holistic and transcalar dimension to bring innovation and change in the culture of technical project, in terms of product but especially process. Talking about reclamation in the landscape regeneration project implies the identification of nature-based, eco-innovative and site-specific solutions to be incorporated within more sustainable and delineable strategies of action. **Which methodology is most appropriate for their identification? What are the reliable urban scenarios that could be envisaged in relation to these approaches, also in terms of landscape reconfiguration?** Agreeable conditions for the identification of these strategies are verifiable in fertile territorial contexts of experimentation, change and encounter, called Living Labs (ENOLL, 2016). In reality, these virtual places are laboratories of participated planning which combine different competences, also technical, coming from disparate stakeholders, including the final users. Transforming the project space into a public place and, intersecting nature-based solutions on the different scales and the anthropic dimension leads to channelling towards territorial projects based on open and integrated visions. In this light, remediation, far from being mere technical intervention within traditional mechanical planning, is configured as new material of the landscape project, more performing, organic and dynamic (Jakob, 2009), especially within processes involving local communities. This line of action is aimed at improving the resilience of the contexts and, at the same time, strengthen the intrinsic and strong link between urban space and society. These unconventional strategies of environmental regeneration, aimed specifically at the decontamination and creative

Former Bourbon gunpowder factory, Scafati (Salerno)
Photo taken by the author, 2015

reuse of pieces of compromised cities, and are incrementally expanding planning models. In the light of the above, this chapter investigates the case of the regeneration of the Buiksloterham area, in the Netherlands, and the European research project REPAiR, aimed at defining new geographies of landscapes restoring ecosystem, social and cultural balances through circular approaches, starting from the existing resources. Starting from a process of identifying the territorial dynamics that have crossed the site, both case studies propose strategies and results of experiments outlined in living lab, with local communities, activated on the territory. The operational line allows developing, in the end, design vision through minimum interventions to lead WL to new life-cycles. Over and above the problems encountered in connection with degradation, contamination and inflexible bureaucracies, both case studies represent a clear example of how it is possible to apply a reversal of sign to territorial realities apparently irreversible. In the same way, also the other reference cases, set out in summerised form at the end of the chapter, are a proof of how a wasted landscape can be considered again a vital and dynamic nodes within metropolitan contexts.

4.1 PROSPECTS FOR ECO-INNOVATION

The role of Nature-based Solution in the remediation processes

Land is often the most valuable resource in cities (Williams, 2019). Anthropological supremacy over the ecosystem resulted in a pathological degeneration of the relationship between man and nature (Madau, 2014). This dominance has inevitably led to the alteration of the balance and essential ecosystem services in the regenerative processes of cities. Within territorial contexts, there may be many drivers of disposal and degradation, as unlimited and not planned urban growth, waste emergencies, disproportionate consumption of non renewable resources and so on. Among them, the contamination of environmental matrices, in particular soil, has a relevant impact on the sustainability, liveability and global competitiveness of the metropolitan contexts. Prevent the degradation of ecosystems, envisaging the restoration of about 15% of them (EU, 2015), and place the soil resource in a circularity perspective, is one of the priority objectives of the European Union as well as providing a strategic line of action, more punctually and therefore at lower scales, to increase the attractiveness of the territories compared to the triple bottom line (Lee, 2007) of the sustainable approach. Considering the city as a complex and artificial heterotrophic system (Williams, 2019) where resource consumption occurs in a variety of sectors and at multiple scales of intervention, the challenge facing urban planning is essentially reflected in the identification of flexible design solutions for contaminated contexts, promoters of adaptive and innovative changes in a multisectoral and multiscalarity perspective (Russo, 2015). These solutions can also be intercepted in the context of sustainable environmental reclamation, such as processes that are essential to soil decontamination and regeneration strategies aimed at its usability. These operating devices, at the same time, can positively influence the economic and social dimensions of cities and a more conscious transition to circular optics. The proactive shift of urban metabolisms from linear to circular modes, highlighted some issues related to urgent changes to be implemented in the technological but also environmental, economic and socio-political sphere (REPAiR, 2018a).

This impelling operational rollover finds in the Eco-Innovation concept (European Commission, 2011) and more specifically in that of Nature-Based Solutions (European Commission, 2015), a preferential intervention approach.

Eco-innovation (Fig. 15) refers to "*all forms of innovation – technological and non-technological – that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimising the use of resources. Eco-innovation is closely linked to the way we use our natural resources, to how we produce and consume and also to the concepts of eco-efficiency and eco-industries. It encourages a shift among manufacturing firms from end of pipe solutions to closed-loop approaches that minimise material and energy flows by changing products and production methods, bringing a competitive advantage across many businesses and sector* "(EU, 2012:2).
This is the definition most widely accepted among other proposals in the literature and from which it is easy to understand that these are practical measures aimed at restoring the integrity of environmental balances while simultaneously encouraging innovation in terms of productivity and competitiveness, in accordance with ecosystem requirements.

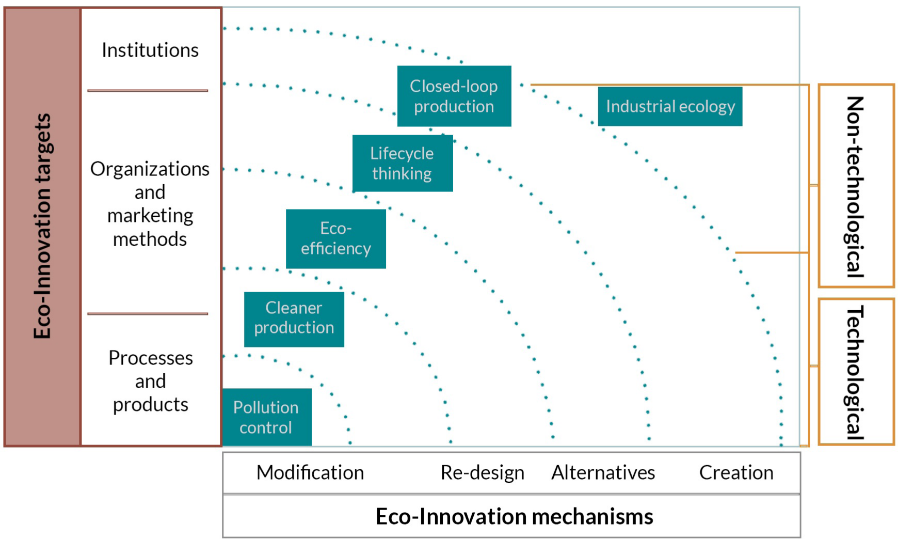


Fig. 15
Conceptual relation between sustainable manufacturing and eco-innovation.
Source: OECD, 2005.
Graphic adapted by the author

The Eco-Innovation is a multi-aspect concept (Hojnik, 2017), applicable to different spatial dimensions, intended to promote the creation of an ecological product, understood as goods and/or services, the realisation of an ecological process, interpreted as method and/or procedure, and the management of an ecological organisation, aimed at the distribution of responsibility (Cheng, Shiu, 2012). In short, the concept of Eco-Innovation tends to encompass a win-win situation that is well suited to both entrepreneurial and environmental logic, in a long-term perspective (Horbach, 2008). Among the possible eco-innovations, there are some inspired and supported directly by nature and that in the European panorama, in the late 2000s, were labeled as **Nature-based Solutions (NbS)**. They are innovative solutions aimed at emphasizing the approaches and modalities according to which the apparent antithetical relationship between nature and development sectors are being oriented unanimously, in the urban context, towards shared lines of action.

Nature-based Solution refers to living solutions inspired by, continuously supported by and using nature designed to address various societal challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits (Janzen, Maginnis, 2016).
NbS is a blanket term encompassing a range of ecosystem approaches[2] that can be implemented individually or integrated with other solutions by combining economic aspects, governance, regulation and social innovation. The strength of these solutions, of which effectiveness can only be seen in case of adaptivity to local contexts (site – specif), resides in the use of natural systemic functions and processes to ensure the improvement and protection of natural capital[3].
The objectives of the NbS are multiple, from the adaptation and mitigation of climate change and the restoration of degraded ecosystems, to the increase of the sustainable component in urbanisation processes. Compared to the latter target, it is estimated that by 2050 population growth in cities will increase by 82% (European Commission, 2015) requiring the adoption of measures to meet this additional challenge by supporting economic growth and, at the same time, environmental improvements in terms of the attractiveness and safety of urban environments. The identification of NbS, in the regeneration of WL annihilated by degradation and contaminated, is particularly supported globally for reasons related to both environmental and socio-economic aspects. From an environmental point of view, NbS can provide innovative ecosystem approaches, such as in the case of adaptive phytoremediation in remediation processes which, using local vegetation species, contributes to soil decontamination and land resilience. With a view to urban regeneration, they are solutions that also provide relevant input about the design of the public space, making it more functional and attractive to local and neighbouring communities, contributing to the enhancement of citizens' well-being. Such an approach is also economically positive, as it increases the value of a WL, considered marginal, and contributes to the emergence of new business models that also contribute to the increasing decrease in local unemployment. In conclusion, through the implementation of regenerative and remediation strategies based on the identification of NbS, WL can be considered, from an urban and circularity perspective, as innovative hubs, in which to experiment and test NbS through participatory approaches that are an important factor for the long-term effectiveness of solutions.

4.2 INNOVATIVE CATALYSTS FOR SUSTAINABLE CLEAN-UP PURPOSES

The Urban Living Lab methodology

NbS, or more generally Eco-innovative solutions - EIS, aimed at regeneration and remediation of WL are effective in the long term if they are identified in prolific contexts of experimentation in which the involvement of stakeholders, in particular of the end users, is placed like relevant component. Considering cities, and more specifically the WL, as drivers of innovation within urban planning processes, it is possible to contribute to their resilience by directly acting on the metabolisms of the territorial contexts in which they are placed, through the introduction of elastic, retroactive cycles with socio-ecological multifunctionality to better react to external pressures (Cerreta & Panaro, 2017). Similar approaches are explored and analysed, for the identification of appropriate solutions, within open and collaborative decision-making processes in which the concept of innovation is directly applied. These experimental ecosystems, which are a valid methodology to be adopted to facilitate a transition towards sustainability, have been defined in the European context as Living Lab (LL).

Living Labs are defined as "*user-centered, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings*" (ENOLL 2016,12)[4].

With specific reference to urban contexts, the traditional definition of LL has been adapted to form a kind of evolution of the primigenial concept and has been coined the definition of **Urban Living Lab** (ULL) in reference to strictly local experiments, of participatory nature, for the development, implementation and testing of innovative solutions within real life contexts.

By definition, an ULL "*is a local place for innovative solutions that aims to solve urban challenges and contribute to long-term sustainability by actively and openly co-constructing solutions with citizens and other stakeholders*" (Steen & van Bueren 2017, 5). Despite the definition, susceptible to implementation or changes, the methodology and organisational scheme underlying this type of approach is unchanged and it is based on the model of the quadruple helix (Arnkil et al. 2010). The above mentioned model ensures the achievement of innovations through the interaction between knowledge and information, human resources, financial capital and institutions (Carayannis & Campbell 2016). In this light the emphasis is placed on the four substantial components of the decision-making process, People – Public- Private- Partnership (P4) (Dupont, Morel, & Guidat, 2016). Regarding the methodology, a first definition and recognition of the steps to be considered in order to achieve an optimal result in the co-creation process was developed by the FormIT method (Bergvall-Kåreborn, Holst, & Ståhlbröst, 2009) (Fig. 16), a human-centred approach to develop innovations (Evans, P., Schuurman, D., Stahlbrost, A. and Vervoort, 2017). The methodology is articulated, using a spiral shape that justifies the iterativity of the process, in three main phases, Design concepts, Design prototypes(s) and Innovation Design. The first phase, which takes priority over citizens' needs for a solution that has been identified or still to be intercepted, is based on the collection of information, for example through direct narration, which are subsequently classified and prioritised for a first draft of ideas in conceptual form. The second step, using methods such as focus group, co-design, interviews based on the evaluation of concepts developed during the first phase, is aimed at the realisation of approximate models, precisely prototypes of innovation. The third phase involves the evaluation of the developed prototype (Holst, Ståhlbröst, & Bergvall-Kåreborn, 2010). Beyond these three phases, in the methodological structure, two more have been added, referring respectively to the overall project planning (Evans, P., Schuurman, D., Stahlbrost, A. and Vervoort, 2017) and the marketing of the final obtained result, understood as an activity, benefit or object. In conclusion, the LL methodology, or ULL as it may be called, is configured as an effective catalyst of innovation, productivity and competitiveness for the testing of innovative NbS aimed in particular to the reclamation of WL, as it will later emerge from a case study selected in Amsterdam, and an application case developed in peri-urban context in the Metropolitan Area of Naples. The proposed methodology is also particularly welcome as a driver of behavioural changes in local communities towards more sustainable and circular viewpoints.

4.3 CIRCULAR PLANNING FOR WASTED LANDSCAPE IN TRANSITION

The Dutch cases of Buiksloterham industrial area and De Ceuvel district

The notion of sustainability, together with that of circular economy and NbS, are concepts in which there are forward-looking perspectives for urban planning and in which WL takes on the role of vectors of innovation to promote a profitable transition of metropolitan contexts towards an increased resilience. Very often, comparable objectives can be abstract and difficult to apply for obstacles of various kinds, first of all economic and bureaucratic aspects. By contrast, a case study selected in Netherlands, namely Buksloterham area and the De Ceveul distict, is a tangible example of highly innovative, sustainable and circular urban living lab, totally dispels myths demonstrating a perfect environmental and social integration in relation to the metropolitan context in which it is located.

4.3.1 Buiksloterham, the city of Amsterdam starts again from here!

Buiksloterham has become THE place for research and experiment on circularity in a real-life context; an example for the Netherlands, and beyond. […] The process still has many rough edges, buti t is very special that we work together to implement new and integrated sustainable solutions on such a scale.

(Saskia Müller, Quartermaker Foundation Stadslab Buiksloterham Source: Urban Living Lab. A living lab way of working - AMS[5])

Buiksloterham, located in the northern part of the city of Amsterdam, was a polder formed after the deposit of excavated materials coming from neighboring areas of Amsterdam which, until the twentieth century, retained a purely agricultural use, which

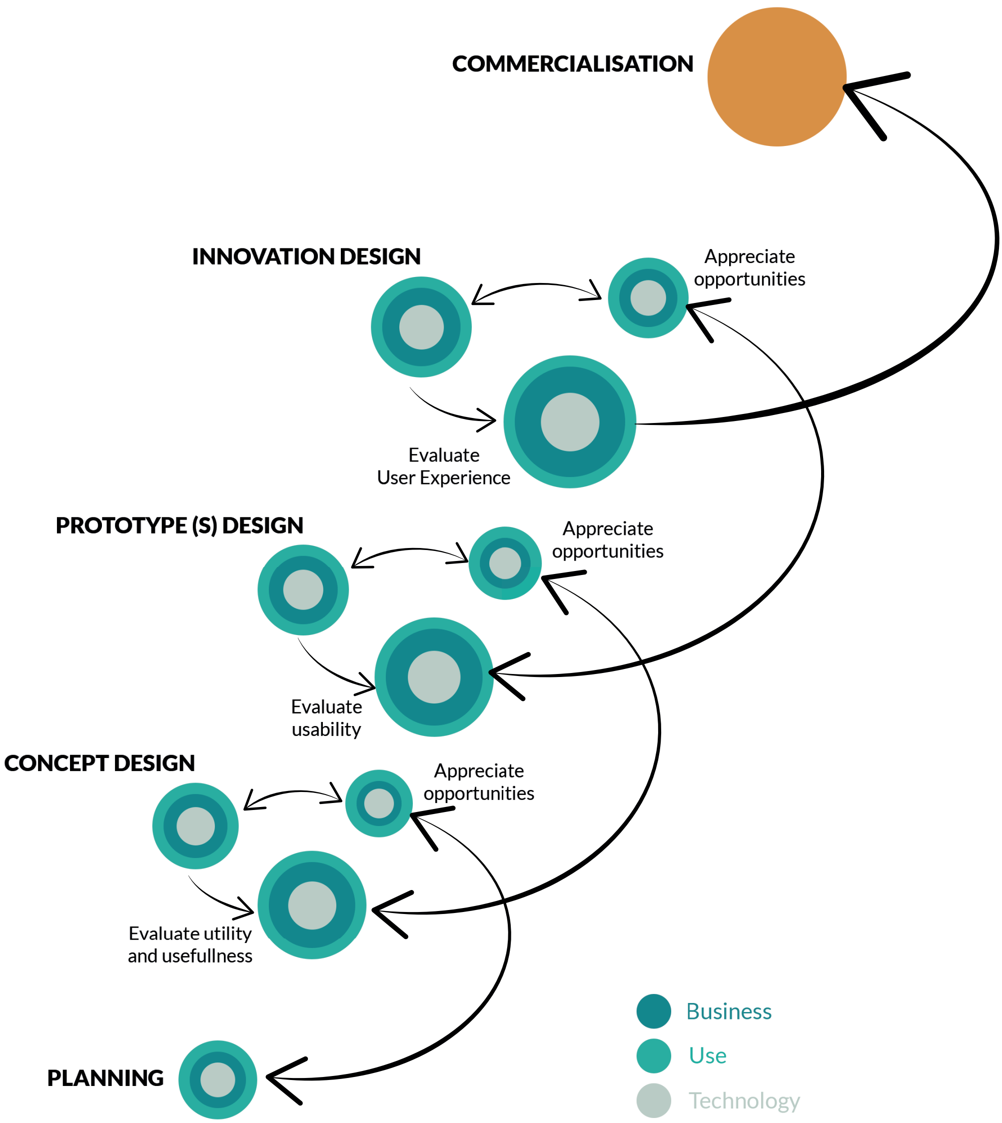
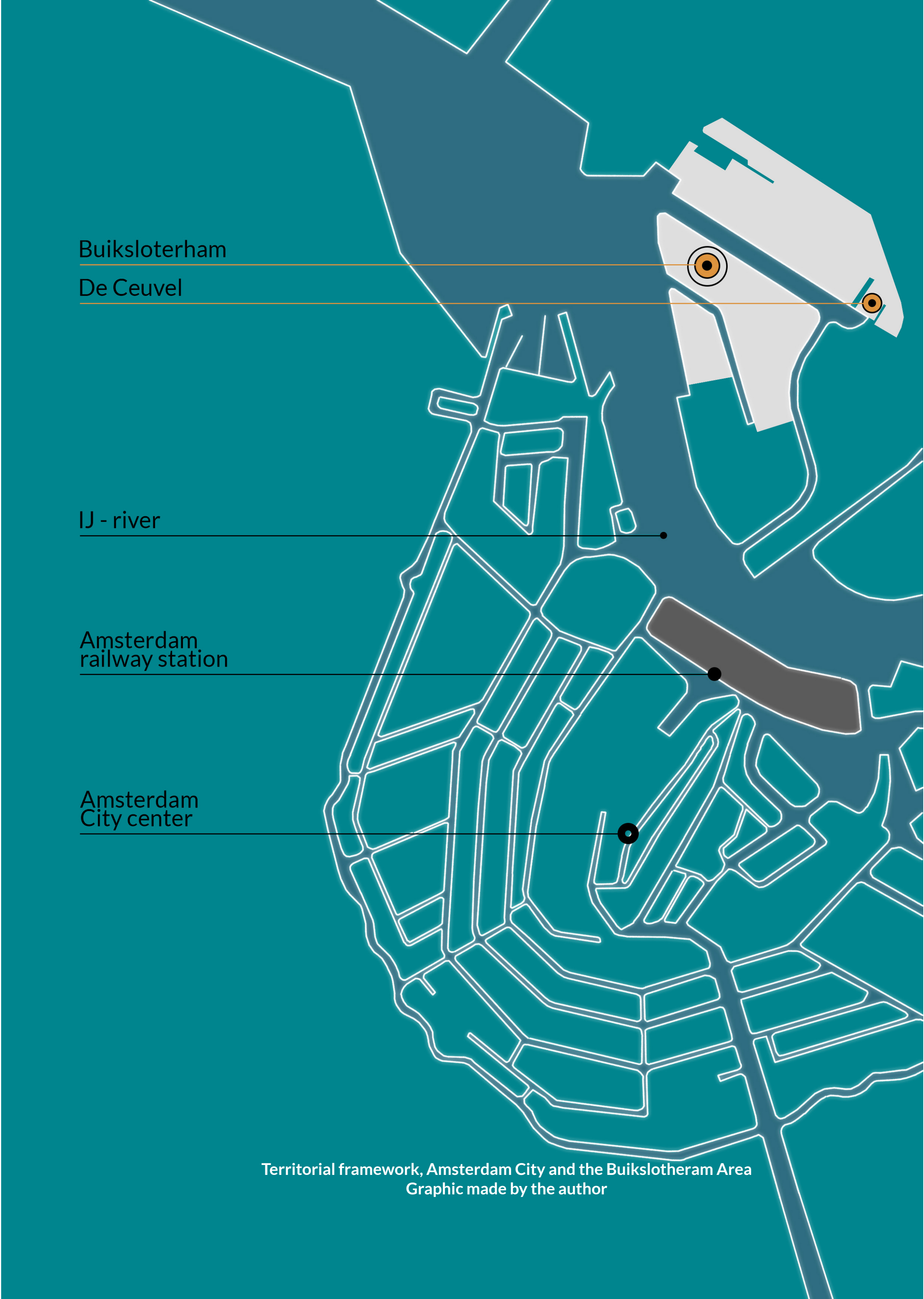


Fig. 16
FormIT methodology. Source: Ståhlbröst & Holst, 2012. Graphic adapted by the author

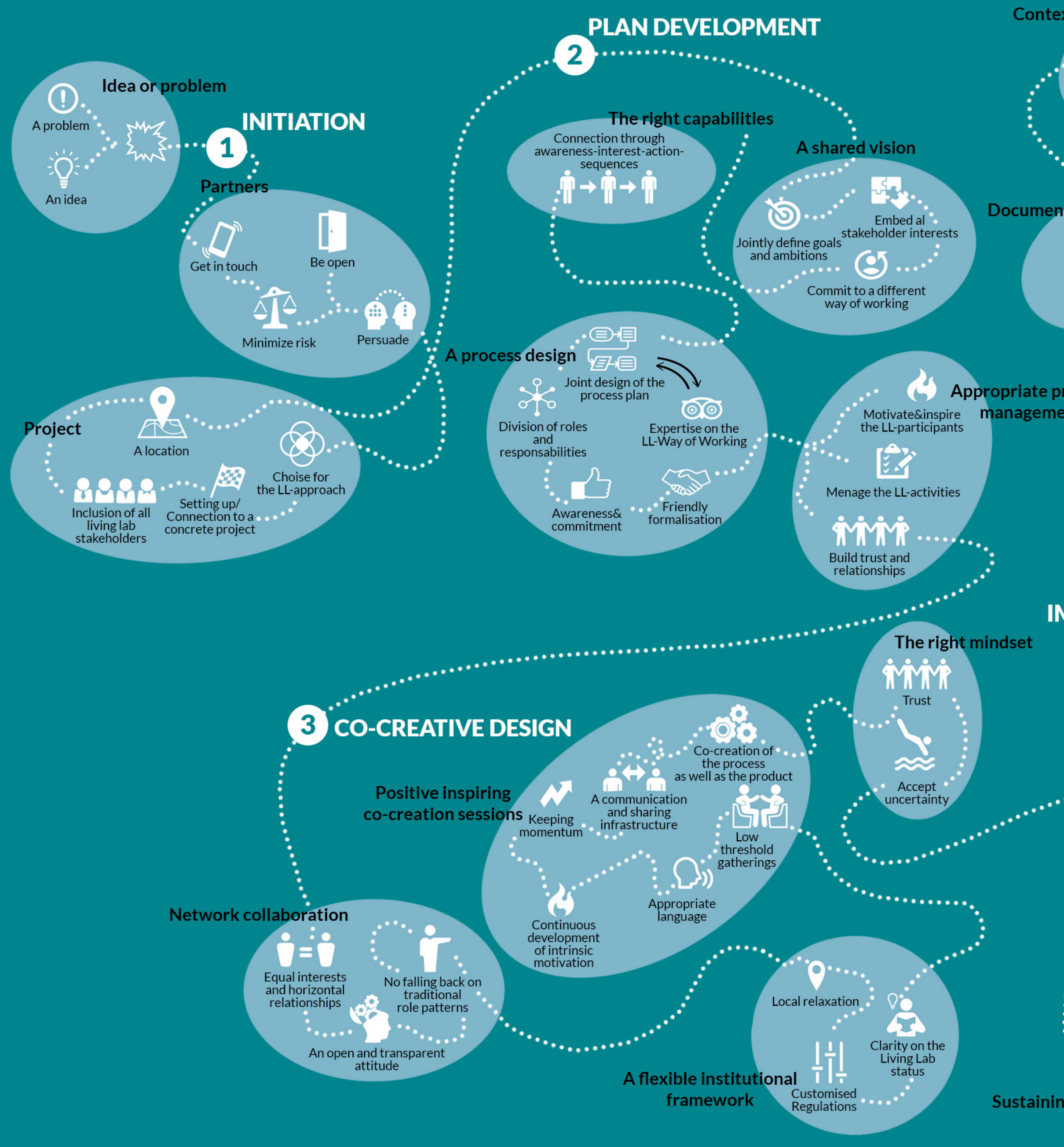
took over another markedly industrial one. It became part of the Municipality of Amsterdam only after the construction of the North Sea Canal, when the construction of housing for the workers of the industries that insisted on its soil began on the site. In the last two decades, the removal of factories has given the area its present appearance (Gladek, van Odijk, Theuws, & Herder, 2014). Currently Buiksloterham has an extension of about 100 hectares, of which 300000 square metres of land occupied and other consisting of empty plots. What emerges is the perfect proportion, at a ratio of 1/3, of the division of the area between communal, private and leased land. By the river, the historic city centre of Amsterdam is just minutes from the old industrial area of Buiksloterham, also accessible through the North-South metro line recently finished. Just beyond the IJ River, until the end of the 2000s, a tongue of contaminated land delineated its northern shore, and for several kilometres the landscape degradation was emphasised by the desolate flatness that the brownfield pattern, in succession, returned to the sight of those who watched it from the ferry. But, shortly thereafter, when the hopes of a regeneration of the area had given way to resignation, the fate of the site was directed towards a brighter outlook. In 2006, the Municipality of Amsterdam decided to intervene on the entire northern bank of the river, through a general recovery plan, which was never approved due to the high costs but was nevertheless an effective tool for defining guidelines, including urban regeneration of four neighborhoods, NDSM, Overhoeks, Buiksloterham and Hamerstraat-Gebied (Gladek et al., 2014). After the first slowdowns due to the financial crisis in 2008, the redevelopment of the area resumed thanks to the resourcefulness of a particularly close-knit community and some local entrepreneurs and professionals who, through a living lab approach, started innovative experiments within a district that currently ranks as the most circular in Europe. During the co-creation process, feedback from the different stakeholders was conveyed in a shared vision of the area, which was then translated, in 2015, in the Circular Buiksloterham Manifesto, signed by over 20 partners, among them the Municipality, research Institutes, Enterprises, Companies and residents (Steen, K., van Bueren, 2017) and which includes an action plan, concrete outcome of interactions with local stakeholders. The actions involved in the plan have been marked on the basis of a prioritisation scale that takes into account their real urgency, possible impacts and the adaptive component with respect to the context. The two approaches used to classify interventions refer to a systemic and technical dimension. The first one includes the process, and therefore the implementation of the Urban Living Lab methodology, aimed at establishing a fertile climate of exchange of ideas and opinions, for the definition of an organisational structure and inclusive governance, who then distributes responsibility to each order and level of the involved stakeholders (Gladek et al., 2014). On the contrary, the technical sphere concerns the operational part which takes the form of a series of actions aimed at the ecological and socio-economic regeneration of the area, including local renewable energy production, natural water management, soil reclamation, gentle mobility and implementation of local metabolism (Gladek et al., 2014). For the relevance of the topics, the dissertation in this section will deepen more questions inherent to the methodology used for the regeneration of the area and the reclamation of the soils with consequent prefiguration of returnable urban scenarios through the use of NbS and other techniques with low environmental impact in complete respect of the principles of sustainability.

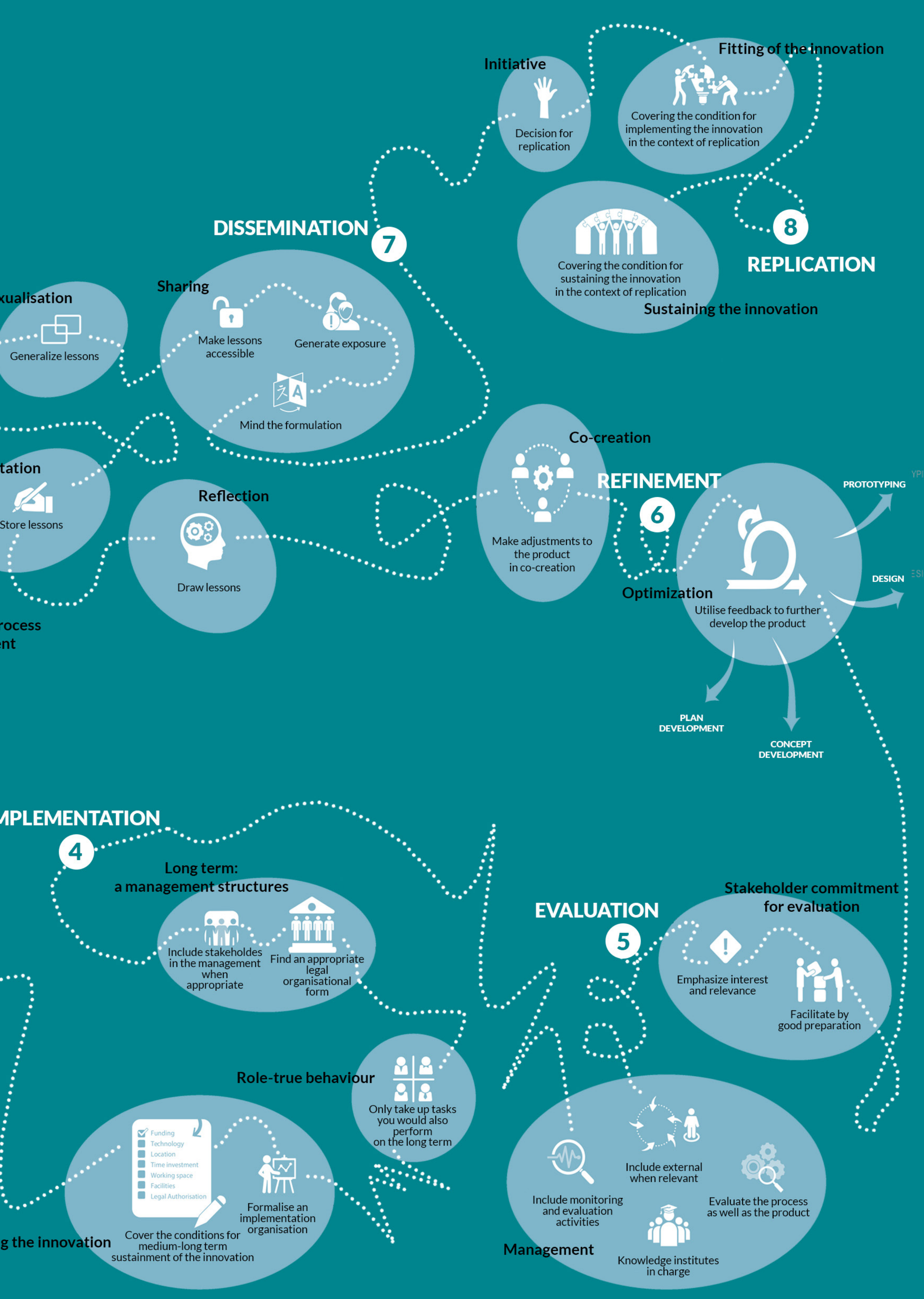


Territorial framework, Amsterdam City and the Buikslotheram Area
Graphic made by the author

The Urban Living Lab methodology

Source AMS - Amsterdam Institute for Advanced Metropolitan Solutions, 2017
Grphyc adapted by the author




Initiative
Decision for replication
Fitting of the innovation
Covering the condition for implementing the innovation in the context of replication
Covering the condition for sustaining the innovation in the context of replication
Sustaining the innovation
8
REPLICATION
DISSEMINATION
7
Sharing
Make lessons accessible
Generate exposure
Mind the formulation
xualisation
Generalize lessons
tation
Store lessons
Reflection
Draw lessons
rocess
ent
Co-creation
Make adjustments to the product in co-creation
REFINEMENT
6
Optimization
Utilise feedback to further develop the product
PROTOTYPING
DESIGN
PLAN DEVELOPMENT
CONCEPT DEVELOPMENT
MPLEMENTATION
4
Long term: a management structures
Include stakeholdes in the management when appropriate
Find an appropriate legal organisational form
Role-true behaviour
Only take up tasks you would also perform on the long term
Funding
Technology
Location
Time investment
Working space
Facilities
Legal Authorisation
Formalise an implementation organisation
Cover the conditions for medium-long term sustainment of the innovation
g the innovation
EVALUATION
5
Stakeholder commitment for evaluation
Emphasize interest and relevance
Facilitate by good preparation
Include external when relevant
Include monitoring and evaluation activities
Evaluate the process as well as the product
Knowledge institutes in charge
Management

4.3.2 Play Buiksloterham! Triggering circular forms of urban planning

The systemic dimension, as mentioned above, is expressed through the application of the Urban Living Lab methodology, as a simulation game among local stakeholders, initiated by the CityLab organisation of Buiksloterham. The Municipality of Amsterdam was the main promoter and supporter of the initiative, despite its purely experimental character, providing funds for it to finance sustainable projects and the regeneration of infrastructure and public spaces (Costa, 2017). The methodology, proposed by AMS, one of the four research entities active within the Urban Living Lab, is divided into eight phases, each one with precise conditions to follow for experimentation to be effective (Steen, K., van Bueren, 2017). The first step is defined initiation and it involves the identification of a problem or an idea to be submitted for the definition of a concrete project, existing or ex novo, to be developed with the involved stakeholders, for the identification of solid and shared objectives to be pursued. This phase is followed by the development plan aimed at identifying a shared vision of design and the subsequent distribution of competences among all the involved parties so as to develop a plan to guide the co-creation process in which each one, spontaneously, assumes a role with its responsibilities. This phase also calls for funding issues to be addressed, which should be ensured at the starting point of the process, including how the parties involved intend to contribute. Finally, it is important, without resorting to a hierarchical structure, to monitor the activities planned within the process, resources and active parties. The co-creating design follows, aimed at the realisation of a prototype using almost free tools and methods. Local stakeholders, organised in accordance with horizontal relations, thus without any priority being given to each other, develop the final product on the basis of practical questions and then also on the basis of purely legal issues. The latter aim at intercepting regulatory limitations on the development of innovative projects based on circularity principles as well as proposing the inclusion of Living Lab methodology in municipal regulations for the development of co-creative plans. In the case of Buisksloterham, in fact, the local stakeholders have claimed the imperative need to adapt the regulatory instruments proposing that within the same are exclusively carried out objectives to be pursued without defining the modalities, in an effort to allow greater flexibility in achieving innovation (Costa, 2017). The implementation and evaluation phases are focused on the improvement and sustainability of the solution in the short and long term. This purpose is achievable assessing the relevance and full compliance of the solutions with the objectives set in the beginning, as well as the possible impacts on local contexts, both from a conceptual and technical point of view. In this evaluation phase, stakeholders can also formulate indicators to verify the reliability and effectiveness of a solution. The last three steps are on refinement, dissemination and replication (Steen, K., van Bueren, 2017). The refinement justifies the iterative character of the approach by providing non-substantial improvements to the project also in the final phase; dissemination is aimed at the collectivisation of information, for example through workshops and seminars, to promote greater knowledge of the project and the methodology adopted with a view to the reiteration in other contexts.

This last point is the hinge around which the last phase rotates, the replicability that, more than all, constitutes concrete and reliable evidence of the feasibility of reproducing the project in other metropolitan realities.

4.3.3 Year 2034, the games will be done!

The deadline for the conclusion of this ambitious urban retrofit project is set at 2034. One of the priority objectives of the Action Plan is soil reclamation. Approximately 80% of the soils in the Buiksloterham area are contaminated. We are talking about a contamination, at best, by heavy metals and mineral oils and with a spatial extension of 15 hectares, equal to 15% of the total area (Gladek et al., 2014). Due to the wide expansion of the contamination, the Plan provides remediation only for some of these plots. The selection was made on the basis of the concentration of contaminant present in the environmental matrix and on the basis of budgetary subdivisions required by the City of Amsterdam. For the reclamation of the site, according to the report, the Municipality has allocated 31 million euros, of which 7 million euros for the operations particularly urgent and 24 million euros for reclamations proposed on the basis of projects. On the basis of these provisions, some of the land has been completely fenced so that it can be used in any way, due to the danger of contamination requiring intensive remediation; others, however, moderately compromised, will be subjected to biological treatments facilitating the temporary use of the area by the local community, and thus support the creation of a flexible public space. The remediation approach, for soils with slight contamination and which, therefore, did not require urgent intervention measures, provided, within the Buiksloterham area, the tree planting species suitable for phytoremediation actions, along the road perimeters of the whole district (Fig. 17).

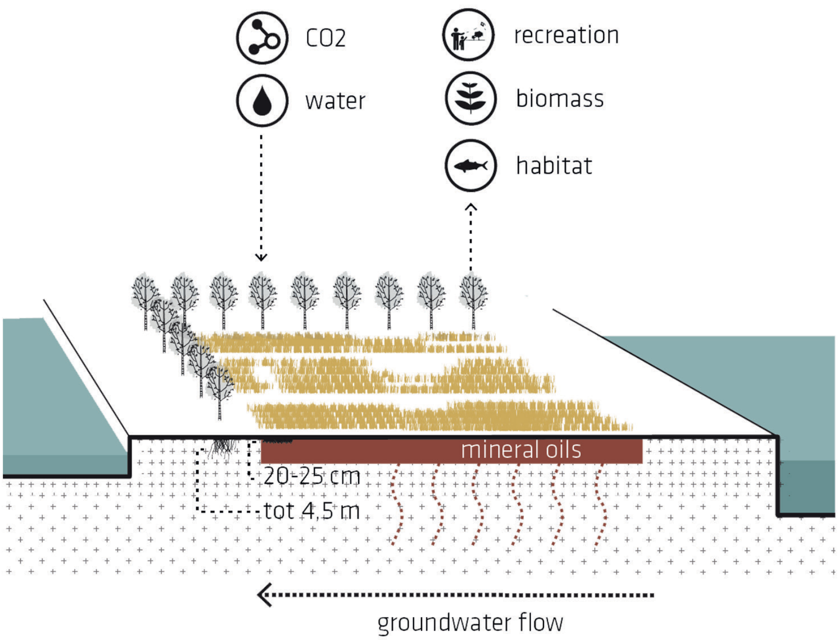


Fig. 17

Phytoremediation process on site. Source: Metabolic&DELVA Landscape. 2017. Circular Cities. Designing post-industrial Amsterdam The case of Buiksloterham

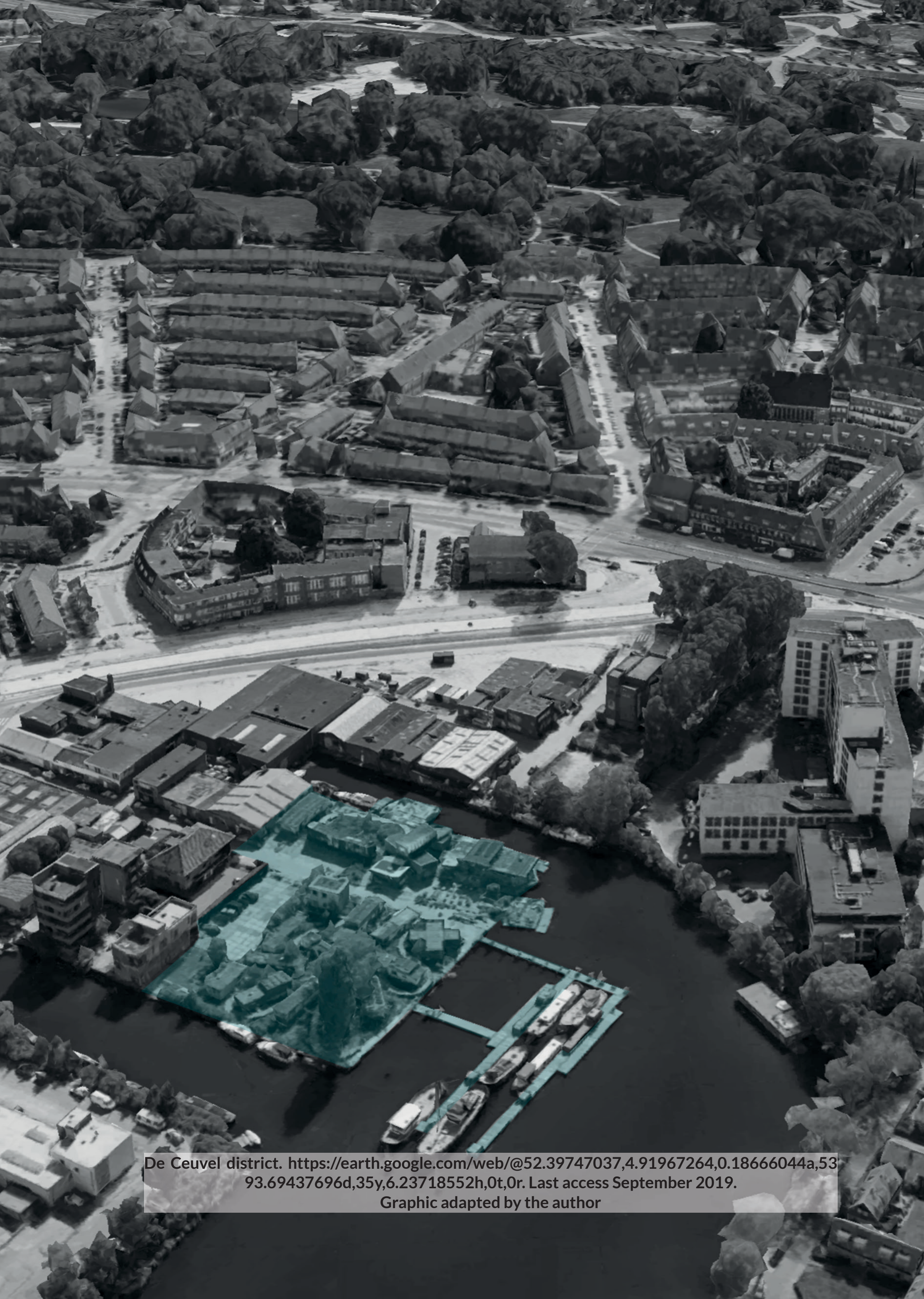
This solution has multiple purposes; on the one hand the oxygen produced by the trees along the routes contributes to the reduction of emissions of carbon dioxide and substances responsible for pollution, improving the health of the area; on the other hand, the intervention helps to improve the perception of the urban space through new landscapes, thus making it more attractive. In order to reduce the content of mineral oils in the soil and to prevent their spreading into groundwater, stabilisers and exclusion devices for the safe use of the site have been added to the phytoremediation process. By 2034, contamination is expected to be reduced by 50% with a 100% increase in biodiversity. The remediation actions, as in most of the sites for which it is considered the temporary nature of the uses, become real flywheels for the development of the area, also from a socio-economic perspective. In conclusion, from the Buiksloterham experience, it emerges that the adoption of solutions such as bioremediation, or in general of low-impact and nature-based techniques, allows the achievement of multiple long-term objectives, including the incremental reconstruction of biodiversity and, in a circularity perspective, the reuse of crops for the production of energy and building materials. In the case of Buiksloterham infact, the ecological regeneration interventions, combined with other strategic and timely initiatives, have returned to the community fluid and multifunctional spaces, partly subsidised by incentives and partly managed by the community itself, thus providing an increase in employment, especially among the youngest. The regeneration of the Buiksloterham complex, until some time ago totally foreign to the vitality and tourist ferment of the city of Amsterdam, has the dual purpose of giving dignity once again to a strategic place with a strong naturalistic value, restoring a picture no longer fragmented but, on the contrary, a cohesive, innovative, and efficient district.

4.3.4 Range-areas, temporary urban regeneration proposals in the De Ceuvel district

The development of the De Ceuvel was hard, but it was also one of the most gratifying things I've ever done. […] It kich started a movement in Buiksloterham that is still continuing today and that induced a more integrated perspective on sustainable development, that is so important in the light of the challenges we're currently facing.

(Eva Gladek, CEO Metabolic
Source: Urban Living Lab. A living lab way of working - AMS)

Within the larger circular project of Buiksloterham, a small district of about 4,600 square metres stands out, It is called De Ceuvel, and constists mostly of offices and co-working spaces where the living lab approach found direct application. Being a former shipyard, this neighbourhood went through out a state of disposal until 2010, when after its final closure occurred in 2000, the City of Amsterdam launched a tender in which the conversion of the shipyard was requested, according to creative and sustainable approaches, in an innovative hub for temporary use. The lease had a ten-year term and a reduced budget. In 2012, the tender was won by a project highly innovative and inexpensive in economic terms, indeed mostly self-sustaining, elaborated by the design studies Space&Matter, DELVA Landscape architects and others, in collaboration with



De Ceuvel district. https://earth.google.com/web/@52.39747037,4.91967264,0.18666044a,5393.69437696d,35y,6.23718552h,0t,0r. Last access September 2019. Graphic adapted by the author local stakeholders, from entrepreneurs and professionals in the field of sustainability, to citizens, volunteers and visitors. From this holistic approach began a fruitful experimentation, to which was added the partnership with the Metabolic Studio for the realisation of a cleantech playground (DELVA Landscape Architects et al., 2017). This is precisely the apparently playful dimension that transpires from the visual impact as soon as you arrive on the site, corroborated by an unconventional spatial conformation, almost surreal, in which boats, stranded on a green lawn, are placed around a winding wooden walkway, elevated in relation to the planking level. The first obstacle, especially from a perspective of temporary reuse of the area, was soil contamination. Fortunately, the district of De Ceuvel falls in those plots of the Buiksloterham area where the percentage of environmental matrix compromised is very low. So, taking advantage of the broad timing established by the lease, the landscape architects opted for nature-based techniques, ositively impactful and effective in the long term. The result was the arrangement of plant species at zero planking level altitude, selected ad hoc for phytoremediation and well integrated into the wild nature of Buiksloterham. In order to avoid direct contact with the contaminated soil and to facilitate the effectiveness of the purification processes, a wooden walkway, of which earlier, was built with material derived from old rowing boats, to also allow direct access to the structures that meet along the way. Bioremediation technique had a dual purpose, on the one hand stabilising, felling and extracting pollutants, on the other hand producing biomass with low impact, together with pruning scraps. The biomass digester, located within the site, is used to provide energy to the different structures active in the area. The remaining digestate is then used, after filtering, to nourish plants and insects. The principles of sustainability and circular logic permeate every action taken to develop the project (Fig. 18). The structures around the wooden walkway are nothing more than boats recovered and redesigned, also with the help of the local community, to host offices, workshops and innovative start-ups. Each boat has been designed according to technological standards that fully meet the circular logic of the district. Each boat has roofs with photovoltaic panels to generate sustainable energy; heating systems with air-to-air heat pump, which therefore do not use gas, or infrared panels combined with ventilation to heat recovery; toilets with individual dry composting, which therefore do not provide water for discharge and produce compost, collected centrally and post-composted, then used as fertilizer and finally, several-layer elophyte filters, sand, gravel and shells for the purification of kitchen grey water (DELVA Landscape Architects et al., 2017). De Ceuvel also has a greenhouse for food production and is based on a closed loop aquaponics cultivation system. All boats were designed to be put back into the water at the end of the concession. The only permanent structure present on the site is the one that currently hosts the Cafè De Ceuvel, also made with waste materials from the port of Amsterdam and Scheveningen beach, near The Hague. At the end of ten years, the site will be completely reclaimed, the boats will sail again, and the land will be available for future use. The flexible, creative, changing and sustainable logic of the intervention, oriented well beyond the schemes of a static and rational design, returns to the local context an unusual landscape, that is a direct reflection of community needs. This is precisely the appropriation of the project by the citizens, the indisputably important component for the effectiveness over time of a regenerative approach and conversion of ecologically compromised contexts in more liveable places, where creativity, the collectivisation of knowledge and culture are

2000 · Shipyard De Ceuvel closes its doors

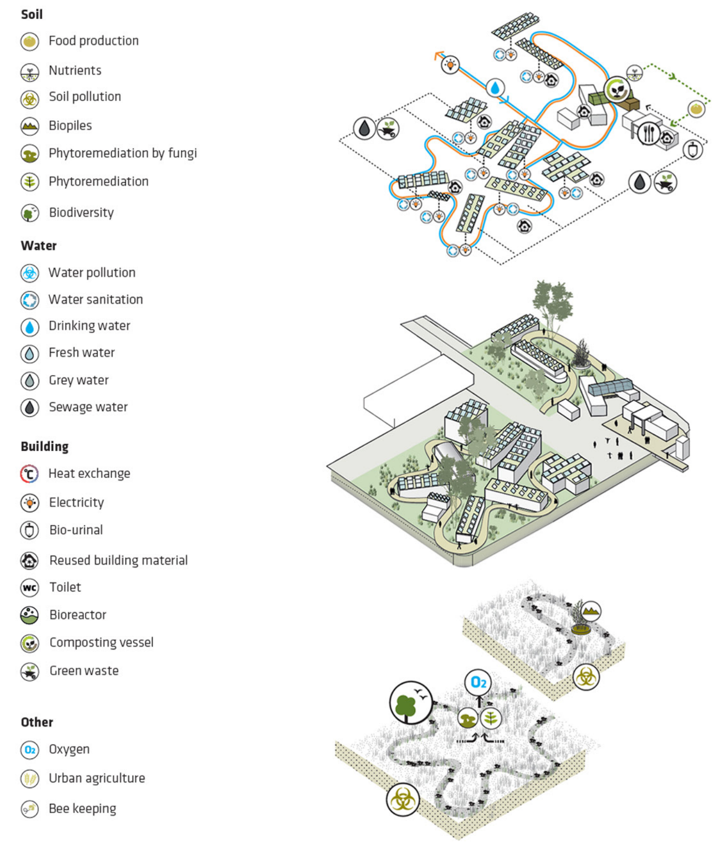
2003 · Ex shipyard De Ceuvel requires remediation

2005 · Decision of investments for its rigeneration

2010 · Municipality holds a competition won by Space&Matter

2015 · Soil remediating park
Opening Cafè De Ceuvel
Construction floating gardens
Greenhouse
Biogas boat

2020 · Creative hotspot



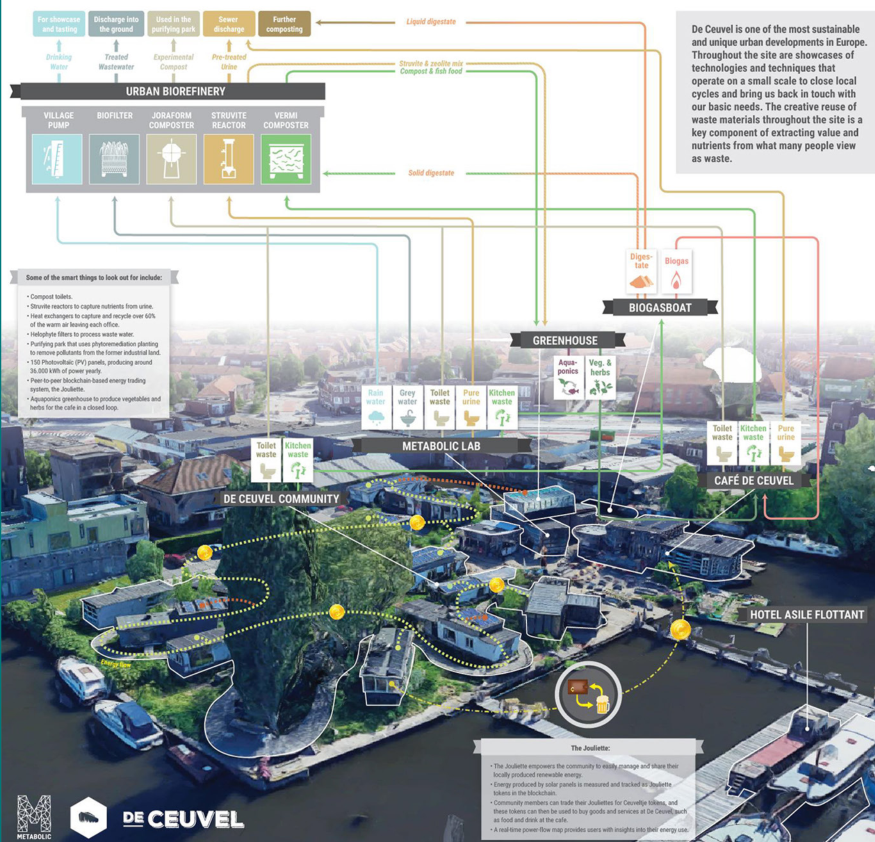


Fig. 18 *Development of the site and the circular approach. Source: Metabolic&DELVA Landscape. 2017. Circular Cities. Designing post-industrial Amsterdam The case of Buiksloterham*


WORK
LIKE
LIKE
A
PIRATE

De Ceuvel district, detail of the wood walkway to avoid contact with contaminated soil.

Last access September 2019.

De Ceuvel district, detail of the wood walkway to avoid contact with contaminated soil.

Last access September 2019.


2'

De Ceuvel district, detail of the co-working boats.
Photo taken by the author, 2017

De Ceuvel district, detail of the hydroponic greenhouse and the outdoor barbeque area.
https://commons.wikimedia.org/wiki/File:De_Ceuvel_(20468018631).jpg
Sharon VanderKaay (via Wikimedia Commons)
Last access September 2019.

De Ceuvel district, temporary uses. Source: https://delva.la/projecten/de-ceuvel/. Last access September 2019.

configured as relational resources, raising De Ceuvel to the place-maker of a regenerative network currently in expansion.

4.4 RETHINKING URBAN METABOLISM IN THE METROPOLITAN AREA OF NAPLES
A European research: REPAiR project

The design activity thus becomes a form of knowledge, both in terms of spatial and physical transformation and modification of the local contexts and in terms of mental and conceptual construct (Viganò, 2010). This approach allows us to intervene directly on the potential inherent in the critical places of metropolitan contexts, in which those fragments of neglected, abandoned and inaccessible spaces that claim the right to return to be an integral part of an ecosystem and a system of urban relations (Russo, 2018). The transition from waste producer contexts, including in the broad sense marginal territories, to sustainable metabolic cities implies their reconsideration in terms of resource by initiating close synergies between reuse practices and environmental regeneration. This reflects the logic and objectives that the demonstration case, developed in the spatial context of the **Metropolitan Area of Naples** (MAN), aims to pursue, placing itself in a wider research framework, an European Horizon 2020 project called **REPAiR – REsource Management in Periurban AReas: Going Beyond Urban Metabolism**[6], aimed at intercepting innovative, eco-friendly, adaptive and transferable strategies and solutions through recursive and co-creative processes, combining technological and territorial aspects and defining new ecologies of living.

4.4.1 Peri-urban fringe and ecological opportunities for regeneration. The case of the Metropolitan Area of Naples

The boundaries of the study area do not correspond to the administrative boundaries but they have been defined in a more complex way, referring to the geographical borders which consider the transport system and the ecological connections incorporating a much larger urban region, with a great density as a whole, amounting to about 3,117 million inhabitants (Rigillo et al., 2018). The conurbation of the plain has a dual structure partially distributed in the Province of Naples and Caserta (Fatigati & Formato, 2012) bordered to the south by the sea, to the north-east by the water system of the Regi Lagni canal and, on the opposite edge, from Vesuvius and the volcano of the Phlegraean area. A previously prosperous mosaic of agricultural fields, woods, and uncontaminated streams of water, was called Campania Felix precisely for the fertility of its lands and Terra di Lavoro for the intensity of agricultural production, appreciable until the first half of the last century. Subsequently a rise of negative contingencies, including the waste crisis, marked the decaying transition of the plain from productive land to land waiting (Fatigati & Formato, 2012) aggravated by the complete absence of a public strategy aimed at restoring meaning, value and coherence to a mosaic of ecosystems and rural landscapes presently compromised (Di Gennaro, 2018). Currently, due to entrenched and consolidated clichés in the public debate and a large slice of citizenship, the

COUNTRY AREA
Italy

REGION AREA
Campania Region

FOCUS AREA
Acerra+Afragola+Caivano+Casalnuovo+Casoria+Cardito+Cercola+Crispano+Frattaminore+Napoli (districts of Poggioreale)+Volla

SAMPLE AREA
Acerra+Afragola+Caivano+Casalnuovo+Casoria

On the left
Across the scales. Metropolitan Area of Naples case study
Source: UNINA Lab REPAiR Team

On the right
Periurban landscape
in Terre comuni: il progetto dello spazio aperto nella città contemporanea.
Graphic made by Enrico Formato

High speed railway station in Afragola.
@Ph Alessandro Capozzoli, 2018

Peri-Urban Landscape.
@Ph Alessandro Capozzoli, 2018

Peri-Urban Landscape.
@Ph Alessandro Capozzoli, 2018

conurbation has been labelled Terra dei Fuochi, term appeared for the first time in the 2003 Ecomafie report of Legambiente. In fragments of landscapes that still denounce their agrarian matrix, lies the uniqueness of palimpsests of biodiversity, culture and history (Di Gennaro, 2018), despite the current fragility that distinguishes them, it is mainly the result of short-sighted institutions, bureaucratic slowdowns and forms of organised crime which prevail in these territories, causing an exponential increase, in percentage terms, of degradation. This extend metropolitan area is characterised by strong emblematicity in reference to density, land uses, and hybridizations that outline a new topological-spatial conformation. Within it the concept of peri-urban territory finds direct correspondence, but with a different meaning, not the traditional literary one of periphery but as polycentric space, porous, stratified according to logics and non-linear trends, at different scales, of the dispersion urban pattern and that of the rural areas. Peri-urban, neither city nor country, by ecological analogy is identified with the *Ecotone* (Mininni, 2013), a transition and tension zone between two neighbouring ecosystems, in which the mutation of linear urban metabolisms in circular spaces finds a fertile ground for starting. Precisely intervening on the metabolism of the city, starting from what is considered marginal from Wasted Landscape, it allows the elaboration of spatial planning configuration strategies able to restore balances not only in environmental terms, but also social and economic ones (Fig. 19). Peri-urban, in this sense, becomes a catalyst for cross-sector action models aimed at activating inclusive processes between local government and citizens, to find EIS that, through practices of recycling and reclamation, give back to the territory a collective use (Russo, 2018).

4.4.2 Setting methodology within Peri-Urban Living Lab for Wasted Landscape regeneration

The complex challenge that the European REPAiR project aims to address is reflected in an attempt to rationalise the flows of traditional peri-urban waste cycles with urban policies of ecological regeneration, determining a close synergy between the sector of environmental engineering, for the development of innovative nature-based solutions, and that of the urban project, all in a framework of circular economy. The REPAiR research has as its engine and place of elaboration of EIS and possible concrete impact on the spatial transformations, the living lab that, intercepting in the peri-urban context a preferential place of intervention, turn their traditional name into **Peri-Urban Living Lab** - PULL (REPAiR, 2018b). In line with the principles of methodology, PULLs are aimed at facilitating a reversal of the traditional top-down mode of planning processes in urban regeneration, to a bottom-up type, generating on the territory spaces of discussion between citizens and other local stakeholders. As regards the methodological structure of the PULLs, the European experimentation promotes an update of the first mentioned FormIT method integrating it with the 4Co model (Pollitt, Bouckaert, & Löffler, 2007) (Fig. 20). The classic design, decision-making, production-evaluation cycle, with a view to sustainability and the involvement of public administration and citizens in governance processes, adds to the nomenclatures of the four cyclical phases the suffix – co, just to emphasise its participatory and circular dimension. The result is the five phases of Co-Exploring, Co-Design, Co-Production, Co-Decision, Co-Governance. The first phase of the methodological structure is the one related to the **Co-Exploring** process. In this

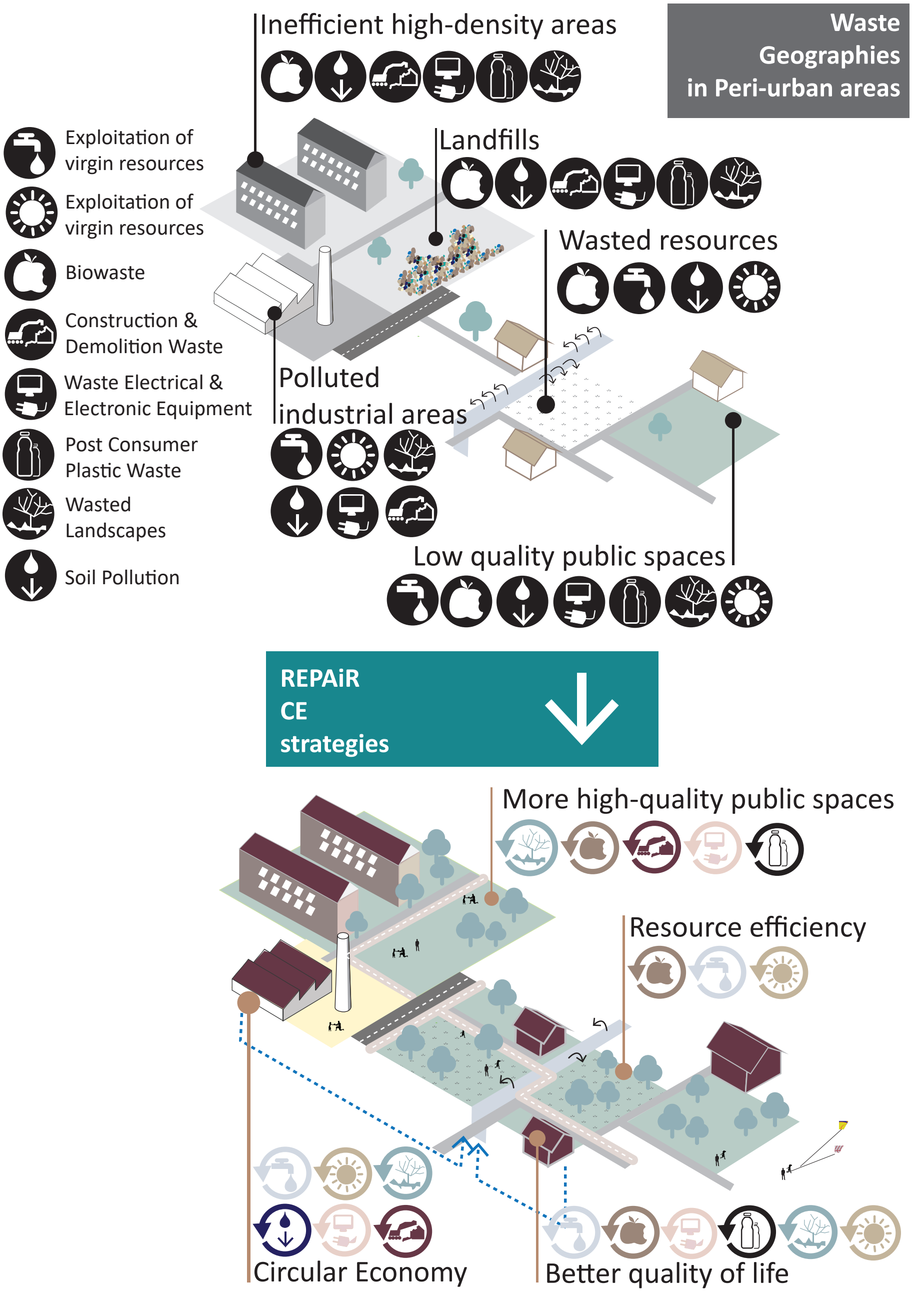


Fig. 19

Waste geographies and circular approach in Peri-Urban areas. Source: REPAiR project proposals, EC 2016. Graphic made by Libera Amenta, UNINA Team and adapted by author preliminary step, not only was a physical meeting place established but also the first roles within the UNINA research group and the first tranche of stakeholder selected, including the Campania Regional Authority and other administrative authorities as well as local delegates, according to the intervention area indentified and defined Focus Area (REPAiR, 2018b). The mapping carried out by the stakeholders is configured as an ongoing process, with imperfect, labile contours, which can be updated throughout the trial phase. A privileged narrative tool, it allows us to reveal the unexpressed potential of the places posing itself as a preliminary and unavoidable phase of the project, whose objectives and challenges it defines and refines. The mapping process thus allows us, through the critical and interpretative look of the stakeholders, to define in advance the intentions of the design strategy by interpreting and reformulating the latent presences in the territory. One of the fundamental cornerstones of the research is the cross-scaling, namely the definition of the intervention context through the use of a multiscalar approach. In this perspective, from the Focus Area, composed of eleven municipalities (Ponticelli, Barra, San Giovanni a Teduccio, Casoria, Afragola, Acerra, Caivano, Casalnuovo, Crispano, Cardito, Frattaminore, Volla and Cercola) another one came out, at an intermediate scale, called Sample Area (REPAiR, 2018c), to encourage both greater interaction with local communities and stakeholders, making recursive the approach, and a deepening of the context with respect to some significant issues. The sample Area is limited to the municipalities of Acerra, Afragola, Caivano and Casalnuovo of Naples (REPAiR, 2018). The project area has been identified taking into account a series of parameters that highlight its complex physical, socio-economic and administrative nature. These include the combination of urban, rural and peri-urban areas; the pervasive presence of WL and waste; the existence of large infrastructure networks connecting the area with neighbouring contexts; and finally the survey of production areas and logistic platforms (REPAiR, 2017). The involvement of stakeholders in the mapping of waste flows and WL has produced as a concrete result a shared map in which different layers converge and overlap, relating both to spatial information and knowledge and to the individual perceptions of the parties actively involved. The second phase, reported in the methodological process, is that of **Co-Design**. Consistently, this further step involves the assessment of the status quo trying to identify further critical issues for the definition of EIS and ensure their long-term effectiveness. This analytical moment, conducted through focus groups and stakeholder interviews, has intercepted a series of challenges that will be accepted in the development of the prototype, including the promotion of improvements in the level of governance; shared vision planning between policy-makers and local communities; the provision of economic incentives, as for agricultural and reclamation activities, defining a framework for knowledge of them and models of actions necessary to undertake them; and raising awareness among stakeholders and citizens, through participatory processes, on shared management practices and models as well as on the behaviours to be taken in reference to the topics intercepted, in an attempt to equip these ecosystems with spaces without any rule, of acceptable standards of civilisation. Each of these challenges refers to environmental, social and economic dimension and for each of these aspects there are obstacles to be contained, above all bureaucratic ones, denouncing the lack of flexibility in the territorial regulatory framework. It follows the development of rough prototypes of ideas that reflect the needs expressed by the stakeholders involved, also evaluating those

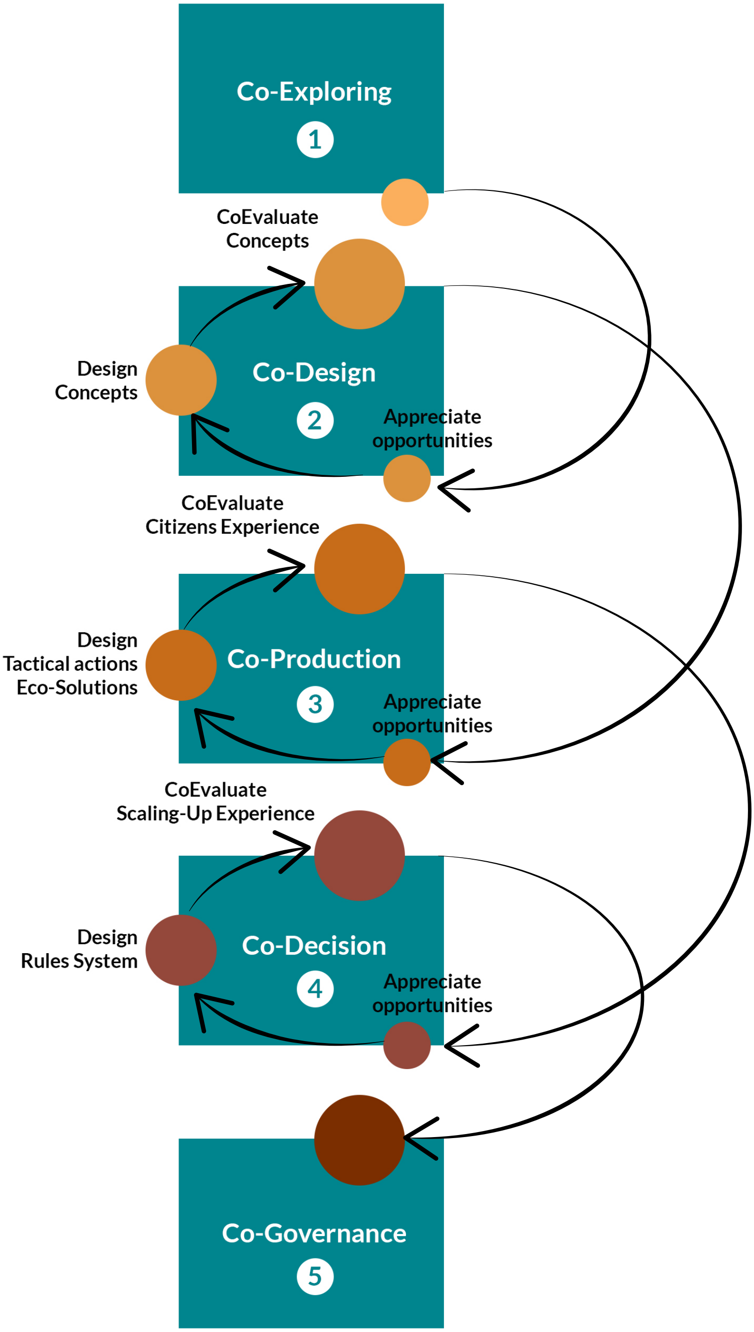
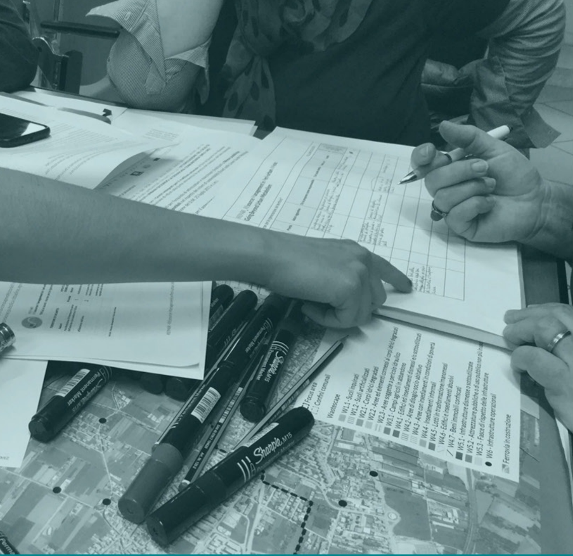
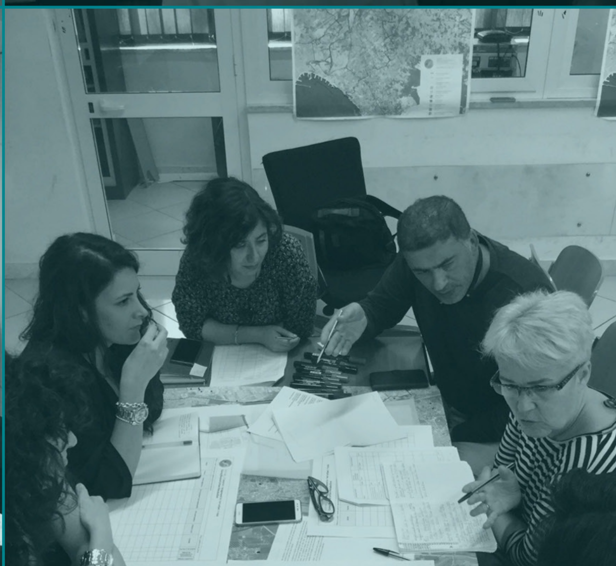


Fig. 20
Living Lab hybrid methodology. Source: UNINA REPAiR team. Graphic made by Cerreta, Panaro, Poli, UNINA Team and adapted by author





SAMPLE AREA






Wastescapes
PAiR


REPAiR
anagement in Peri-urban Areas:
Beyond Urban Metabolism
RE PAiR
ir.eu


unexplored or those changed compared to the previous phases. The **Co-Production** phase is aimed at the transition of contexts from linear to circular spatial models through the development of EIS identified. The specific toolbox for this step consists of surveys, interviews, focus groups, data collection from local, regional or national archives and storytelling moments among stakeholders. A fundamental moment, at the end of this phase, is the monitoring of the progress made in order to validate the effectiveness of the result. The penultimate phase, of **Co-Decision**, is directly linked to the final phase of **Co-Governance**. In these final steps the impacts of EIS at the local level in relation to the triad environment, economy and society are assessed. The objective of this evaluation phase is to establish the actual possibility of initiating local, sustainable and circular development, to make it particularly influential in decision-making processes and generates planning that can manage and integrate innovative strategic plans for the management of ecosystem services (Russo, 2018). The definition of shared decision-making models and therefore outlined in Co-Creation frameworks, should then be easily repeatable in other contexts, enabling the fulfilment of the last requirement required for the optimal success of a Peri-Urban Living Lab, namely the creation of a Co-Governance. Currently these last two phases in REPAiR are not yet completed, the experimentation is now in a phase of Co-Production, in which the elaborated EIS are subjected to evaluation, through exercise of sharing and knowledge transfer to other Consortium members.

4.4.3 Outlining Eco-Innovative Strategies and Solutions

In a more extensive view, among the traditional waste flows that cross the interest area, REPAiR also includes those relating to the territories of disposal and abandonment, the already mentioned Wasted Landscape, defining them as "patches of landscape related to waste-cycles both by functional relations and because they are 'wasted-lands': anomalous areas inconsistent with the peri-urban spaces metabolism that become neglected" (REPAiR, 2018b:12). Starting from the scientific literature on the topic, the project tries to develop its own taxonomy in which a double matrix is distinguishable(Formato et al., 2018), identifying the drosscape (Berger, 2006) in reference to those fragments of territories where abandonment and degradation conditions are evident and operational infrastructures (Brenner, 2014), on the contrary still in operation and with specific functions, such as treatment plants, landfill sites and so on, which are completely unrelated to the urban fabric but which should be included in territorial strategy policies. Among the categories identified (Fig. 21) in this paper those related to degraded lands will be considered, in particular polluted soils, and that of degraded fields, which includes abandoned or particularly vulnerable agricultural plots because they are exposed to conditions of human or natural risk. These categories, sometimes traceable to the Focus scale and sometimes to the Sample scale, have been mapped directly by the stakeholders within the PULL. At the Sample scale, priority areas have also been identified, possible starting points where eco-innovative strategies and solutions are most applicable and the regenerative process most controllable, defined as enabling contexts (REPAiR, 2018c). These preferential intervention contexts have been intercepted according to enabling parameters, which, combined or not within the PULL, direct the interactive process to the local scale and which refer to social/behavioural,

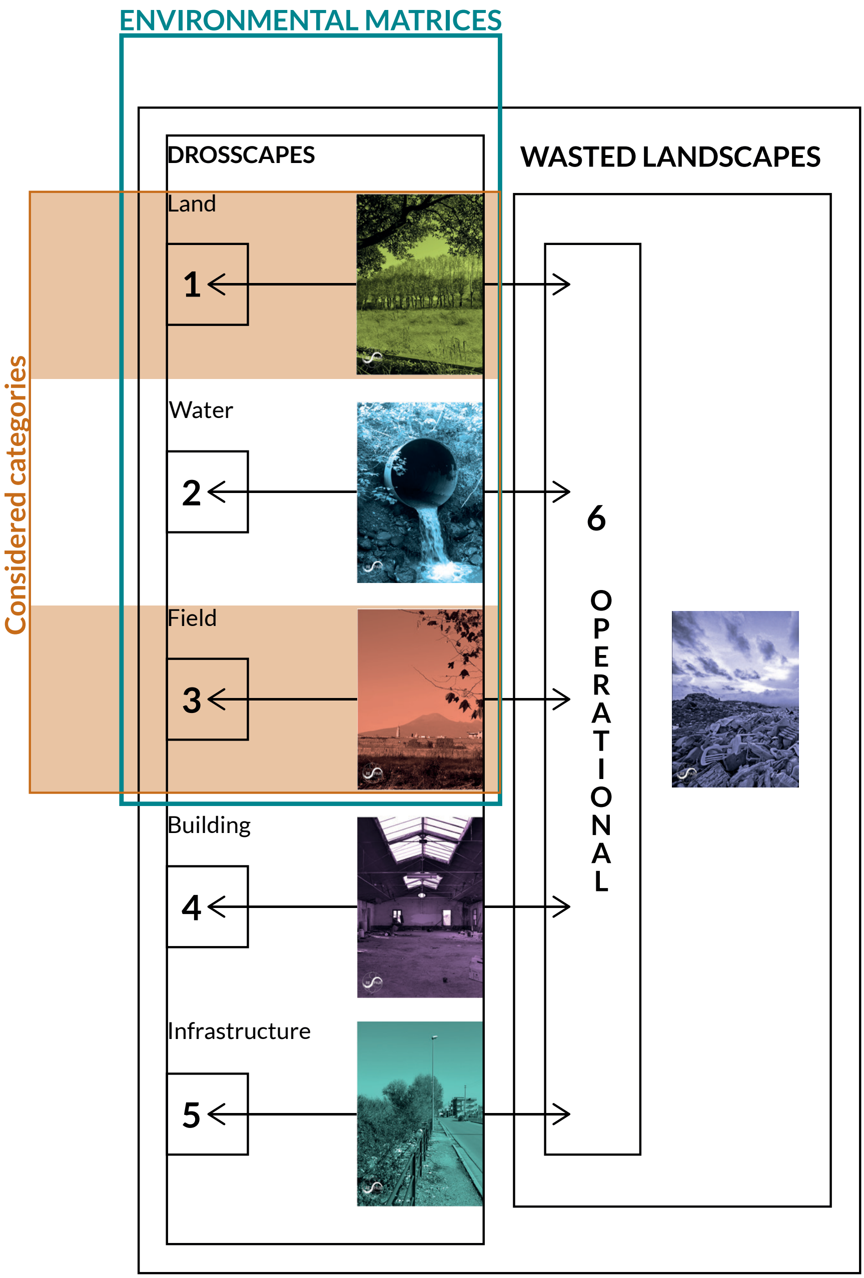


Fig. 21
Wasted Landscape categories.
Source: UNINA REPAiR Team and adapted by the author

cognitive/epistemic, informational/managerial and finally strategic/structural conditions (REPAiR, 2018c). In particular, for the Neapolitan case, enabling contexts have been determined considering the WL in a specific part of the focus area (a sample) (Fig. 22), pointing out the necessity to focus on critical conditions that affected those territories, leading to the development of place-based territorial strategies, in which eco-innovative actions can be distinguished (REPAiR, 2018a:10). The latter, conceived within PULL, are therefore considered not as a phenomenon limited to the application phase, but open to the totality and circularity of the process: from the acquisition and elaboration of the solutions, the phase of testing, monitoring, and transfer of the same to other contexts, in a loop of continuous implementation and interaction with communities and local experienced stakeholders. The methodology adopted for the development of the EIS (Fig. 23) consists of different steps that have, as their starting point, the mapping process mentioned above, developed in three work tables organised during the PULL. The next phase has been incardinated on the discussion and development of some actions for the resolution of problems intercepted on the examined territory that has sprung up in the definition of some preliminary solutions, then grouped in three macro EIS. Subsequently, the three macro EIS, developed as simple actions respecting the critical specificities of the peri-urban context considered and aimed at solving problems related to polluted soils and organic waste streams and construction and demolition, have been combined into territorial strategies. The territorial strategies are defined, within the REPAiR European project, as an alternative course of action aimed at addressing both the objectives and challenges identified within a PULL and develop a more circular economy in peri-urban areas (REPAiR, 2018a:11) and they involve one or more eco-innovative solutions aimed at improving the capacity of urban environments to deal with future resource management challenges, while triggering positive transformations in spatial qualities, sustainability and urban metabolism (REPAiR, 2018a:11). In short, while the EIS separately analyse issues related to specific issues, the strategies mix and combine the EIS in a synergistic way and in a site-specific approach.

4.4.4 RECALL Remediation by Cultivating Areas in Living Landscapes through Phytotechnologies

As already specified in the introductory chapter of this dissertation, the EIS proposed below is part of a more comprehensive territorial strategy based on an integrated approach combining waste treatment (OW and CDW)[7] with that of polluted soils for the definition of "new soils" and therefore of an innovative public space, a new porous border between urbanised and rural areas. The recycling metaphor and circular logic form the basis of the strategies and solutions developed, through cooperation between the stakeholders, within the PULLs to mitigate the impact that degraded and compromised areas entail in territorial terms, thus contributing to the improvement of the well-being and livability of the intervention contexts. The strategy and EIS process was developed step by step using different methodological tools. Preliminary phase for their development has been the identification, within PULL meetings, seminars or through interviews, of problems and objectives to be pursued with relative first mapping to the scale of the Sample. On this scale, with regard to WL, there is a significant proliferation of these spaces and in respect of which the conditions of abandonment and degradation,

Wastescape: degraded land , landslide hazard, degraded water , hydraulic hazard, settlement in crisis , drosscape: underused area alongside the infrastructure, abandoned infrastructures, operational Infrastructure of waste,

Planned expansion areas

Planned Metropolitan parks

Plot division structure: high fragmented rural fields

0 1 2 3 4 5 km

Fig. 22

Focus - sample wastescapes map.

Source: D3.3 Process model for the two pilot cases. UNINA Lab REPAiR Team

as well as not very flexible legislative framework and institutional approaches, has been proposed the overturning of these conditions, fostering the delineation of regenerative strategies and models of action shared with the local stakeholders and, at the same time, promoting the collectivisation of information on the issues referred to above among the parties involved. These strategies, initially rendered in elementary form, have been gradually implemented compared to the interactions occurred in the subsequent PULL meetings and thanks to which it was possible to start the development of EIS on specific issues to be addressed. The strategy of regeneration of contexts placed in a waiting, marginal, and ecologically condition of compromise has been identified as a preferential field of intervention for the development of the EIS. The latter is configured as a fragment of territory peri-urban circumscribed on the edge by the fluid course of the Asse Mediano and by the water infrastructure of the Regi Lagni and, in the middle, by empty residues for mainly agricultural use that wind between the Municipalities of Afragola, with the High Speed Station, an important junction with the local railways, and the former Scafatella landfill site and, of Acerra, with the PIP area (Plans for Production Settlements). The choice of location, which in no way affects the possibility of applying the EIS also to other contexts, has arisen purely on the basis of a series of findings relating to the specific identity of the place and to issues related to its contamination, which claim for the implementation of projects and new planning guidelines so that they can deploy value and collective use for local communities.
The EIS, entitled **RECALL| REmediation by Cultivating Areas in Living Landscapes** (REPAiR, 2018a) proposes a technical intervention of environmental reclamation of the area by phytotechnologies to be implemented with some agronomic proposals related to typical cultivations suitable for that purpose, assessing potential impacts in relation to the landscape, social, and economic dimension (Fig. 24). In this case, the agronomic proposals are the Cannabis Sativa, the Arundo Donax and the Populus, selected, in a vernacular logic, both for specific aspects related to historical local production and for the capacity of these species to play a buffer function in relation to the potential pollutants present in the environmental matrices of soil and water. With regard to the historical and identifying component related to the cultivation of Cannabis Sativa, Italy is considered the second largest producer of hemp after Russia. The largest hemp production was in fact in Campania, specifically in the provinces of Naples and Caserta (Capasso, 1994) and constituted the dominant agricultural activity until the end of the 90s and the main means of subsistence for the local communities. In order to carry out this agricultural activity, the Regi Lagni water infrastructure was, and could still be, an important resource. The Bourbon system of canals was in fact used for the maceration of the hemp, in different tanks that wind along the riverbed, up to the sea. Unfortunately, today its form and condition of open-cast landfill originated from an illegal and uncontrolled discharge of waste, seem to deny and completely invalidate its original function of canalisation and hydraulic reclamation. From a technical point of view and in line with the ECOREMED project (ECOREMED, 2015), the EIS adopts a nature based approach through phytotechnologies that provide the use of species particularly suitable for the decontamination of soils and waters from bioavailable metals and organic pollutants. Cannabis Sativa is in particular known as a hyperaccumulative species, therefore able to tolerate in its fibres large amounts of heavy metals, as emerges from the scientific literature on the topic (Ahmad et al., 2016; Angelova et al., 2004; Groman,

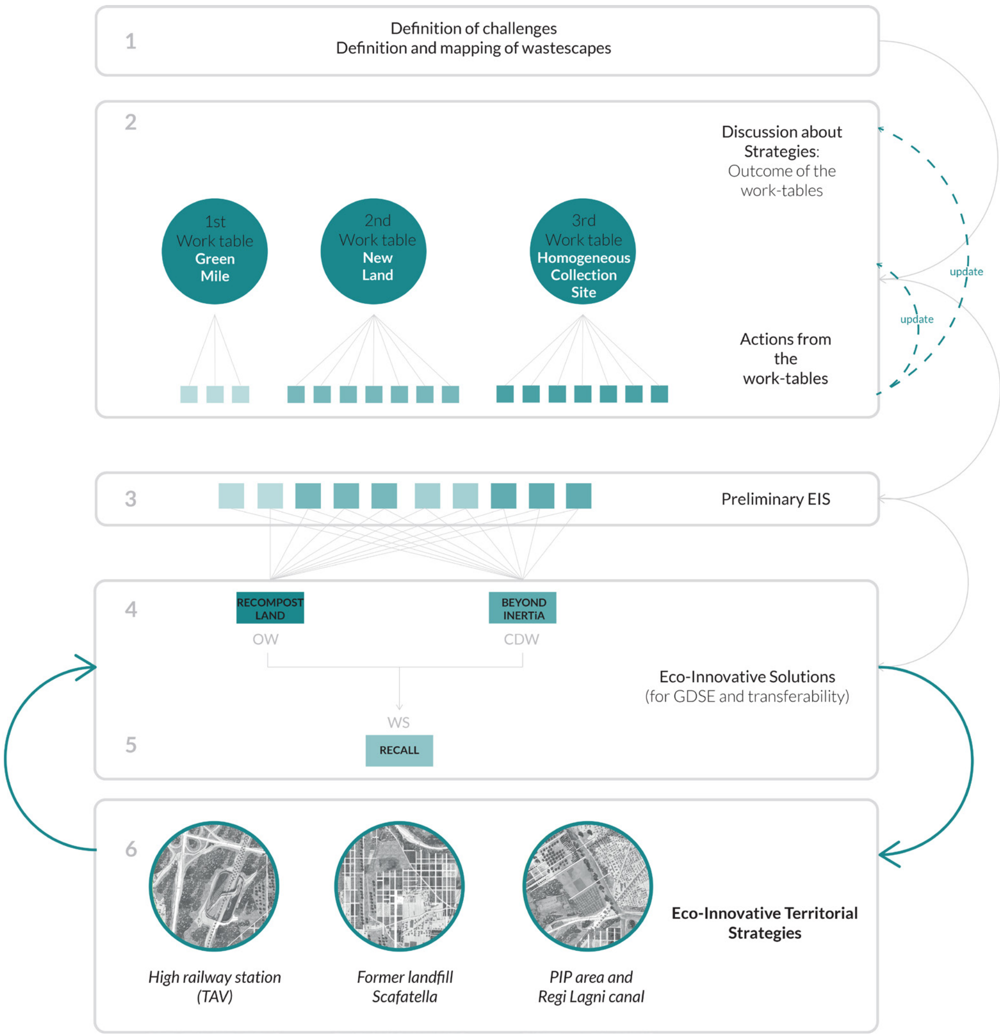


Fig. 23
Defining a place-based approach for the Naples Pilot Case. From Strategies to EIS – and vice versa- in an iterative process.
Source: UNINA Lab REPAiR Team, graphic made by the author

& Leštan, 2003; Linger et al., 2002; Crini et al., 2018; Citterio et al., 2003; Tlustoš et al., 2006). The Arundo Donax instead is a perennial reed indicated for the protection ofcontaminated sites (Fiorentino et al., 2018) and to avoid the risk of transition of contaminants to other environmental compartments, such as air and groundwater, performing a function similar to that of the Populus. A similar technique applied in water through the design of wetland areas contributes to the purification of the surrounding polluted water system of the Regi Lagni canal. The creation of wetland areas in proximity to agricultural lands allows a decrease of rainwater flow into the sewer by water reuse in open air irrigation systems. Phytotechnologies, in this case, are used more for requirements of safety of places and restoration of biodiversity of ecosystems, as well as for landscape reconfiguration choices. Recent studies and monitoring carried out by the community project Life ECOREMED (Ecoremed, 2017), on the state of health of the soils of Piana Campana have shown that, compared to 50,000 hectares of total soil analysed, only about thirty were potentially contaminated, while fruit and vegetable products grown in these areas were found to be up to standard also above the national average (Di Gennaro, 2018). In particular, as regards the site in question, in the adjacent areas of the former landfill Scafatella and on its surface, corings, carried out in the framework of the ECOREMED project and subsequently analysed by the Department of Chemical Sciences of Federico II, reported some surpluses compared to the CSC defined by Legislative Decree 152/06 in relation to the sites for public green, private, and residential use. In particular, from the results of corings carried out in four separate points of the area of the former landfill, the surplus was found in the parameters of beryllium, with an average value of 5 mg/kg on the 2 mg/kg set by the Decree, lead, with an average value of 172,15 mg/kg compared to 100 mg/kg and zinc, with an average value of 198,5 mg/kg over 150 mg/kg. The area in relation to the values of lead and zinc has been labelled as potentially contaminated, while the value of beryllium, although higher than the value of CSC fixed by the Decree, is lower than the natural Background Values –BVs (6.3 mg/kg), which is why the particles should not be defined as contaminated because the alteration is due to the geological matrix of the soil. As far as vegetation is concerned, compared to these metals, it is not contaminated by lead neither the presence of organic contaminants (such as hydrocarbons, PAH and PCB) has been detected. The six corings carried out in the adjacent areas of the former landfill have clearly exceeded the values of beryllium, with an average value of 6.52 mg/kg on the 2 mg/kg established by the Decree, and thallium, with an average value of 1,64 mg/kg on 1 mg/kg fixed. Both parameters were related to natural Background value, which for beryllium is 6.3 mg/kg and for thallium 3.4 mg/kg, thus demonstrating, once again, that the alteration is uniquely attributable to the geological matrix of the soils. Only in some cases, a surplus of lead of about 130.27 mg/kg and copper with 179.68 mg/kg were reported (ECOREMED, 2015). In short, it is easy to deduce that the area is not contaminated and that for the excess values it is sufficient to provide for safety measures, as provided for by the proposed EIS. Compared to the traditional and more impacting remediation techniques, phytotechnologies require longer implementation times but lower economic impacts. In order to overcome the problem of the long time required for the efficacy of the process, the EIS proposes temporary uses of the site, with a further measure to allow safe use, namely the predisposition on the ground, in addition to the species mentioned above, ecological structures as permanent dense grassing to

Afragola	inhabitants 65 057	Surface of wasted landscape (m^2) 7 188 712
Acerra	inhabitants 65 057	Surface of wasted landscape (m^2) 4 057 867

prevent dust lifting (Fagnano, 2018). In addition, to avoid the use of fertilisers harmful to the soil, it is advisable, following the harvest of hemp in August– September, the planting of leguminous crops, such as Vicia faba minor, commonly known as fababean, to be incorporated into the soil in May as green fertiliser for the next cycle of hemp. Among the agronomic proposals selected, hemp, within the regenerative practices of the landscape, in addition to the already known environmental benefits, also has other indirect ones, related to the social and economic sphere, to trigger the initiation of a transition to more circular metabolisms. The innovative component of the proposed solution is carried out mainly in the process that is in the application and strengthening of the short supply chain in the territorial context, by combining the agronomic development of new crops with the recovery of the reference spatial context. The proposed EIS, which is being examined by agricultural and reclamation experts within the PULL meetings, has also been considered feasible and effective in relation to other important tasks it performs (Russo et al., 2019) within a circular regeneration of contexts. Plants used for phyto-purification purposes are also producers of biomass that can be used to produce energy or other renewable materials that allow us to regulate the ecosystem and the climate, retaining carbon in the soil. Their roots, in particular poplars, absorb and reduce the flows and the percolation towards the slopes, carry out filter action, reduce the erosion of the wind, as well as being containers of biodiversity. The effectiveness and feasibility of the EIS has been further assessed through a checklist (Fig. 24) in the PULL meetings organised by the other consortium members. Particular attention has been paid to the EIS development process, from conception to implementation, highlighting the critical issues and potential obstacles to its development; on how to cooperate between the various components of the partnership (Public-Private-People); and on the testing of the eco-innovative aspect, emphasising potential improvements. The checklist submitted to the participants, was composed of a series of questions to identify the operational relevance of the EIS selected for the pilot case of Naples. The questions were (REPAiR, 2018: 31):

1. According to your expertise, which are the positive aspects of this EIS?
2. And which are the negative aspects of this EIS?
3. What is missing in this EIS?
4. Is this solution correctly addressing the main criticality of the case study area?
5. Is this solution improving the spatial/environmental/social quality of the case study area appropriately?
6. Who are the actors to be involved?
7. Who could be willing to cooperate with whom?
8. For whom could it be a business model?
9. What are other possible sources of funding?

The EISs, as mentioned above, are designed to be transferred to other contexts, in particular the second pilot case of the project, Amsterdam, and other follow-up cases. To achieve this goal, an additional sheet (Fig. 25) was provided to participants with the following questions (REPAiR, 2018: 32):

1. Is this EIS transferable to your region?
2. Where could this EIS be applied in your region (location)?
3. What are the barriers for transferability of this EIS?
4. What adaptations are needed to enable transfer to your region?

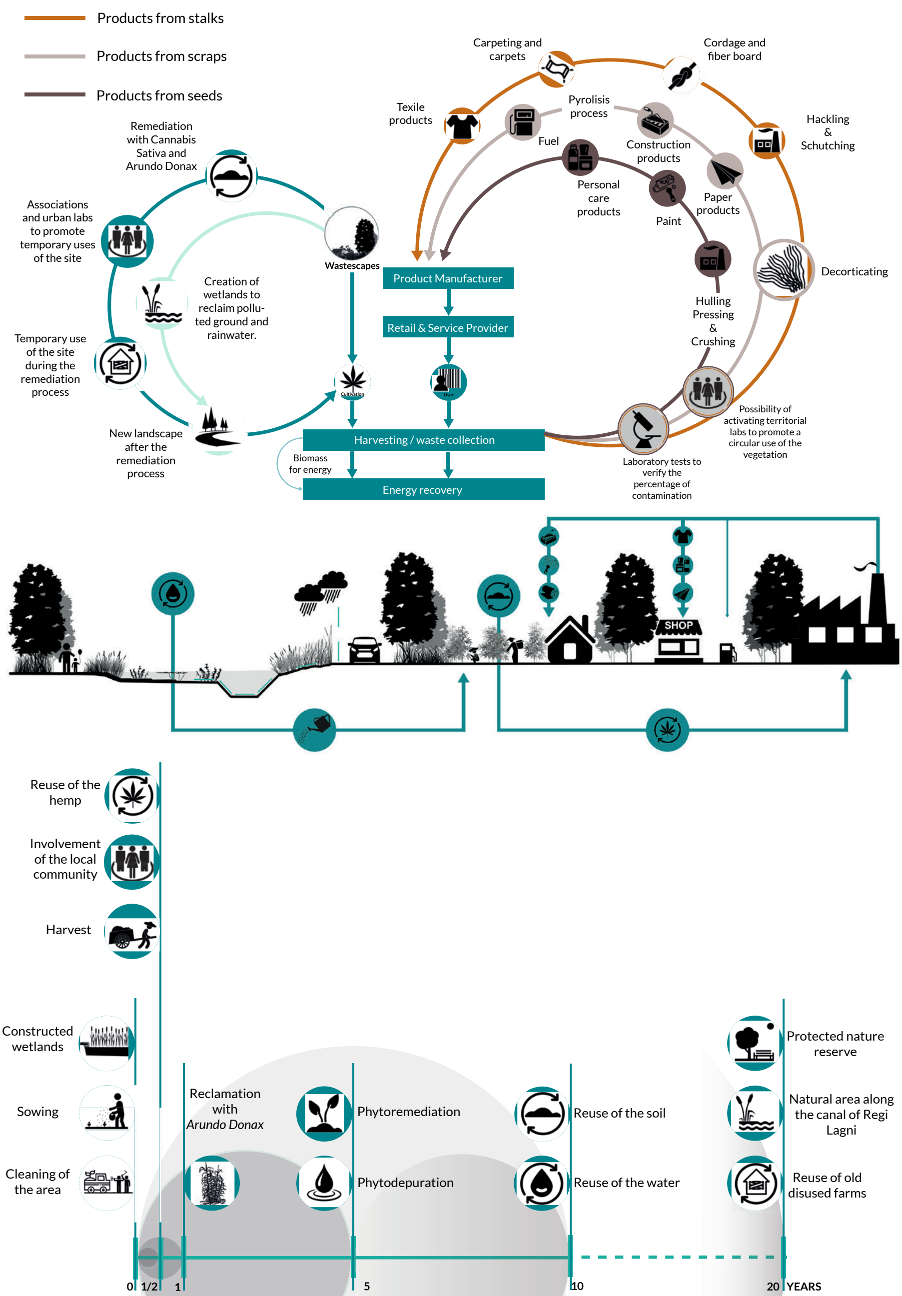


Fig. 24

1. Circular processes scheme of the agricultural choice, Cannabis sativa, selected for Wasted Landscape remediation. Based on the Ellen MacArthur Foundation process.
2. Systemic section of the short supply chain process feasible through the use oh hemp.
3. Possible timeline of the remediation and regeneration of Wasted Landscape with the selected plants
Source: Deliverable 5.3 Eco-Inovative Solutions Naples, p.44. Graphic made by author.

5. Who should be the actors involved?
The feedback has been largely positive, revealing concrete possibilities of adapting the solution to different contexts from the one for which it was developed. The spill-over effects of the EIS on the physical configuration of space, its urban morphologies and functional characterisation, have been summarised in a series of design visions that restore an innovative shape of public space by outlining unexpected waste landscapes as catalysts for large-scale sustainable change, in a circular and metabolic perspective (Fig. 26).

Conclusions

The lack of adaptability and resilience of cities to environmental pressures and the result of wrong anthropic actions against ecosystems, requires an urgent subversion of the traditional operational, planning, and territorial governance strategies. Despite the current perception of the contemporary territory as a chaotic mosaic of spaces in decline, the urban and landscape project is moving towards bottom-up strategies that elevate the concepts of recycling, reclamation, and reuse of derelict and contaminated areas to innovative paradigms of urban planning. To the needs of renewed spatial configurations the strong emphasis on the themes of sustainability and circularity is added to converge in experimental processes, therefore by definition changful, dynamic, and susceptible to in-depth analysis and policy changes in which local community involvement plays a predominant role. The attention to these themes in reference to the portions of compromised territory has two purposes; on the one hand it involves a renewal in the conception of landscape project as a collective work; on the other hand, it facilitates the development of new forms of governance aimed at providing effective responses to the tight deadlines imposed by environmental and social emergencies in contemporary contexts. In this sense, the selection of case studies in the Dutch and Italian context, working on an approach to reclamation of an eminently naturalistic nature and based on the methodology of social interaction of Living Labs, stresses its importance as a precondition for urban and territorial development and as a starting point for the design of the open and public spaces system. Both cases selected propose virtuous models of interaction between urban planning, evaluation, and decision-making, public system design and the orientation of environmental remediation actions, where WL are configured as vectors of change on a large scale. In conclusion, the complexity of the interventions of regeneration and the reclamation of the neglected places requires the use of integrated, transcalar, adaptive design approaches. The outcome of such operating modalities is the definition of propositive visions based on the interrelationship between the physical-spatial transformations of the contexts and their environmental and socio-economic dimension. Therefore, WL become privileged portions of contemporary metropolises on which to act, experimental fields in which risk mitigation needs are intertwined with new landscape reconfiguration operations in a strategic and more environmentally oriented perspective and potential spaces for community regeneration.

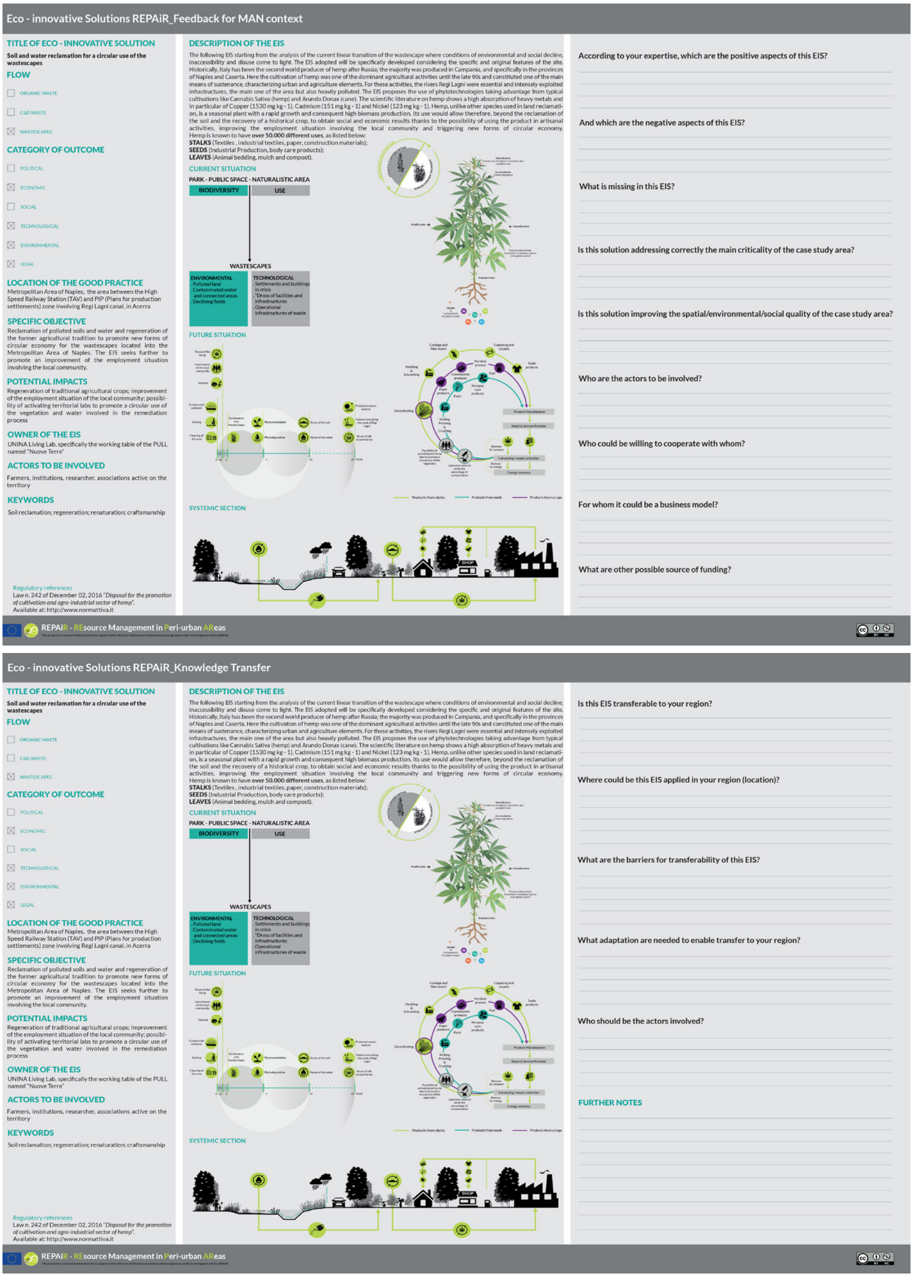
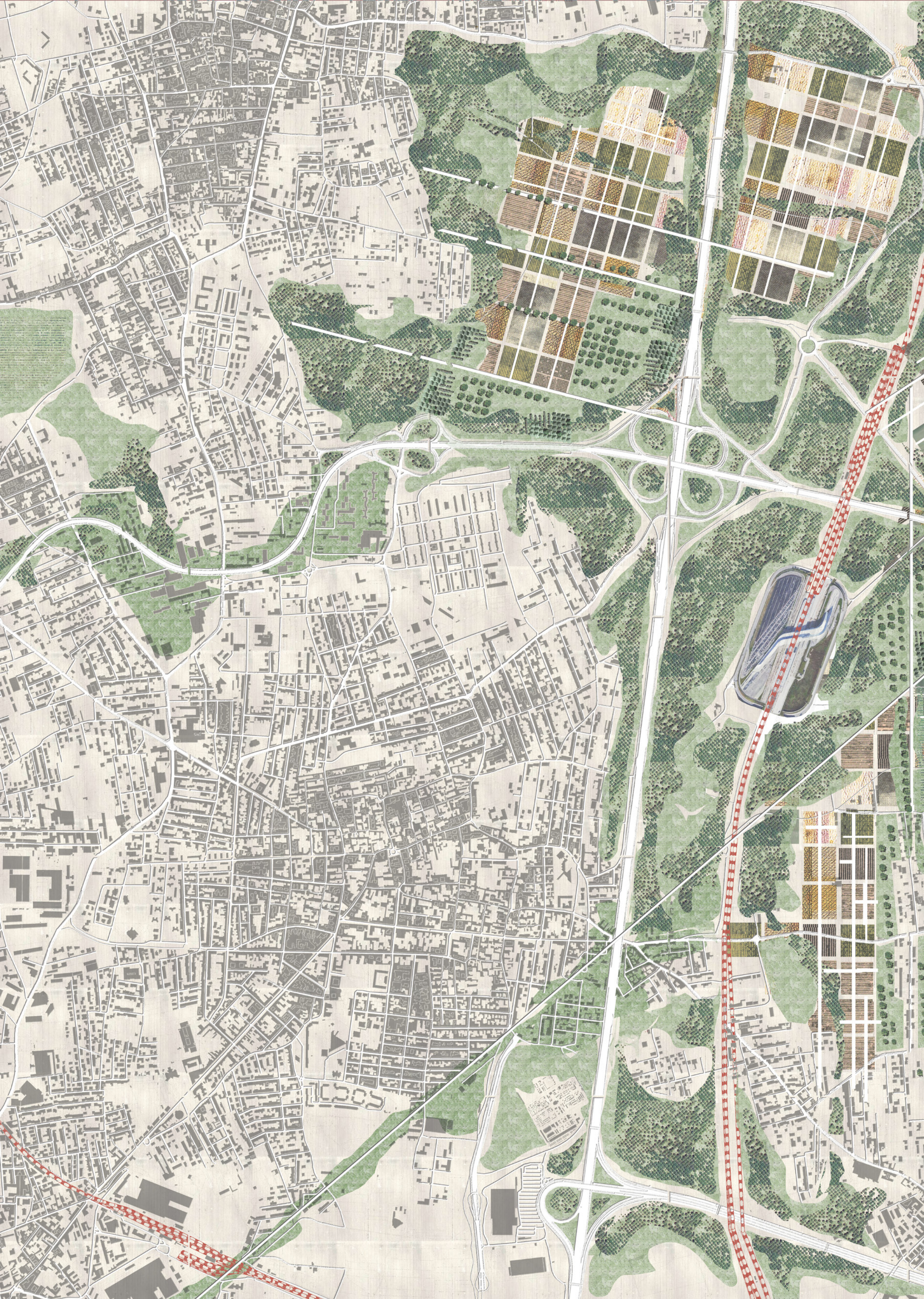
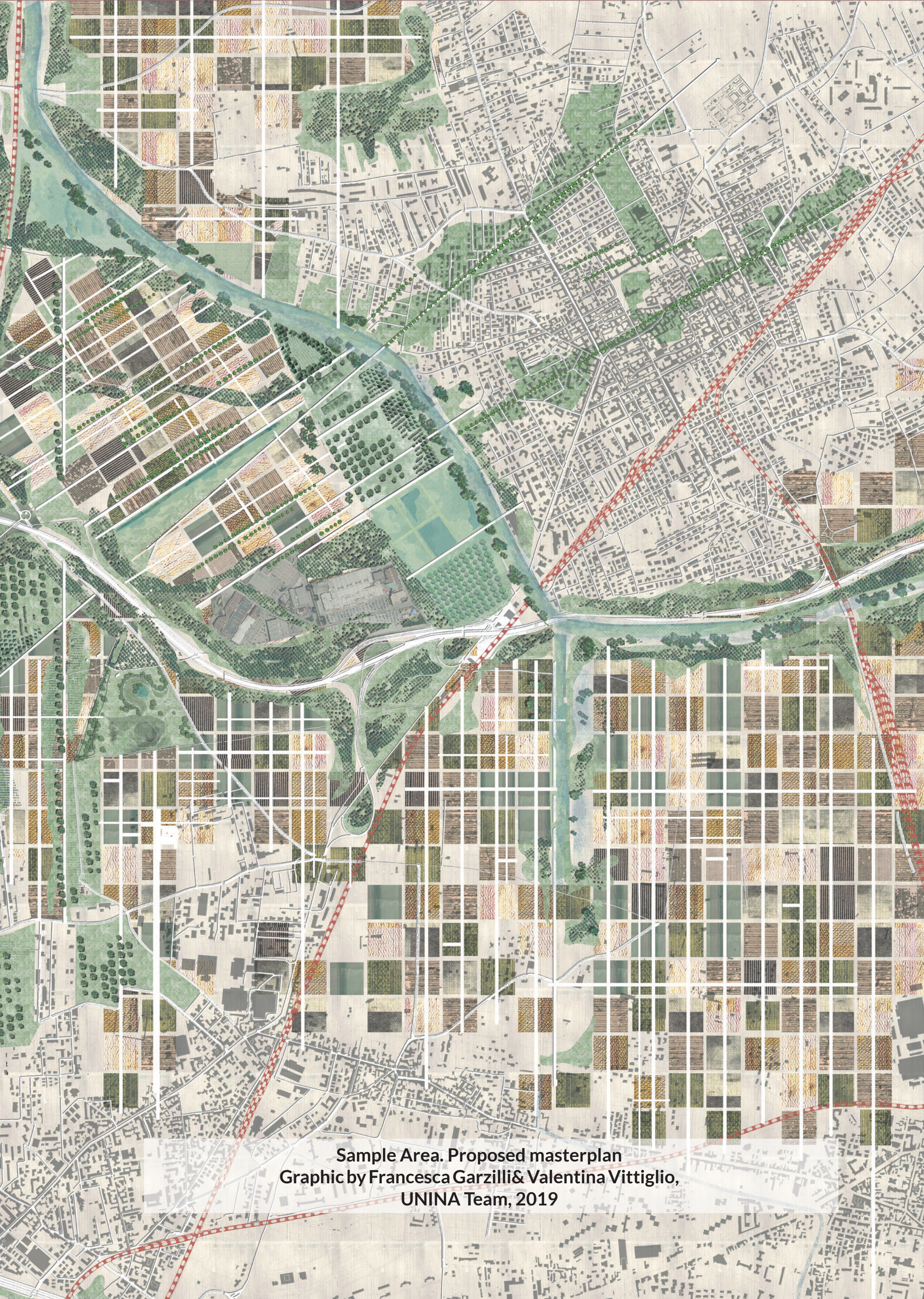


Fig. 25

Example of a card to test the feasibility and transferability of the EIS to other contexts and to collect feedback for Naples
Source: Knowledge Transfer event, Amsterdam 18.09.2018 - TU Delft Team





Sample Area. Proposed masterplan
Graphic by Francesca Garzilli& Valentina Vittiglio,
UNINA Team, 2019

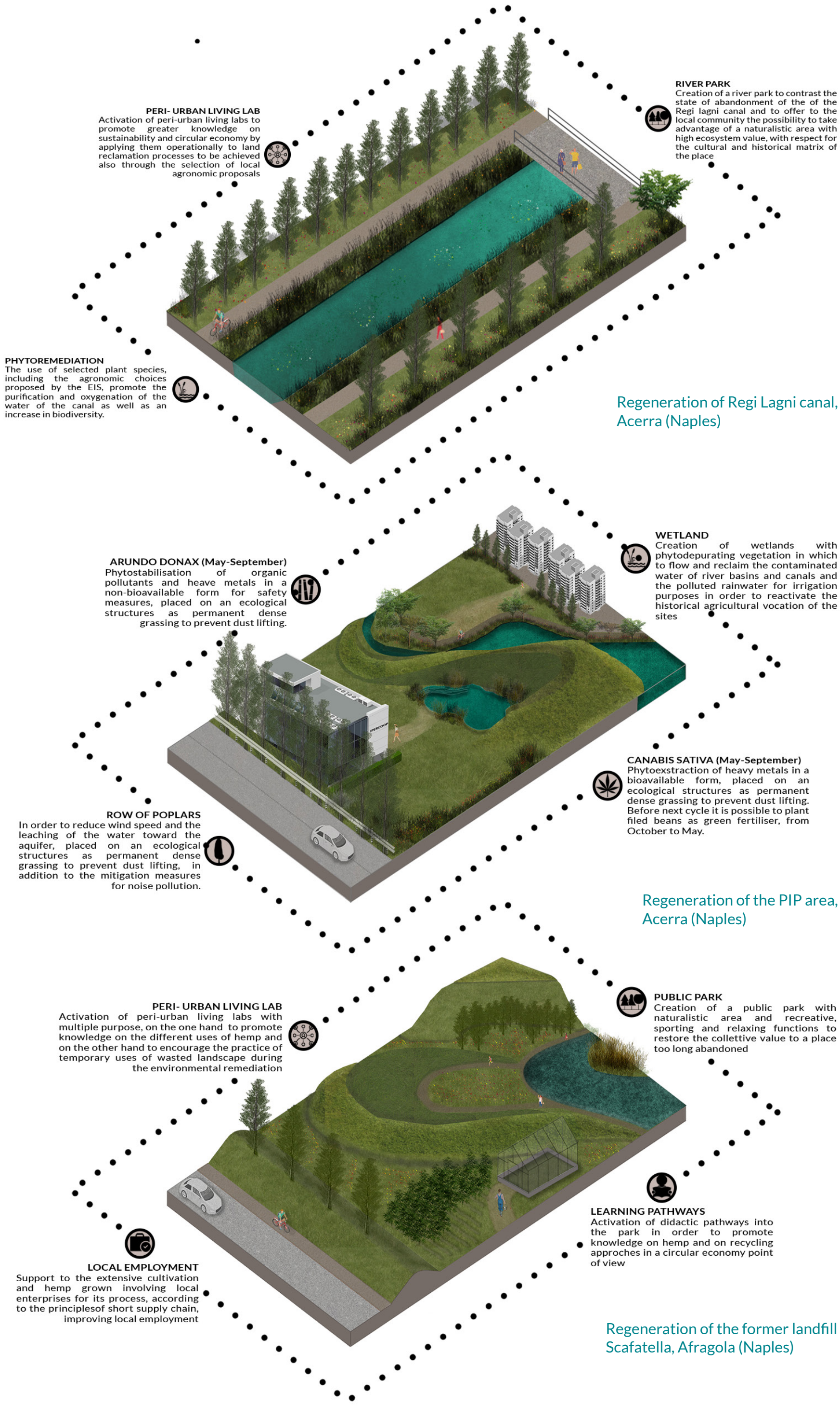


Fig. 26

Circular layers scheme and possible urban scenarios. Graphic by Valentina Vittiglio, UNINA Team, 2019

Regeneration and reclamation of the Regi Lagni Canal, Acerra (Naples)
Concept Image Valentina Vittiglio; Graphic by Luca Esposito.

Urban regeneration of the PIP Area, Acerra (Naples)
Concept Image Valentina Vittiglio; Graphic by Luca Esposito.

Urban regeneration of the former landfill Scafatella, Afragola (Naples)
Concept Image Valentina Vittiglio; Graphic by Luca Esposito.

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Notes

1 World Urbanisation Report was published by ONU, specifically by the Department Of Economic and Social Affairs, and it is available on the United Nations website https://population.un.org/wup/Publications/Files WUP2018-Report.pdf

2 The ecosystem approach was adopted in 1995 by the Convention on Biological Diversity (CBD), and subsequently refined and defined as an integrated land, water and living resources management strategy promoting conservation and sustainable use. It does not replace other traditional conservation approaches, but rather concentrates on rare species or protected areas, it is a holistic process aimed at addressing natural resources in an integrated way. The three key objectives of the Convention, with regard to the ecosystem approach, are: conservation, sustainable use of biodiversity and equitable sharing of the resulting benefits (Maltby, 2000).

3 Natural Capital refers to the entire stock of natural assets (living organisms, air, water, soil and geological resources) that contribute to provide valuable goods and services, direct and indirect, for humanity and which are necessary for the survival of the environment from which they are generated. For further information see ISPRA website available at http://www.isprambiente.gov.it/files comitato-verde-pubblico/2_Primo_Rapporto_Capitale_Naturale_Italia.pdf.

4 European Working for Living Lab – ENOLL was founded in November 2006 and it is a Brussels-based international, indipendent and non-profit organisation of bench-marked living labs with more than 340 accredited living labs worldwide. Further information are available at the EU website https://ec.europa.eu/digital-single market en/news/european-network-living-labs-enoll-explained.

5 AMS – Amsterdam Institute fo Advanced Metropolitan Solution, is an internationally leading institute where engineers, designers, and both natural and social scientists jointly develop and valorise integrated metropolitan solutions. For further information, see the website https://www.ams-institute.org/.

6 REPAIR – Resource Management in Peri-Urban AReas has received funding from the European Union's Horizon 2020 research and innovation programme, under the grant agreement number 688920. The research project identifies a typical moment of the circular processes of the economy but is also, in this sense, an acronym aimed at indicating the possibility to manage in an innovative way, and customizing the results, the resource cycle in peri-urban areas of major European cities. The term resource, in this case overturns the traditional negative conception of waste, stressing the opportunity to consider waste, broadening the focus towards marginal territories, wastescapes, as a potential great resource for an innovative and unprecedented cycle of sustainable economic development. There are six partners who have joined the consortium, and in each one a PULL– PeriUrban Living Lab has been activated, among them: TU Delft, in the Netherlands and UNINA in Naples that represent the two pilot cases of the project, with four follow-ups including the University of Ghent in Belgium, the University of Hafencity in Germany, the Institute for Regional Studies in Bulgaria and another University of Geographers in Poland. The ongoing experimentation will end in September 2020, the project leader is Prof. Arjan van Timmeren of TU Delft University of Tecnology, while the coordinator of the Neapolitan unit, in which I am included, is Prof. Michelangelo Russo, of DiARC– Department of Architecture of Naples. Further information are available at the website http://h2020repair.eu/.

7 The EIS identified for organic material (OW) and construction and demolition (CDW) waste have been developed in two doctoral research, still in progress, respectively conducted by Francesca Garzilli and Chiara Mazzarella, both members of the UNINA research unit. In short, the OW solution proposes the construction of medium-sized treatment plants, integrated from the planning point of view to precise peri-urban geographies, for the production of compost, to be selected according to quality, to fertilise crops and create top soil for the coating of recycled aggregates deriving from re-use practices of CDW in an optical of naturalization and environmental mitigation and landscaping.

05

Conclusions and future prospects

The research addresses a current and particularly problematic issue in the context of the processes of transformation and regeneration of urban and peri-urban areas in crisis. The study in particular highlights critical issues relating to the ecological contamination of environmental matrices within territorial areas under critical ecological and settlement conditions, due to their lack of resilience and the persistence of anthropic pressures, which can be found and disseminated in different national and international realities. The practical and operational research approach is thus expressed in the definition of eco-innovative remediation strategies which, conceived in co-creation processes initiated in the Living Lab territorial, trigger ecological and landscape regeneration processes of WL that can lead to more flexible forms of governance and innovative plan sizes. The aim of the research is therefore to grasp the limits of a sectoral approach to environmental remediation measures, analysing its potentialities and impacts from a planning and programmatic perspective connected to the integration of forms and tools of governance, through a comparative analysis of European cases in the Netherlands and in Italy. Starting from a comparison with the regulatory framework of the two contexts, the evolutionary and involutive conditions in relation to the wider European context are highlighted, stressing the ineffectiveness of current remediation measures in managing the complexity of ecologically compromised urban contexts. WL are configured as an intrinsic result of the evolutionary state of the cities, as outputs of linear metabolic processes and growth and are therefore unsustainable. Their spatial and social condition of abandonment, marginality and often pervasive contamination, paradoxically constitutes a profitable trigger point for a semantic reversal and consider them as a resource within metropolitan contexts. This short circuit is feasible with respect to different directions that correspond to attributes structuring these places. In the first instance, with respect to their ecological potential, and therefore to their status as intermediate natures (Desvigne, 2010), which restores a high degree of biodiversity; and in the second place, with respect to their predisposition to change and experimentation, which can take the form of bottom-up processes, as well as their identity, as relevant layers of the territorial palimpsest (Corboz, 1985). The ultimate goal of the research, with respect to the fragility and ecological vulnerability that undermines these contexts, is to provide a series of useful guidelines for their reintroduction into the life cycles of cities with the aim of increasing their resilience. Working on the degree of adaptability of the WL means acting on the ecological problems that distinguish them almost always traceable in phenomena of contamination of their environmental matrices, in particular of the soil. This aim can be achieved with reclamation operations, as effective means of resolving and mitigating the problem, able to start a systemic and circular recycling. The WLs from sterile residues of previous and backward production models are configured as new landscape geographies with a strong functional and strategic value. The complexity inherent in these latent spaces, derived from the interrelationship between the urban, economic and environmental dimensions, entails the need to place the ecological restoration intervention in a transcalar and multidisciplinary perspective. The reason for this need stems from the desire to initiate approaches of reclamation, in co-design, co-development and co-implementation, able to deploy prolonged benefit in terms of space and time, in line with the evolutionary and changing character of urban contexts. The research, promoting the shared development of sustainable remediation strategies within the Living Lab territory activated in Campania, aims to achieve two objectives:

on the one hand, to promote a renewed concept of remediation no longer based on sectoral approaches but adaptive and strong public value, as preliminary and essential steps of the landscape project; and on the other hand, to impose, leveraging the potential condition of remediation as a collective work, a review of the strict implementation tools to promote more flexible aimed at integrating remediation operations within the provisions of the plan. With the aim of providing an answer to the main research question:

In a sustainable and circular perspective, according to which approaches could the reclamation take the form of an integrated, operational and programmatic instrument of urban planning within the regeneration of Wasted Landscapes?

the study was divided, as outlined in the introductory part, into four chapters each aimed at providing answers to four sub-questions.

The **FIRST CHAPTER**, compared to what emerges from the literature on the subject discusses the deep-rooted condition of crisis that has affected the city and the consequences it has entailed in spatial terms, with a proliferation of latent spaces on the territory where there is a significant ecological risk and where the remediation is an imperative, to answer questions

- *What change of course is needed to counter the serious effects of anthropisation on environmental balances?*
- *What operational strategies should be put in place from the point of view of land and landscape design?*

The city and the landscape are in fact complex socio-ecological systems and tangible result of the disastrous anthropic action on the environmental system, today strongly compromised and not at all resilient to the pressures induced by climate change. Making fragile urban contexts adaptive means starting their conception in terms of resources, acting on their metabolisms and on their compromised environmental matrices through reclamation actions that, integrating technical, social and ecological aspects, are oriented towards the definition of the city as a sustainable, self-regenerating and socially equitable ecosystem. The ambitious aim can be pursued starting from the local scale, by intercepting site-specific regenerative solutions and focusing on the needs of the settled communities, actively involving them. This approach allows to outline possible and positive evolutionary scenarios that can be integrated and reflected in the provisions of the implementation tools in force in the territory under investigation.

The **SECOND CHAPTER** investigates, with respect to the latter point, the critical issues that emerge from the current European regulatory frameworks, especially in the Italian context of which it highlights the condition of backwardness with respect to the new demands for sustainability required by the contingencies. In answering the questions

- *What directions should be taken towards a renewed concept of clean-up?*
- *What are the criteria to be pursued for its integration into the policies of the plan?*

The chapter stresses the need for an immediate shift from a sectoral approach to an integrated reclamation for the activation of more flexible forms of governance aimed at accommodating multiactorial strategies of recovery and public management projected in the long term. An intervention of adaptive regeneration and remediation with a strong social connotation that through collectivisation of information extends the cognitive contribution and produces effective regenerative strategies, initiates dynamic processes that constantly reformulate objectives and revise operational and policy instruments by implementing semantic and structural change in planning instruments and planning policies. In this sense, the reclamation is configured as a potential opportunity to experiment with incremental and temporary solutions that lend themselves well to the long time required by urban planning tools. This operational line allows to prepare the basis for profitable socio-economic practices, public-private partnerships and for the social acceptability of the proposed strategies, developed within Living Lab. The temporary approach, in fact, starting from hostile initial conditions, is not only configured as a concrete action to deal with possible unforeseen events, accelerating the mutations of space, but also as a device capable of foreshadowing innovative scenarios of future development supported and welcomed by local communities for the realisation of parts of cities more resilient and prone to change. By preparing the compromised sites for new life cycles, the reclamation approach is thus configured as an integral part of the territorial project, therefore with a strong public value, finding in a plan dimension, with margins that are no longer restrictive, a preferential and adequate location.

The **THIRD CHAPTER**, in addition to providing functional definitions for a better understanding of the remediation process, it addresses the shift from a sectoral approach to a more integrated and technologically sustainable one by providing an overview of the potential remediation technologies applicable during the ecological regeneration of a contaminated environment. At the same time, it also identifies a series of indicators aimed at assessing the sustainability of interventions not only with respect to each individual phase of the process but also with respect to the techniques that are intended to be applied, assessing the impacts with respect to the ecological, economic and social dimension. With respect to the questions

- *What are the mandatory issues that lead to a change of course about the traditional remediation approaches in favour of others that are more sustainable?*
- *On what indicators can their sustainability be assessed?*
- *Which of these approaches are also particularly suitable to meet the needs of landscape reconfiguration of contexts in crisis?*

The chapter underlines the need to adopt sustainable remediation approaches by analysing the critical points that can be found compared to traditional ones. A traditional reclamation intervention is by definition sectoral, therefore aimed at the mere decontamination of the site without any assessment of the potential impacts with respect to the environmental, economic and social components. In most cases, in fact, this type of approach is not only expensive from an economic point of view because it prefers techniques capable of eradicating contamination in the shortest possible time, but also returns to cities sites with which there is no spatial relationship, in which society struggles to identify. On the contrary, a sustainable reclamation intervention tends to be oriented towards technological choices that benefit the three dimensions of sustainability, i.e. environmental, economic and social, promoting the activation of integrated, innovative and multiscale projects on the territory. From the environmental point of view, in order also to satisfy the needs of landscape reconfiguration, the choice is more directed towards nature-based solutions and therefore of phytoremediation, as they are integrated with the naturalistic component of the contexts whose functioning they try to emulate. From an economic point of view, they are the least expensive because they act in situ, even triggering virtuous economic forms, and finally, from a social point of view, they contribute not only to increasing the resilience of contexts, but also to improving the visual perception and quality of life of contexts.

The **FOURTH CHAPTER**, represents the confluence of application and design of the previous strategies and issues identified. Answering questions

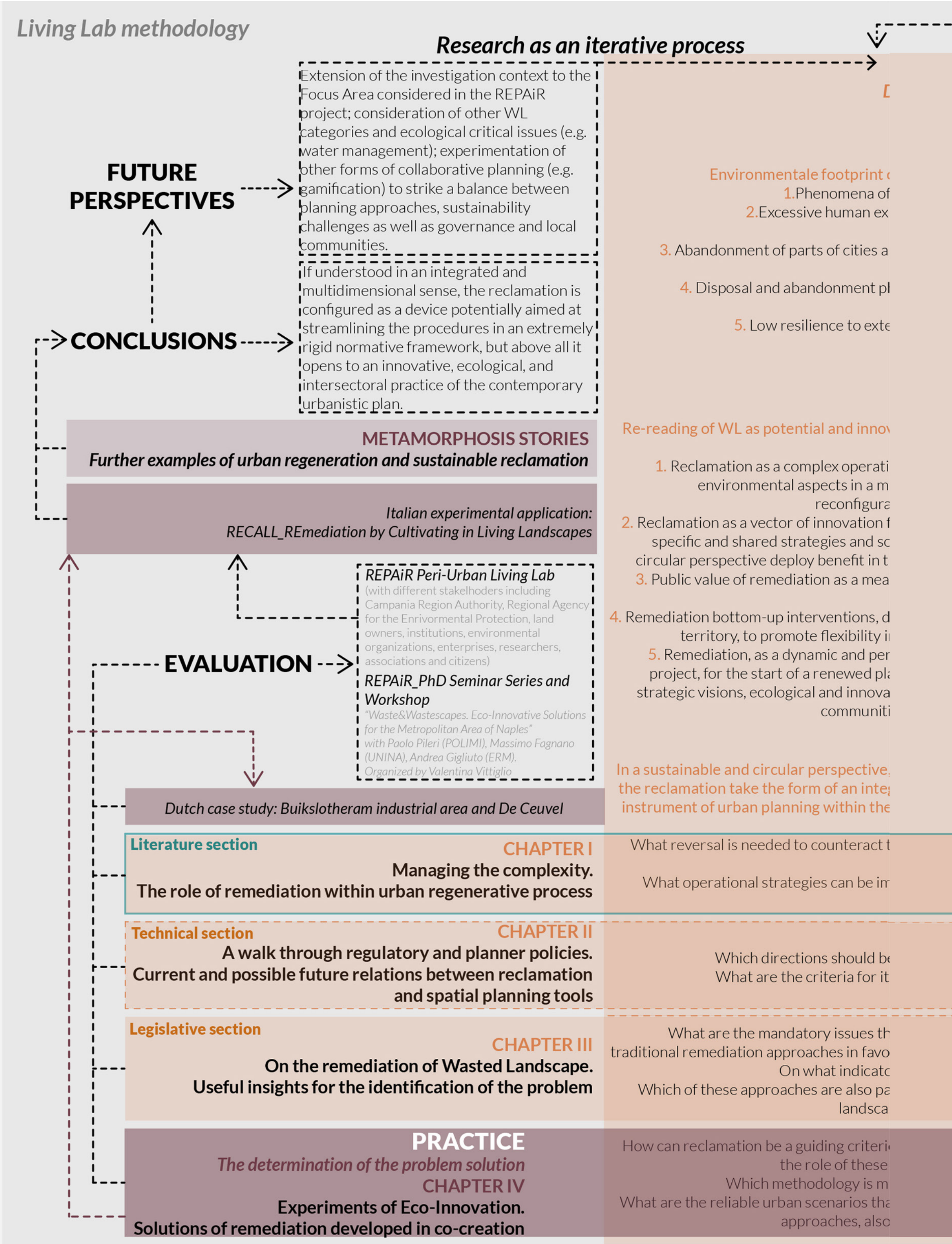
- *How can reclamation be a guiding criterion and strategic material for redefining the role of these areas within the metropolitan context?*
- *Which methodology is most appropriate for their identification?*
- *What are the reliable urban scenarios that could be envisage in relation to these approaches, also in terms of landscape reconfiguration?*

the chapter reaffirms the close synergy of the reclamation with the urban planning project, elevating it to a strategic device aimed at restoring value of use to compromised contexts. To this end, the research selects the Dutch case study as an effective example of existing best practice in which the outlined research objectives are effectively reflected. On the basis of the Dutch model, the research focuses on the implementation of integrated and shared interventions of environmental rehabilitation and territorial regeneration on the basis of an Italian case selected as a demonstrator and developed within a wider project of European research Horizon 2020. In the context of Campania, the proposed approach opens up innovative perspectives both in terms of product but above all of process. As far as the product is concerned, the research intercepts in nature-based solutions a valid eco-innovative, site-specific and sustainable alternatives for the ecological restoration of the peri-urban contexts that characterise the experimental area selected in the Campania Region. These solutions, incorporated in strategies of actions of a wider scope and based on a circular logic, also trigger in the territory a process innovation through the introduction of the short-supply chain, able to combine technological and environmental aspects and defining new ecologies of life for the inhabitants. The short-supply chain is an eco-innovative and place-based process with a positive environmental, economic and social impact on the contexts in which it is applied. In this specific case, it contributes to promoting the agronomic development of new crops for hemp production but also the landscape regeneration of the context in which it is started, facilitating the introduction of circular economies at local level and benefiting the stakeholders. Both cases chosen are application examples of how the remediation intervention, conceived in a collective dimension and shared in a logic of sustainability, can have multiple and effective effects in territorial and spatial terms On the one hand, it allows us to transform the wasted landscapes towards new life cycles, on the other hand it helps to trigger new potential economies connected to a deeper sense of belonging of communities to the investigated places. In the light of the above, both in the case study selected in the Dutch context and in the experimentation started on the Italian context, the research finds as appropriate and effective methodology for the development of eco-innovative solutions that of the Living Lab, consistent with the multidisciplinary and multiscalar dimension that characterises the solution itself. These territorial laboratories, in which the active involvement of the community plays a central role, constitute the point of convergence of different knowledge, skills and techniques to identify the underlying potential in latent urban and peri-urban contexts. Both cases, reporting the results of field trials conducted in co-creation with stakeholders and local users, show how the methodology identified is easily applicable and repeatable in various contexts to develop innovative action strategies that can promote even greater synchrony between the needs of the communities and the planning and decision-making processes. In the end, the approach developed, starting from critical conditions found at the local level, shows how it is possible to activate an 'inversion of sign through which the reclamation understood in this integrated and multidimensional sense. It sets up a device with the potential to streamline procedures in an extremely rigid regulatory framework, but above all it opens up to an innovative practice of contemporary, ecological and intersectoral urban planning. By analysing and deepening the conditions necessary to make a transition to integrated models of sustainability, the research aims to trigger reflections, provide guidelines and a methodology to promote a renewed approach and concept of remediation that is out of step with the traditional and restrictive sectoral logic, active regenerative processes adaptive to marginal places to be transformed into public space systems with eco-systemic value. The research study therefore proposes a model of interaction between urban planning, evaluation and decision-making, public system design and the orientation of environmental remediation actions, with particular reference to the reclamation of polluted and contaminated soils, working on the potential of an approach to reclamation of an eminently naturalistic character as a precondition for urban and territorial development and as a material from which to design the system of open and public spaces.

However, the complexity of the issue addressed presupposes the future deepening of further and relevant issues related to it. Firstly, the research study, with reference to a possible WL taxonomy and the experiences intercepted and conducted in the Netherlands and Italy, considers in particular only the categories of brownfield and disused landfills investigating contamination problems related only to the environmental matrix of the soil and therefore not including criticalities related to water management. In fact, only within the Campania case is there mention of a potential intervention to be achieved for the reclamation of the canal of the Regi Lagni by introducing wetlands for the phyto-purification of water that would require specific and relevant analyses of the pollutants present in the matrix, in addition to checks on the aquifer to determine the degree of contamination and to assess the most suitable technique for eradicating it. Similar sources of contamination found in different ecological matrices and territorial conditions require reflections on additional and specific operational approaches to be implemented with respect to structural characteristics places, providing an opportunity for further verification with regard to the effectiveness of the proposed methodological and application approach. This premise introduces a second question as a potential deepening for future research developments, in particular on the selected survey context in Italy. The area in question, as mentioned above, constitutes a sample of a larger territorial portion, the focus area characterised by morphological conditions and peculiarities as well as potential compromises of different matrices with respect to which the identified operational strategy could be subject to changes. Therefore, with respect to the socio-cultural and historical-political specificities of the site, to the addresses of the regulatory system on it in force and to the type and degree of existing contamination, the type of regeneration intervention, remediation or safety measures could change and with it the environmental and socio-economic implications to be assessed beforehand. As regards the proposed methodology, other collaborative planning approaches could be tested. In the definition of innovative urban scenarios in which the regenerative process of crisis contexts is defined as flexible and dynamic, it is important that communities are actively involved and that from passive spectators they become active agents of change. However, the involvement of stakeholders in collaborative planning processes could reveal limits to the possible mistrust not only of institutions that trigger the process but also in the effectiveness of process itself. In order to overcome this problem, it might be interesting to experiment with other decision support tools and participatory processes which, by examining how to plan a sustainable regeneration intervention, able to reach effective and appropriate decisions by balancing planning approaches, sustainability tools and challenges, with governance and organisational structures, making them more adaptive. These include, for example, gamification as a possible collaborative planning approach which, by simulating a game between the parties and improving their capacity for collective reflection, can trigger an innovative process of urban regeneration.

Far from wanting to impose itself as the only and absolute perspective actionable to achieve this goal, the research path is set as iterative, experimental and never assertive therefore constantly open to new implementations and improvements. This condition consistently reflects the essence of the proposed methodology, with the outlines never defined but, on the contrary, flexible, and adaptive to the specificities of the contexts in which it is intended to be applied. The research proposes, with a view to managing the complexity inherent in WL and remediation measures aimed at their regeneration, the adoption of a multiscale and multidisciplinary approach as the only one able to relate to the peculiarities of these places and to promote a translation from linear to circular metabolisms to initiate them to new life cycles. The proposed strategy could be a privileged lens to draw contemporary territories compromised in terms of resources, such as complex ecosystems in which to launch sustainable and eco-innovative strategies to manage the not always easy interaction between anthropic and natural components. The research addresses the city project from a twofold point of view in spatial terms but also as a result of the interaction of environmental, economic, and social processes that it is proposed to manage with a view to sustainability, stressing the collective dimension. Through the proposal of new scenarios achievable through unconventional approaches and remediation solutions, the research aims to outline possible and new perspectives for contemporary urban planning leading to a review of the current content and restrictive governance tools that require homogeneity, impartiality and adaptability to the needs of communities for a new, circular, and collective vision of landscape.

The Research Roadmap


Living Lab methodology
Research as an iterative process
FUTURE PERSPECTIVES
Extension of the investigation context to the Focus Area considered in the REPAiR project; consideration of other WL categories and ecological critical issues (e.g. water management); experimentation of other forms of collaborative planning (e.g. gamification) to strike a balance between planning approaches, sustainability challenges as well as governance and local communities.
CONCLUSIONS
If understood in an integrated and multidimensional sense, the reclamation is configured as a device potentially aimed at streamlining the procedures in an extremely rigid normative framework, but above all it opens to an innovative, ecological, and intersectoral practice of the contemporary urbanistic plan.
METAMORPHOSIS STORIES
Further examples of urban regeneration and sustainable reclamation
Italian experimental application:
RECALL_REmediation by Cultivating in Living Landscapes
REPAiR Peri-Urban Living Lab
(with different stakelhoders including Campania Region Authority, Regional Agency for the Enrivormental Protection, land owners, institutions, environmental organizations, enterprises, researchers, associations and citizens)
EVALUATION
REPAiR_PhD Seminar Series and Workshop
"Waste&Wastescapes. Eco-Innovative Solutions for the Metropolitan Area of Naples"
with Paolo Pileri (POLIMI), Massimo Fagnano (UNINA), Andrea Gigliuto (ERM).
Organized by Valentina Vittiglio
Dutch case study: Buikslotheram industrial area and De Ceuvel
Literature section
CHAPTER I
Managing the complexity.
The role of remediation within urban regenerative process
Technical section
CHAPTER II
A walk through regulatory and planner policies.
Current and possible future relations between reclamation and spatial planning tools
Legislative section
CHAPTER III
On the remediation of Wasted Landscape.
Useful insights for the identification of the problem
PRACTICE
The determination of the problem solution
CHAPTER IV
Experiments of Eco-Innovation.
Solutions of remediation developed in co-creation
Environmentale footprint
1.Phenomena of
2.Excessive human ex
3. Abandonment of parts of cities a
4. Disposal and abandonment pl
5. Low resilience to exte
Re-reading of WL as potential and innov
1. Reclamation as a complex operati
environmental aspects in a m
reconfigura
2. Reclamation as a vector of innovation f
specific and shared strategies and sc
circular perspective deploy benefit in t
3. Public value of remediation as a mea
4. Remediation bottom-up interventions, d
territory, to promote flexibility i
5. Remediation, as a dynamic and per
project, for the start of a renewed pla
strategic visions, ecological and innova
communiti
In a sustainable and circular perspective,
the reclamation take the form of an inte
instrument of urban planning within the
What reversal is needed to counteract t
What operational strategies can be im
Which directions should be
What are the criteria for it
What are the mandatory issues th
traditional remediation approaches in favo
On what indicato
Which of these approaches are also pa
landsca
How can reclamation be a guiding criteri
the role of these
Which methodology is m
What are the reliable urban scenarios tha
approaches, also

PROBLEM ANALYSIS

)efining the main and critical issues

INTRODUCTORY STUDY

Background to the problem

of the urban systems on a global scale:
expansion and contaction of the cities;
ploitation of non-renewable resources;
- Bad waste disposal and management
nd occupation of land in marginal areas
compared to large urban centres;
ıenomena resulting in degradation and
environmental contamination;
ernal pressures in fragile environments.

Problem statement

Research objectives

vative resources aimed at reactivating
existing territorial capital:
onal tool able to combine technical and
ethodological perspective of landscape
ition, beyond the current sectoral logic;
or the delineation of nature based, site
olutions that in a holistic, multiscale and
he long term for the local communities;
ns of creating sustainable, resilient and
socially equitable ecosystems;
eveloped in Living Lab activated on the
n the practice and in the planning tools;
forming material of the urban planning
an concept, as a device able to envisage
tive for a new urban condition in which
ies can rediscover a sense of belonging.

Research questions

, according to which approaches could
grated, operational and programmatic
regeneration of Wasted Landscapes?

he serious effects of anthropisation on
environmental balances?
plemented with a view to land-use and
landscape planning?

e taken for a new remediation concept?
s integration into the planning policies?

ıat lead to a change of course about the
ur of others that are more sustainable?
ors can their sustainability be assessed?
ırticularly suitable to meet the needs of
pe reconfiguration of contexts in crisis?

on and strategic material for redefining
areas within the metropolitan context?
ost appropriate for their identification?
at could be envisage in relation to these
in terms of landscape reconfiguration?

THEORY

Formulating the research problem

IDENTIFICATION OF THE PROBLEM STATEMENT

1. Wasted Landscapes as complex socio-ecological systems and spatial transposition of outputs of the linear and unsustainable metabolic processes of the urban system, located in urban and metropolitan fringes;
2. Latency and contamination conditions of environmental matrices that define their degradation and marginality in the urban context;
3. Operational-programmatic concerns of regeneration and remediation mechanisms, sectoral and poorly integrated in plan forecasts;
4. Practices and tools planners still incardinated on short-sighted logic and long and intricate a uthorization iters;
5. Conventional , fragile, and impacting remediation solutions, not responsive to the needs of communities and not integrated into a wider project of cities and landscapes .

BODY OF KNOWLEDGE AND STATE OF ART

SYSTEM UNDERSTANDING

Literature review

Understanding of the causes responsible for the proliferation of WL and the dynamics attributable to their contamination.

Data collection

More widely adopted approaches and practices in the European context for WL regeneration and reclamation. Legislative aspects governing these mechanisms at European level, comparing the Dutch and Italian context.

Cores on portions of the soil of the considered Italian sample area to detect the presence or absence of pollutants and to assess their concentration against the permissible values.

SYSTEM MAPPING

Systematisation of the information collected;
Delineation of the boundaries of the problem;
Definition of malleable parts of intervention with respect to a sample area identified for the Italian demonstration case to fill the gap between theoretical and practical dimensions.

Main experts involved

DiARC Dipartimento di Architettura

University of Naples "Federico II" Department of Architecture Naples, Italy

TUDelft Delft University of Technology

TUDelft University of Technologyand Built Environment Department of Urbanism Delft, Netherlands

ERM

Environmental Resource Management Milan, Italy

Dipartimento di Agraria

University of Naples "Federico II" Department of Agricultural Sciences Naples, Italy

REPAiR

Metamorphosis stories

Further examples of urban regeneration and sustainable reclamation

ALUMNAE VALLEY

Start/end
1997-2000

Location
Massachusetts, United States

Category
Former natural gas pumping station and parking area

Surface
13.500 m²

Project Team
Michael Van Valkenburgh Associates (Landscape Architects), Pine&Swallow Associates (Soil Consultant), ARUP e Vanasse Hangen Brustlin (Engineers), H Plus (Graphic Design)

Type of pollution
Heavy metals, hydrocarbons

Site end use
Seat of a college and public park

Sources
Photo: www.asla.org/awards/2006/06winners/309.html
http://cs.wellesley.edu/~namadeo/sust/landscape-11916.pdf
http://academics.wellesley.edu/EnvironmentalStudies/Curriculum/ES%20101/ES101%20AlumnaeValley.pdf
https://issuu.com/tylersmithson8/docs/thesisbookfinal

Formerly the site of a natural gas pumping station and finally a car park, Alumnae Valley fell into a long state of neglect until 1997 when the project for its conversion into an ecological campus green space was presented. However, the recovery project had to cope with the contamination in the ground, during the removal of the parking plate and during the excavation of the new structures. The contaminated soil has undergone two different treatments based on the percentage of pollutants present. The strongly compromised soil has undergone ex situ decontamination, while those with a low degree of contamination have been reused in situ after being encapsulated and covered with geosynthetic clay and then covered with 30 thumbs of fertile ground re-natured and on which walkways have been located. To these operations is added the constant pumping of the contaminated groundwater thanks to the construction of wells and pumps that transport it out of the site, where it has undergone further treatments. This operation resulted in an increase in the surface area of about two metres from the lake level. The wet sedimentation system was designed along the shores of the lake instead. The water is collected here, filtered and purified thanks to plant species suitable for the purpose, before flowing back into the lake. The conversion project is an example of the protection and conservation of the historical identity of the place and, at the same time, of the restoration and reclamation of the landscape, strongly guided by the respect of ecological principles, restoring an intervention perfectly integrated in the natural landscape of the Valley.

ARIEL SHARON PARK

Start/end
2004-2020 (ongoing)

Location
Tel Aviv, Israel

Category
Former landfill

Surface
118 hectars

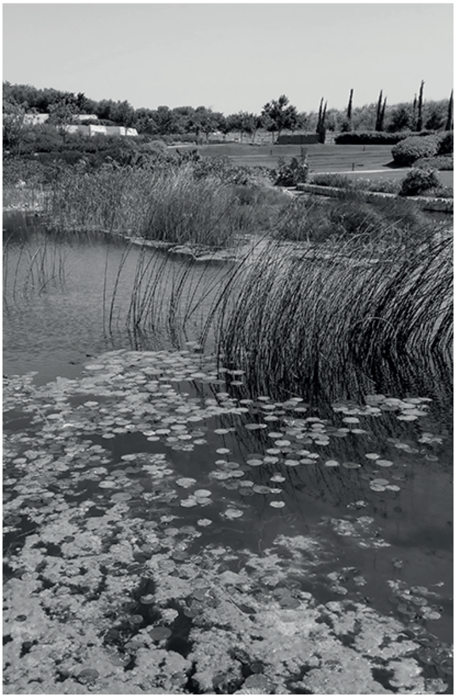
Project Team
Latz+Partner

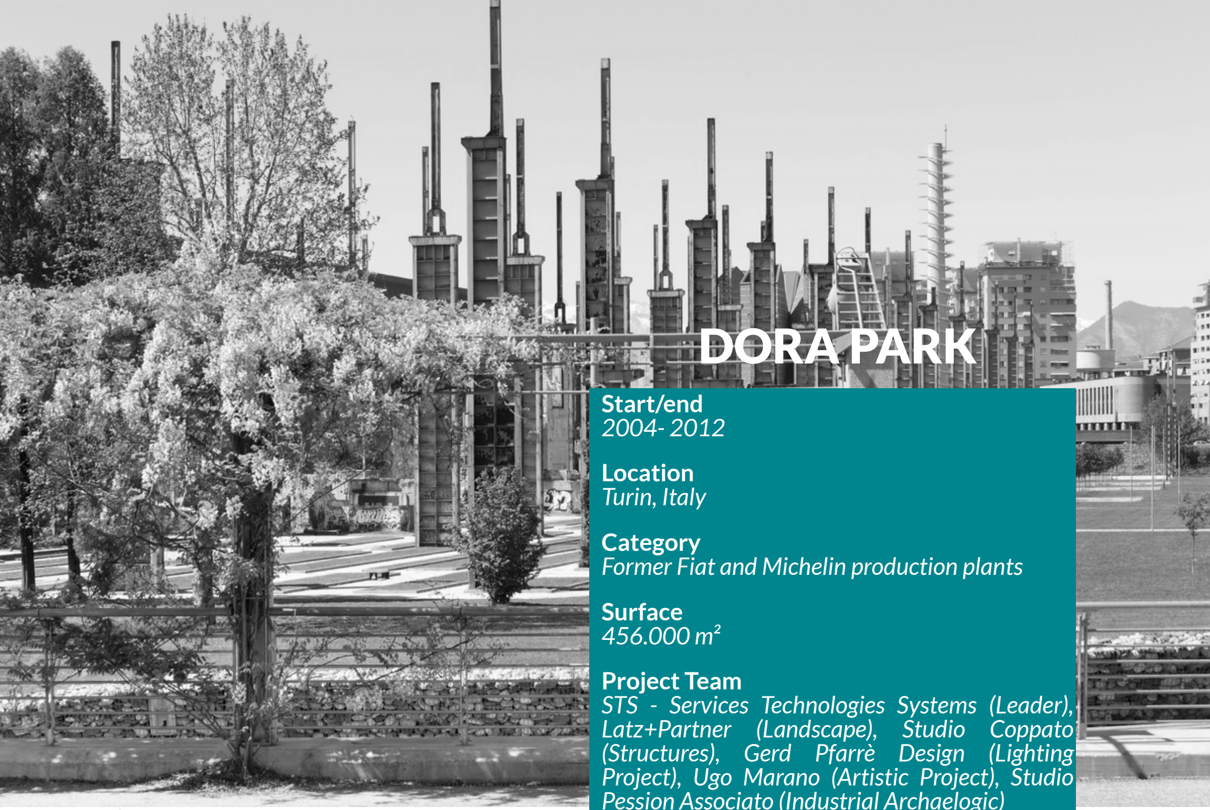
Type of pollution
Leachate derived from accumulation of mu nicipal solid waste

Site end use
Public park

Sources
Photo: www.commons.wikimedia.org/
www.latzundpartner.de/en
www.fromthegrapevine.com
www.cclr.org

Hyria is the gigantic landfill of Gush Dan that stands 60 meters far from the dense surrounding urban fabric. It was active from 1952 to 1998, until the regional authorities decided to end its intensive disposal of municipal solid waste. In 2004, work began on converting the landfill into the largest green lung in the urban area of Dan, which is still being completed and will allow the final opening of the park in 2020. The remediation project was carried out with respect to three main issues to be addressed in order to reduce impacts, greenhouse gas emissions, slope instability and leachate formation in the soil. The problem of slope stability has been solved by using counterweights and a palificate wall at the base of the mountain. Regarding the other two criticalities they have been used for different arrangements. To allow safe use of the park, the upper part of the former landfill hosting the oasis has been treated with the technique of capping, with several protective layers. The first sealing layer in bioplastics prevents the leakage of methane and prevents water infiltration; a draining layer of gravel for the collection of water and finally, the last one, about one-metre-high, of pure and renaturalised soil. Other in situ plants are those for the waste water treatment of the disposal process. The landfill leachate is treated naturally by the wetlands, which are designed on the side of the road. The biogas, produced by the chemical processes of decomposition of the waste, is extracted through wells and transported through pipelines to a textile factory not far from the landfill to provide energy to the city, in a perfectly circular optics of recycling according to which all the furniture of the park were also made. The opening of the park took place in several stages, the last in 2020 and will give back to visitors a large green park as well as scenic point on the city of Tel Aviv.





DORA PARK

Start/end
2004- 2012

Location
Turin, Italy

Category
Former Fiat and Michelin production plants

Surface
456.000 m^2

Project Team
STS - Services Technologies Systems (Leader), Latz+Partner (Landscape), Studio Coppato (Structures), Gerd Pfarrè Design (Lighting Project), Ugo Marano (Artistic Project), Studio Pession Associato (Industrial Archaelogic)

Type of pollution
Heavy metals

Site end use
Public park

Sources
Photo: www.latzundpartner.de
Anelli, R., Croci, I., Pirovano, L., Pisani, F., Rizzi, A., Sicchi, R., Villa, E. 2015. Nuovi modelli di parchi urbani in Europa. Milano: Libri della Natura
www.recycledlandscapes.org
www.comune.torino.it

Dora Park project is part of a wider and more ambitious project called Spina 3, in turn connected to that of redevelopment of the central connection between the north and south of Turin, crossed by the Dora Riparia river. The linear park has a length of 1700 metres and a width of 800 metres.The park is divided into five sections. Specifically, the Ingest area is a large public garden in which lakes of water wind through the garrison industrial framework; the Mortara area, green plug connecting along the north bank of the river, culminates with a panoramic viewpoint from which to enjoy the view of the whole area and access to the north park; the Michelin area, with a large lawn area, is dominated by the cooling tower plant; the Valdocco area with its wooded square and finally the beating heart of the whole park, the Vitali plot where the Fiat industries were built. Its conversion has included a functional mix perfectly integrated with the remains of the steelworks, recreational and sports areas alternate in fact with the naturalistic ones where the large ponds have been converted into aquatic gardens. The preliminary phase of the redevelopment project was that of reclamation, due to the significant presence of chromium in the environmental matrices. The first interventions, very impactful, provided the injection of ferrous sulphate into the soil to lower the chromium concentration threshold in the matrix. Subsequently, more sustainable and nature-based measures were adopted, such as phytoremediation with Short Rotation Forestry with yield, waste to energy and biomass ash disposal at the end of each growing season. This process will be repeated for about 15 years. The sustainable approach and the respect for the identity values landed it the prestigious International Architecture Award 2012.

EMSCHER PARK

Start/end
1990- 2002

Location
Duisburg, northen Ruhr disctrict, Germany

Category
Former steel industry

Surface
200 hectars

Project Team
Latz + Partner, Latz-Riehl, G. Lipkowsky

Type of pollution
Heavy metals and polyaromatic hydrocarbons

Site end use
Public park

Sources
Photo: www.commons.wikimedia.org/
www.latzundpartner.de/en
www.urbangreenbluegrids.com
www.recycledlandscapes.altervista.org

The reclamation of the Ruhr basin is a clear demonstration of how the choice of technologies aimed at the decontamination of the site can be integrated in a pre-existing historical framework, without altering it but favouring a close synergy among them. The decline of the area began in the late 80s. L'IBA Emscher Park was established to promote the conversion of the district into a multifunctional park, according to some important steps, firstly the reclamation of contaminated matrices. As far as water is concerned, action has been taken to rehabilitate the river and its tributaries, contaminated by industrial waste, by distributing micro-purifiers in the area and designing wetlands, aimed also at restoring biodiversity. As regards soil, it has been divided for decontamination purposes into three different categories according to the percentage of pollution. The first included land that could be used for environmental rehabilitation; the second category provided for reusable soil only after surface insulation with impermeable barriers, in order to prevent the spread of contaminants; the third one included soils to be treated ex situ for use only after specific treatment because they were heavily contaminated. The soils belonging to the first and second category have been directly reused in situ while the soil characterised by slight contamination has been encapsulated inside the impermeable barriers and subsequently renaturalised. It had the role to shape hills, with heights ranging from 50 cm to 2 metres, to exalt the morphological reliefs of the park and to return a landmark intervention through panoramic viewpoints. Finally, the industrial pavilions became cultural and recreational centres as well as productive. The project is a clear example of how a territorial limit can be transformed into opportunities for innovative and sustainable development.

FRESHKILLS PARK

Start/end
2002-2030 (ongoing)

Location
Staten Island, United States

Category
Former landfill

Surface
1890 hectars

Project Team
James Comer Field Operations HR&A. HDR, Rogers Surveyng, Geosvntec. Langen Engineering, Halcrow Yolles, Biohabitats, Applied Ecological Services, AKRF, Philo Habib & Associates.

Type of pollution
Leachate derived from accumulation of municipal solid waste

Site end use
Public park

Sources
Photo: www.https://archpaper.com/
Kirkwood, N. 2001. Manufactured Sites. Rethiking Post-Industrial Landscape. London: Taylor&Francis
www.fieldoperations.net
www.recycledlandscapes.org
www.timeline.freshkillspark.org

Freshkills is considered the largest storage area of urban solid waste since 1948. It was closed in 2001. The main objectives guiding the development of the master plan concerned the creation of a park for recreational and cultural use, the restoration of ecosystem balances and the creation of networks and routes to solve problems of accessibility to the site. The park is divided into five parts, the confluence, the cultural and recreational heart as well as market area; the north park with cycle routespedestrians and areas for bird watching and fishing; south park dedicated to sport; east park with wetlands for the restoration of biodiversity and finally the west park which is the higher than the park's share of development. All these activities were started after remediation intervention, which included a multi-layer capping system. A first layer, placed directly on that of solid waste, consists of assorted and compacted soil to reduce erosion phenomena and slope stability and drainage; the second layer, consisting of waterproof plastic, placed on the previous one prevents the infiltration of water and therefore the formation of leachate; the third layer is made with draining material to soften the pressure of the water on the underlying layer; an additional layer of soil is applied to avoid lifting and breaking the underlying layers and to provide a solid base to the last layer of soil suitable for sowing to re-naturalize the surface. The project, carried out on the basis of a 30-year master plan, will include flexible steps in which to start management and ecological processes to promote its transition from contaminated landfill to sustainable public park.

GAS WORKS PARK

Start/end
1973-1975

Location
Seattle, United States

Category
Former gas production plant

Surface
80.000 m²

Project Team
Richard Haag Associates con Douglas Tuma, Stephen G. Ray, Kenichi Nakano

Type of pollution
Polyaromatic hydrocarbons

Site end use
Public park

Sources
Photo: www.commons.wikimedia.org/
Kirkwood, N. 2001. Manufactured Sites. Rethiking Post-Industrial Landscape. London: Taylor&Francis www. seattle.curbed.com

The project was conceived in 1971 and it is the first attempt in the world to recover, reclaim, and convert a former industrial district into a public park. On the shores of the Lake Union, opposite the center of Seattle, the production plant was active from 1906 to 1956, long falling into a state of decay and abandonment before its redevelopment that began in 1973. The only pre-existence to be protected, the refining towers that were then converted into recreational spaces. A revolutionary idea for those times when demolition and construction of extended concrete platforms were the only options available. Before retraining, information campaigns were organised to raise awareness of such projects among local communities and actively involve them in the conversion process. In addition to the design aspect, the innovation for those times was the remediation technique used for the decontamination of soil hydrocarbons, the bioremediation, demonstrating as more natural choices are equally effective in reducing contamination to acceptable levels. The process involves mixing organic matter with contaminated soil which is then encapsulated in a large pile and capped with 18 inches of hard-packed clay, also responding to landscape reconfiguration needs, as the pile has formed a small hill, Kite Hill, which is a vantage point over the city.Gas Works Park was listed in the National Register of Historic Places in 2013.

NANSEN PARK

Start/end
2004-2008

Location
Oslo, Norway

Category
Former airport

Surface
200.000 m²

Project Team
Biørbekk&Lindheim architects, Norconsult (Techinical consultant), Atelier Dreiseitl (Artistic Water Project)

Type of pollution
Heavy metals

Site end use
Public park

Sources
Photo: www.landezine.com
Anelli, R., Croci, I., Pirovano, L., Pisani, F., Rizzi, A., Sicchi, R., Villa, E. 2015. Nuovi modelli di parchi urbani in Europa. Milano: Libri della Natura
www. archello.com

In Fornebu airport area the reclamation and landscaping project was a pretext for launching a more ambitious project involving beyond the recreational functions of the park, also the realisation of residences and offices for the public-private sector. The redevelopment project envisaged the creation of a road link which developed around a central hub, the park, from which seven green beams would allow access from several directions.The ring and other infrastructure networks served building plots for residences and offices. The conversion project also addressed issues related to the compromise ecological status of the places. The contaminated soils have been reclaimed by phytoremediation while the water, draining from a thin strip of cement and corten, located at the beginning of the park, converge in a large humid area. The latter has a dual function, on one hand it acts as containment during periods of heavy rain and, on the other hand, it purifies and oxygenates water before it flows into the sea, through ecological sand filters. Structures, testimonies of the past land use, are the control tower and the adjacent buildings that host recreational functions, refreshments and a library, while the terminal part of the track has been converted into a playing field. A cycle-pedestrian path leads into a large square, paved entirely with granite which declines slowly towards the lake, configuring itself as a land art sculpture. On the opposite side of the lake, hills and slight slopes bear witness to the ancient morphology of the land, welcoming varied jumps of altitude, different vegetation and biodiversity, all merged in a perfect balance.

QUEEN E. OLYMPIC PARK

Start/end
2004-2021 (ongoing)

Location
Stratford, England

Category
Former industrial area

Surface
227 hectars

Project Team
Hargreaves Associates, LDA Design (Landscape Project Masterplan)
Allies&Morrison (Bridge and main infrastructures Project),
Heneghan Pen Architects (Central Park Bridge Projects)

Type of pollution
Heavy metals, hydrocarbons

Site end use
Multifunctional park

Sources
Photo: Photo: www.commons.wikimedia.org/
Anelli, R., Croci, I., Pirovano, L., Pisani, F., Rizzi, A., Sicchi, R., Villa, E. 2015. Nuovi modelli di parchi urbani in Europa. Milano: Libri della Natura
Kirkwood, N. 2001. Manufactured Sites. Rethiking Post-Industrial Landscape. London: Taylor&Francis

The park was born from the transformation of the London 2012 Olympic and Pralympic Park, the degraded industrial area of East London. The whole area is divided into two sections, the North Park and the South Park that extend along the bank of the river Lea. The project still in progress, is being finalised with the development of the areas of the district, on which new districts have arisen and will arise. The South Park includes spaces dedicated to recreational, sports and cultural activities, thanks to the presence of amphitheaters and theatres. The reference buildings in this first compartment are the Aquatic Centre designed by Zaha Hadid and the Olympic Stadium of Populous Architects. The main cornestone of the South Park is the square, about 22 hectares, along which follow the gardens designed by James Corner, each with a different function. the South Park peninsula leads to the North Park via the Central Park Bridge. The North Park is the most naturalistic part, the morphology of the land is shaped by natural sinuous forms that converge towards humid basins with function of phyto-purification for the water, before these flow into the river. As regards the decontamination of the area, the reclamation project took three years to eradicate the pollution produced by the previous industrial activity, and used techniques such as soil washing, bioremedation and chemical and geotechnical stabilisation to ensure the sustainability of the intervention, reusing about 90% of the soil coming from the excavation. A catalyst for environmental regeneration and urban, economic and social development of the territory, it is one of the largest parks in Europe and its recovery has allowed to restore dignity to one of the most degraded areas of London before the Olympics.

VALL D'EN JOAN

Start/end
2003-2010

Location
Garraf, Spain

Category
Former landfill

Surface
85 hectars

Project Team
Enric Batlle, Joan Roig (Architects); Teresa Galí (Agricultural Engineer)

Type of pollution
Leachate derived from accumulation of municipal solid waste

Site end use
Public park

Sources
Photo: www. wastearchitecture.com
www.recycledlandscapes.altervista.org
www.architetturaecosostenibile.it
www. wastearchitecture.com

Garraf is one of the 12 protected sites in Catalonia and it was a former municipal solid waste dump which has been converted into a public urban park, after reclamation and renaturalisation process. The landfill site was active from 1974 to 2006 and the recovery project included four separate implementation steps, addressing specific issues for the future and safe use of the site. The first challenge was to solve, from a technical point of view, the problem of concealing waste; the second one was the re-use of biogas from the decomposition of waste for energy purposes; and the third one, purely landscape, was characterized to restore identity to an area strongly compromised by a system of terraces that, in accordance with the steep slope of the valley, facilitate the arrival at the lookout point located at the top. The system of small terraces of soil, besides playing a function of regulating the flow of irrigated water and meteoric avoiding problems of runoff along the slopes, have allowed the optimal sealing of the leachate from organic waste, isolated by a capping system culminating in a layer of soil, then re-natured with native species, about 20 cm. The area hosts different functions, recreational, sports, nature trails but especially a museum aimed at raising awareness of sustainable and ecological issues the primary purpose of the intervention, the restoration of primary ecosystems.

ECOBAT

Start/end
2015

Location
Caserta, Italy

Category
Former industrial area

Surface
227,5

Project Team
Life Ecoremed Project

Type of pollution
Heavy metals

Site end use
Wood inside the factory

Sources
www.ecoremed.it

The Ecobat chain is the largest producer and recycler of lead in the world and one of its branches, in Italy, is the Ecobat Spa, a company that has always been sensitive to the issues of sustainability and circularity. The strong interest in environmental issues was translated in 2013 into a project to secure a site adjacent to the industrial plant contaminated with heavy metals. The intervention provided for phytostabilisation of industrial soil to counteract the lifting of contaminated dust and phyto-purification by planting 17,500 poplars to neutralise the presence of heavy metals in the soil, all completed with fertilisation with compost. From a circular economic point of view, the compost used came from the nearby Salerno plant and was produced from the organic fraction of municipal solid waste. According to the same circular principle, at the end of the phytoremediation process, the wood produced, and presumably contaminated, will be used as a reducing agent in the furnaces, replacing the petroleum coke, for the fusion of batteries for the recycling of lead. The intervention therefore has a twofold usefulness, on the one hand it implements the process of phytoremediation also in order to limit the migration of contaminants towards the groundwater, while on the other hand, it promotes the reconstruction of a natural environment and the restoration of biodiversity in a place that would otherwise have been further and irreversibly compromised.

NOTES