beyond WASTESCAPES

Opportunities for sustainable urban and territorial regenerations

LIBERA AMENTA

Preface by Arjan van Timmeren
Afterword by Enrico Formato

Fig. 1 Uncultivated areas, Amsterdam Metropolitan Area.

Fig. 2 Buffer zones of infrastructures, Amsterdam Metropolitan Area.

Fig. 3 Illegal dumping of waste along the streets. Naples Metropolitan Area.

Fig. 4 Area in a waiting condition. Amsterdam Metropolitan Area.


ALURA
hekwerk

Fig. 5 Informal waste deposit. Amsterdam Metropolitan Area.

Fig. 6 Unfinished building. Naples Metropolitan Area.

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TU DELFT Open, 2019

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Published by:
TU Delft Open
1st edition Delft, March 2019

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ISBN/EAN: 978-94-6366-156-0

Cover designed by the author. Sources: Naples wastescapes map, by UNINA Lab REPAiR Team; "Dry Land", https://commons.wikimedia.org/wiki/File:%22Dry_land%22.JPG, Arivumathi [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], last access March 2019.

To my family

Fig.7 Area in a waiting condition. Amsterdam Metropolitan Area.

Note to the Readers

This book is based on PhD research entitled "REVERSE LAND: Wasted Landscapes as a resource to re-cycle contemporary cities" (2015) – which is a PhD Course in the Department of Urban Design and Planning at the University of Naples Federico II. Research has further developed at the Delft University of Technology by Libera Amenta since 2014.

Moreover, this research has been done within the framework of the European Horizon 2020 funded research program called 'REPAiR (REsource Management in Peri-urban AReas): Going Beyond Urban Metabolism.' This project has therefore received funding from the European Union's Horizon 2020 research and innovation programme, under the grant agreement number 688920. This book reflects only the author's view, and the Commission is not responsible for any use that may be made based on the information it contains.

Acknowledgments

Firstly, I would like to show my sincere gratitude to my supervisor Prof. Arjan van Timmeren for the continuous guidance of my research, for his patience, motivation, positive attitude and immense knowledge. My sincere thanks also goes to Enrico Formato for his precious personal and professional support. Moreover, I would like to thank Fonz Dekkers for his feedback, Valentina Vittiglio for the graphic support, and Lei Qu for the photo courtesy. Moreover, I am also grateful to the whole REPAiR Team, in particular to my colleagues of the UNINA and TUDelft Research Teams. I would like to thank my family without which this project could have not been possible. Finally, I wish to thank my loving and supportive husband Paolo.

Fig. 8 Agriculture in crisis. Naples Metropolitan Area

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Preface

Land as a resource: the need to regenerate wastelands

by Arjan van Timmeren

Around the beginning of the 20th century, Camillo Sitte (1901) first called parks the "lungs of the city". Not late after, as one of the first signs for a changing attitude toward health aspects in the built environment is Ebenezer Howard's (1902) publication "The garden cities of tomorrow", in which he designs "healthy urban living" with garden cities which should facilitate interaction between the city and the country. In his publication he responds to the past industrial age, with all it's downsides to the environment and people. He intends to direct social processes with these garden cities. He hopes to secure the quality of the improved situation with the occupants having their own management and self-government of their housing and surroundings. After the First World War, movements arise in Britain and Germany as a reaction to industrialization going back to movements such as Arts & Crafts from the previous century, which also aimed for healthier living and housing. It is also in this period that Leberecht Migge and Ernst May link up "healthy" agriculture with "healthy" building and living. Gradually, a movement of "building with a shifted focus" comes into existence, such as Rudolf Steiner's anthroposophist movement. About a decade later Patrick Geddes (1915) publishes his study on the urban growth patterns. Geddes's antidote planning was planning at a regional scale, based on a solid analytical understanding of the natural features and processes of the landscape and its resources. It can be seen as one of the first expressions of a regenerative vision on urban development. A regenerative system provides for continuous replacement, through its own functional processes, of the energy and materials used in its operations (van Timmeren, 2006).

While several decades of different interpretations followed, it was in 1953 that Eugene Odum published Fundamentals of Ecology, the first textbook to introduce systems theory— or complexity theory—into the study of the natural environment. In his book Odum outlines the concept of interdependence between ecosystems, which will justify our reliance on ecosystem services for survival and highlight the economic importance of natural resources. He argued that this has great implications in the assessment of the carrying capacity of natural ecosystems. This concept became a key concept for environmental sciences in the next decades. Nevertheless, throughout the 20th century, consumption, the throughput of the one-way flows, became increasingly concentrated in large cities, demanding ever increasing volumes of material from the sources. To support this, centralized infrastructure provision facilitates such a linear urban metabolism and leads to ecological overshoot. More and more cities are determining what happens in the rest of the landscape, namely a pattern of degeneration. By the 1960's the ecological dysfunctions were beginning to gain attention, and environmental activists began to make themselves heard.

In April 1968, Italian industrialist Aurelio Peccei and Scottish scientist Alexander King

convened the first meeting of the Club of Rome. Concerned by prevailing short-term thinking in international affairs, their mission was to focus on the long-term consequences of growing global interdependence and environmental deterioration. The Club of Rome's project, the "Predicament of Mankind", was one of the pioneering works aimed at identifying the limits to growth in population and industrial capital. In 1972, one year before the worldwide energy crisis, the report "The limits to growth" (Meadows, 1972) is published. It deals with explorations by the Club of Rome into the situation of mankind in relation to the amount of base materials in the world and the restrictions related to this. In the report, the dynamics of the global system, such as population growth, supplies of base materials, food production, industrial production and environmental pollution, is simulated in computer models and the limits to growth are investigated. Although numerical answers to the investigations were not possible owing to the simplicity of the model coupled with the data quality, information on the causes of growth and limits to growth were able to be gathered (Meadows et al., 1972). The model was, however, criticized for its exclusion of scientific and technological advancements that were apparent at the time. While the physical aspects of human activities were well represented, the critical social factors that affect value systems, such as education and employment, were not included. Important to consider in relation to this is that a policy document published by the Canadian Minister of Public Health in 1974, "A new perspective on health for Canadians", has much influence internationally. In the "Health Field Concept", part of this document, attention is drawn to physical and social living conditions, to ways of life and to biological (genetic) characteristics as the so-called "determinants" of health (van Timmeren, 2006). Following this document, the WHO emphasises and supports initiatives for stimulating a healthy interaction between people and their environment, where the interaction between man and environment is considered a self-organizing system leading to enhanced health through an evolutionary or growth process.

Meanwhile, studies on the capacity of nature to support human activities already were started in the late 1960s (Beck 1994). While these studies focussed on various indicators such as energy requirements, non-renewable resources or even photosynthetic potentials, they are based on the principle of quantifying energy and resource flows through human society. This is also the time in which first attempts on further going interconnections between several essential flows (energy, sanitation, nutrients) were made. An example of this time is the city of Kalundborg (population 16,000), located on the Danish coast about 110 km west of Copenhagen, which is regarded today as the oldest and best-known example of *industrial symbiosis*. The symbiosis activities in Kalundborg began in 1961, when a project was developed and implemented to use surface water from Lake Tisso for a new oil refinery in order to save the limited supplies of ground water. The city of Kalundborg took the responsibility to build the pipeline, while the refinery financed it. Starting from this initial collaboration, the number of partners gradually increased. However, it was not until 1980, that partners realised they had effectively "self-organised" into an industrial ecology cluster. This term refers to a specific type of material and energy exchanges that occur whenever industrial clusters

take advantage of the geographic proximity between companies to eliminate industrial waste. In the past decades it has been expanded to the built environment in general, and in particular to the reciprocities between different 'key flows' in/of society, their origin/destination, the infrastructures necessary to support them, and spaces needed.

Here comes in the importance of physical space (next to the dimension of time), and in particular the concept of carrying capacity. Meadows et al. (1992) defined carrying capacity as the size of the population that can be supported indefinitely by a delineated habitat. This concept was originally applied to relatively simple populations or resource systems. The maximum number of people that can be supported may not be the optimum, as both biological and industrial consumption relating to a population of people have, in turn, to be supported. Therefore, Rees (1996) redefined human carrying capacity in terms of maximum load –and not the population- that could be safely imposed on the environment, as human beings differ from the other species due to industrial activities. Based on the work of Odum, different interpretations were developed that address ecology and the relations between nature and culture. Interpretations such as (in this order) autecology, synecology, cybernetic ecology, system dynamics ecology and chaos ecology. The difference is based on several indicators related to abiotics and biotics, but foremost the before stated order represents a decreasing human centred approach. Until the late nineties, most projects on environment related flows of energy, water, waste, nutrients and materials do not make any attempt to rise above the compartmentalized policy domains. Many well-meant initiatives get stuck in thematic and effect-oriented solutions without reaching a certain degree of integration or added value of environmental measures. The corresponding infrastructure is often restricted to transport infrastructure with its own status, dominant parties involved and path-dependent policy. Meanwhile, few people in society deny the necessity to preserve or enhance the environment or our living surroundings, to distribute wealth and welfare, to offer all people scope to develop themselves and more awareness (the "equity" principle within the concept of 'Sustainable Development'). The emphasis on the restriction of the environmental load is expected to lead soon to increasing resistance. Background of the slow change in this was that public support is lacking at times when this has consequences that cannot immediately be capitalized within the current economic models. Also socio-economical difficulties to change are at play. "Most people like progress, fewer like changes" Boisseleau stated in this context (van Timmeren, 2006). Therefore, the emphasis should be on conducting a transformation process. Some scholars already in the nineties of the previous age added to this the need for 'expanding environmental space' (i.e. environmental performance) (Kristinsson et al., 1997). Critical to the implementation of this option of expanding the environmental space, or better: of integrated resource management in the urban living environment from the perspective of urban metabolism, is knowledge dissemination of (inter)location related low exergy solutions including strong feedback systems–constructive feedback loops– (Folke et al., 2006) between the different physical scales (site, neighbourhood, city-region, et cetera) (van Timmeren, 2013).

An important aspect to consider in order to meet the above-mentioned goals is the availability of land as a resource. Land use change is to be considered an important threat (and driver) for the (im)possibilities of agriculture worldwide, and thus of our survival. Since the turn of the millennium, urban expansion into natural and agricultural lands has been recorded in countries around the world. From a global outlook, urban expansion is expected to take place on soils that are 1.77 times more productive for cultivation than the global average (Bren d'Amour et al, 2017) until the year 2030. At the same time, being 'pushed out' of urbanised areas (often fertile deltas), agriculture on its turn pushes out fragile natural areas, mostly in the southern hemisphere. But besides of this ongoing process of gradual, but intense, 'land grabbing', in urbanised areas there's also an existing and growing problem related to land (and soils) which includes issues of abandonment, dereliction, pollution, waste, and territorial vulnerability, known as 'wasted landscapes' or 'wastescapes' (Amenta & van Timmeren, 2018), which on its turn among others directs the way urbanization takes place, again forcing it towards the 'rich' agricultural soils. In particular, the peri-urban areas are spatially affected by these processes. This often leads to less effective use and/or abandonment because they are currently impossible to use, demanding impactful (and often expensive) regeneration and revalorization to make them usable again. These areas are also exemplifying the lost relation between citizens and their soils, and related to that food and water and related functional aspects of (green)space. It could be related to the 'fear' once expressed by Jean Jacques Rousseau who, worried about cities' food system and thus citizens diminishing relation to land and food related to the ongoing process of their moving to cities, stated that 'when you move into cities you become a cannibal'. Referring to the parasitical relation between cities and hinterland that started to grow. This, within the actual global asymmetrical growth due to shifts in land use, can be related to the concept of autophagy (van Timmeren, 2013), a term usually used within cytology to denote the process of self-digestion by a cell. This is a dangerous process, which emphasises once again, that together with the context of climate change and global depletion the issue of derelict, polluted land, wastescapes should be addressed urgently, and by doing so should be seen as the ultimate opportunity to do things right, the lever to propel lasting sustainable development. This uncertain struggle is necessary to calibrate global civilization with the realities and limits of the biosphere.

The complexity involved with wastescapes deals with the notion that it includes many different fields of focus, making it a multidisciplinary topic. The term is associated with concepts related to economic, quality of life, health, accessibility, resources, society, landscape, environment, and infrastructure. The clustering of these terms helps to compose (peri) urban challenges, while offering valuable space(s) for finding solutions. It relates to the (need for) 'systems thinking': "Understanding that sustainability cannot be achieved by one single party, process or building alone" (Choy 2017). System thinking allows one to utilize a holistic and trans-disciplinary approach across multiple scales and sectors. Which, on its turn within a strategic approach or setting can be related to the

concept of place-making (Healey, 1997): a 'balanced concept which is interconnected with surrounding areas/ projects, in a structure that supports flexible and continuous change processes, is open, and is continuously capable of absorbing corrections through permanent reflection (and learning)'.

The focus of this book, wastescapes, and in particular the process of regeneration of wastescapes, from such a perspective of placemaking eventually might be able to also help support circular concepts by including the creation of closed resource loops to the concepts that produce little to no waste. Regeneration can also help in the development of a more vital city through the qualitative improvement of connections by physically increasing accessibility to existing urban infrastructures, as well surrounding environments. The development of strategies to achieve the ability to incorporate continuous change is necessary to tune the complex structures of society, the flows considered, and nature (natural processes) to each other, and thus reduce (or eventually diminish) the ongoing autophagous processes related to land use worldwide.
For this purpose, sustainable development of an area had better not follow the ready-made plan, but should be embedded into a structure of flexible and continuous processes of change (van Timmeren, 1999). It should be open to corrections and capable of continuously absorbing changes. Starting from the ambition of sustainable development, an integrated development of areas assumes a simultaneous change in the material/physical, social and symbolic domains. In this, the building and perseverance of relationships based on mutual trust between the participants is considered the social capital in the area. By including a broad coalition of actors, such regeneration will not only assess and address existing problems (pollution, nuisance, etc.) and related economic damage, but will help linking solutions between regeneration of wastescapes with general issues of water management, urban development, ecological restoration, improvement of environmental quality, energy generation and resource management (Amenta & van Timmeren, 2018), a conjoint that often is summarized as eco-systems services. This will result in novel forms of land use and maintenance, encouraging urban organization that takes historical sub soils and landscape morphologies into account.

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Outiline and ambitions

This book entitled: **"beyond WASTESCAPES. Opportunities for sustainable urban and territorial regeneration"** is organized into four chapters, with two additional sections that are responsible for deepening the analyses of two case studies. These cases inolve the Metropolitan Area of Naples, which is in Southern Italy, and the Metropolitan Area of Amsterdam, which is located in the Netherlands.

The target audience of this book is potentially extensive through many fields. Firstly, this book is addressed to both researchers and students, which are in the field of Architecture, Urban Design, and Planning, and are interested in experimenting with eco-innovative solutions and strategies for recycling wastescapes in a circular way. Secondly, it is intended for local and regional authorities that are willing to establish urban and peri-urban living labs that could target the reuse of wasted lands and materials in their constituencies. Finally, the aim of this work is to stimulate the development of specific European programs and policies that can help with the regeneration of wastescapes and recognize them as a resource for a more circular economy. Doing so will allow for the widening of the current definition of waste, which is mostly focused on the waste of materials and energy.

Chapter 1: "Setting the problem. Why wastescapes?" focuses mostly on issues dealing with resource scarcity and concepts regarding the linear growth of contemporary cities that generate wastescapes. In relation to these concerns, the health and happiness of citizens' are measured and investigated. Thus, this chapter investigates how a closed loop of resources, which includes 'soil' as a non-renewable resource, can be seen as a precondition for achieving healthy cities. These can be places where the quality of life is improved from both a socio-economic and environmental perspective.

Chapter 2: "Metabolism and the definition of wastescapes" explains the concept of urban metabolism, and how to use it as a framework to interpret the fragility of our territories. In order to achieve this, issues involving urban growth and contraction are investigated together with new waste geographies found in the peri-urban areas, which are defined as wastescapes. This term is understood as a collection of discarded parts within a territory, which have resulted from dysfunctional urban metabolisms and urban dynamics. It is because of this that new perspectives on waste are explored, and the lens of landscape is understood as a holistic way to approach the regeneration of wastescapes. Finally, wastescapes are then described and organized into different categories that are related to specific challenges that exist in these places.

In the section dedicated to the **case study of Naples**, the previously introduced classifications of wastescapes are further specified, and are proposed accordingly to the specific characteristics that exist in each of these places. Moreover, a pioneering eco-innovative solution for the recycling of polluted wastescapes is introduced. This can be achieved through the use of local crops as bio-accumulator of heavy metals that are presented in this section.

Chapter 3: "Developing eco-innovation in Living Labs" proposes new approaches to define wastescapes, and to co-create eco-innovative solutions for their regeneration. The implementation of (Peri-) Urban Living Labs allow for various stakeholders and multidisciplinary contexts to work with wastescapes, involving them in processes of co-creation. Living Labs are suited to tackle the complexities that characterize the conditions found in wastescapes.

In the **Amsterdam case study**, wastescapes are presented as opportunities for sustainable and circular regeneration. The application of a circular model for urban and territorial regeneration is investigated. This analysis is done through the use of some implemented examples that vary in scales within the Dutch context.

Chapter 4: "The next steps towards circularity. Scaling up from materials to territory" goes more in depth, explaining issues regarding the spatial dimensions of circularity, which is a topic still not sufficiently explored in scientific literature. The re-cycling of wastescapes allows for discarded and worthless areas to once again regain their value. This approach considers them as a new opportunities and resources for sustainable transformations. The iterative nature of this research illustrates a continuous necessity to go back to the definition of the problem. When changes arise, it is best to start again processes of developing solutions regarding new challenges from the beginning.

1. Setting the problem. Why wastescapes?

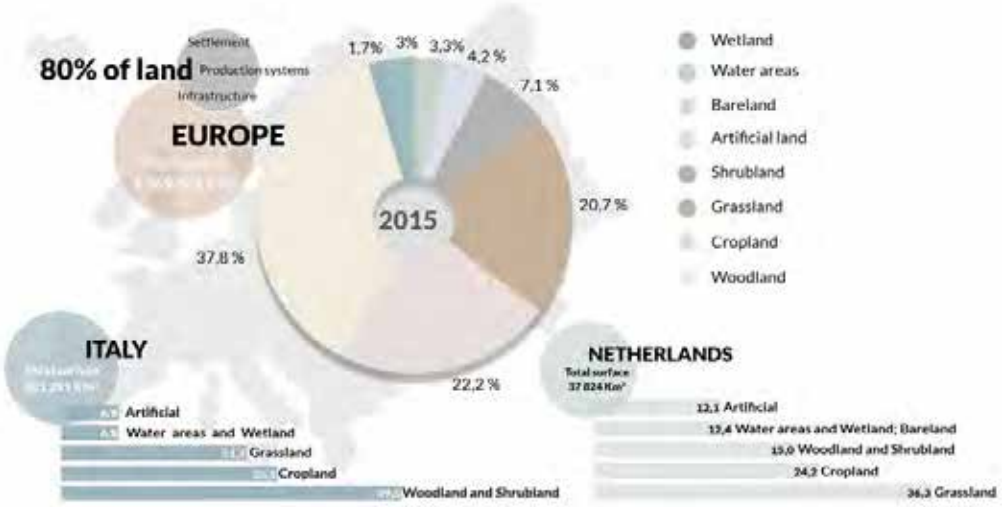


Fig. 1.1 Data sources: (Eurostat 2015; EEA European Environment Agency 2008; OECD.stat, 2015). Graphic by V. Vittiglio.

Fig. 1.2 Agriculture. Naples Metropolitan Area.

Resource scarcity and the pressure on ecosystems

Globally, the consumption of virgin resources is largely overcome by the embedded current capacity of ecosystems. This is because they are self-regenerating, but this process is only sustainable until a threshold is passed - the planet's limits (Henriquez and Timmeren 2017). In addition to this threat, the temperature of the globe is predicted to rise even more in the next century, which might lead to food shortages, water scarcity, and even conflicts (Emanuel 2018). Studies show that resources will rapidly become depleted if this current model of growth continues, and in order to make up the difference, we will need almost an additional planet Earth just for us to be able to survive (EC 2018b). More specifically, at the moment, in just one year we utilize and consume a quantity of resources that is eventually transformed into waste, and it is done at a rate that is much higher than the natural ability of ecosystems to regenerate them (1.7 higher to be exact). In addition to this problem, we also produce much more carbon dioxide than our current forests are capable of absorbing through natural processes (Global Footprint Network 2018).

These conditions of scarcity also regard the land itself. Indeed, soil can be understood as a non-renewable resource (Zanotto and Amenta 2017; Unmüßig and Töpfer 2015), and is part of these previsions mentioned above. 2 percent of the all land on this planet is covered up by our cities and infrastructures (built-up land). This percentage is destined to grow up to 4 or 5 percent of the total global land area by the year 2050, and this will mostly happen through the consumption of various agricultural fields (UNEP 2013).

80% of the soil in Europe is exploited for new settlements, productive areas, agricultural zones (Fig.1.2), and infrastructure projects. The most important drivers for land-use change in Europe are therefore mostly related to the production of food, the creation of biomass for bioenergy, and a growing demand for housing (EEA European Environment Agency 2008). Europe is made up of many different kinds of landscapes, which host an extensive variety of biota, including areas with vastly different population densities (Orgiazzi et al. 2018).

In 2015, the total area of the EU was around 4.3 million square kilometres (km^2). More specifically, woodlands covered 37.8% of the whole EU area, with croplands covering around 22.2%, and grasslands making up 20.7%. The remaining areas within the EU are occupied by shrublands (7.1%), artificial areas (4.2%), and barelands (3.3%). This is in addition to water areas that cover the remaining 3.0%, with wetlands coving around 1.7% of the total EU area (Fig.1.1) (Eurostat 2015).

In addition to these statistics on land use, Europe has 340.000 sites that are listed as polluted, and many of them are still in need to be identified (EEA European Environment Agency 2014). Moreover, the consumption of virgin resources and raw materials are strictly related to a consequent production of waste. For example, Europe produced 480kg of waste per capita in 2016 (EC 2018a). Statistics show that the majority of the municipal waste produced in Europe is either still disposed of in landfills or exported to

Asia. This approach to using waste dump sites is negatively affecting both human health and the spatial conditions in which they live in (Williams 2019). The combination of all these alarming sets of data makes it clear that the actual threat facing environmental sustainability, human health, and happiness.

Are today's citizens happy?

An improved quality of life that takes into account every citizens' health, happiness, and well-being should always be the ultimate goal of any urban design strategy and/or planning transformation. However, a considerable number of complex factors also influence human physical and mental states, whether they be directly or indirectly. Among them are the continuous linear model of economic growth, the overconsumption of natural resources, and the related waste production caused by them. These issues are negatively affecting the quality of life in urban and peri-urban contemporary environments, which are places where the majority of the people on earth live.

In fact, both in cities and highly urbanized areas, citizens tend to suffer more mental and physical stress because of being exposed to a greater number of stimuli in their environment (Peschardt and Stigsdotter 2013). In addition to this, it has been shown that the presence of wastescapes such as forgotten, polluted, underused spaces (Fig.1 to 8) (Amenta and Attademo 2016; Amenta and van Timmeren 2018; Palestino 2015; De Leo and Palestino 2017; De Leo, Lieto, and Palestino 2017; EC 2016; REPAiR 2018d; Amenta 2015), combined with the lack of accessibility to green public open spaces in cities, the scarcity of green infrastructures, (Krekel, Kolbe, and Wüstemann 2016), and — more generally — the lack of ecosystem services (e.g. provided by a green infrastructure), are all factors that can impact the physical and mental stress of citizens (Tzoulas et al. 2007). In the same way, these aforementioned conditions can reduce the opportunities available for people to experience quality social interactions (Tzoulas et al. 2007). In relation to this problem, studies show that social isolation can negatively contribute to poor mental and physical health, even causing diseases and premature mortality (Giles-Corti et al. 2016).

More specifically, wastescapes are strongly present in peri-urban areas (a space defined as the area between urban and rural zones) because peri-urban areas seem to be the most fragile parts of our territories. These areas are characterized by mixed functions and fragmentation, which are created by various infrastructure networks and waste flows. Moreover, in both peri-urban areas and sprawling territories — even if the presence of green open spaces is higher than in cities — the level of stress is still high, with unhealthy habits being largely diffused among its inhabitants. In fact, people in low-density territories are more likely to spend a long time commuting by car or public transportation. The traffic and distance caused by the spatial organization of peri-urban areas are scarifying away people's precious time, who would otherwise spend that time taking part in healthier physical activities (e.g. walking or cycling).

Therefore, it is concluded that a healthy city is a circular city. There are currently many

initiatives in place that promote healthy cities that aim to create new actor networks in their local contexts that help in the pursuit of spatial and environmental justice.
The strategies aimed to achieve healthy cities are strongly related to the question of environmental justice. In a healthy city, citizens should be involved in the political decisions that shape their life, and they should be able to have equal access to culture and information (Benton-Short and Short 203).

Let's move forward! From 9% to 100% circular

As many researchers have pointed out, there need to be a paradigm shift[1] away from an extensive and linear model of growth, and more towards a circular and regenerative approach (Mang and Haggard 2016). If this linear model of growth and consumption continues in this way, we would need to have an extreme quantity of virgin resources for our survival, health, and happiness that will exceed the actual limits of our ecosystems. Obviously, this demand on our planet is impossible to achieve. Therefore, we are forced to find alternative and creative ways to satisfy our needs of clean and fresh water, food, fertile soils, and raw materials.
A circular approach represents an adopted European strategy developed by the European Commission to improve Europe's economy. Their aim is to move towards a more sustainable model of growth by closing the loop of resource consumption (European Commission 2018). This method has emerged as the most appropriate way to globally achieve the reduction of resource consumption. Doing so will reduce massive quantities of waste that needs to be disposed, will lower greenhouse emissions, other types of pollution, and socio-economic problems that are occurring in today's cities (Williams 2019).
It has already been several years since the European Commission and other research institutions, such as the Ellen MacArthur Foundation, believe that a paradigm shift must take place towards a more circular economy (EC 2014; Ellen MacArthur Foundation 2013) in order to achieve a regenerative and restorative economy by design. Despite this outlook, we have achieved very little change for our planet so far, with only 9% of our economy becoming circular (Circle Economy 2019). Based on findings published in a report by the Circle Economy research group titled "The circularity gap report. Closing the Circularity Gap in a 9% World," it is argued that housing, infrastructure, nutrition, mobility, consumables, services, healthcare, and communication, represent the seven societal needs that are the biggest contributors to resource footprint (Circle Economy 2019, 15).

1 A paradigm implies "the entirety of generally accepted beliefs and scientific methods at a specific juncture, or the theories accepted at that juncture" (Kuhn 1970) cit. in (Timmeren 2013, 16). In urbanism and architecture language, a new paradigm is a completely new way to operate in urban areas that have a significant effect on the common spaces. It is a completely new way to look at the living spaces and at their mutations (Ricci 2012, 7).

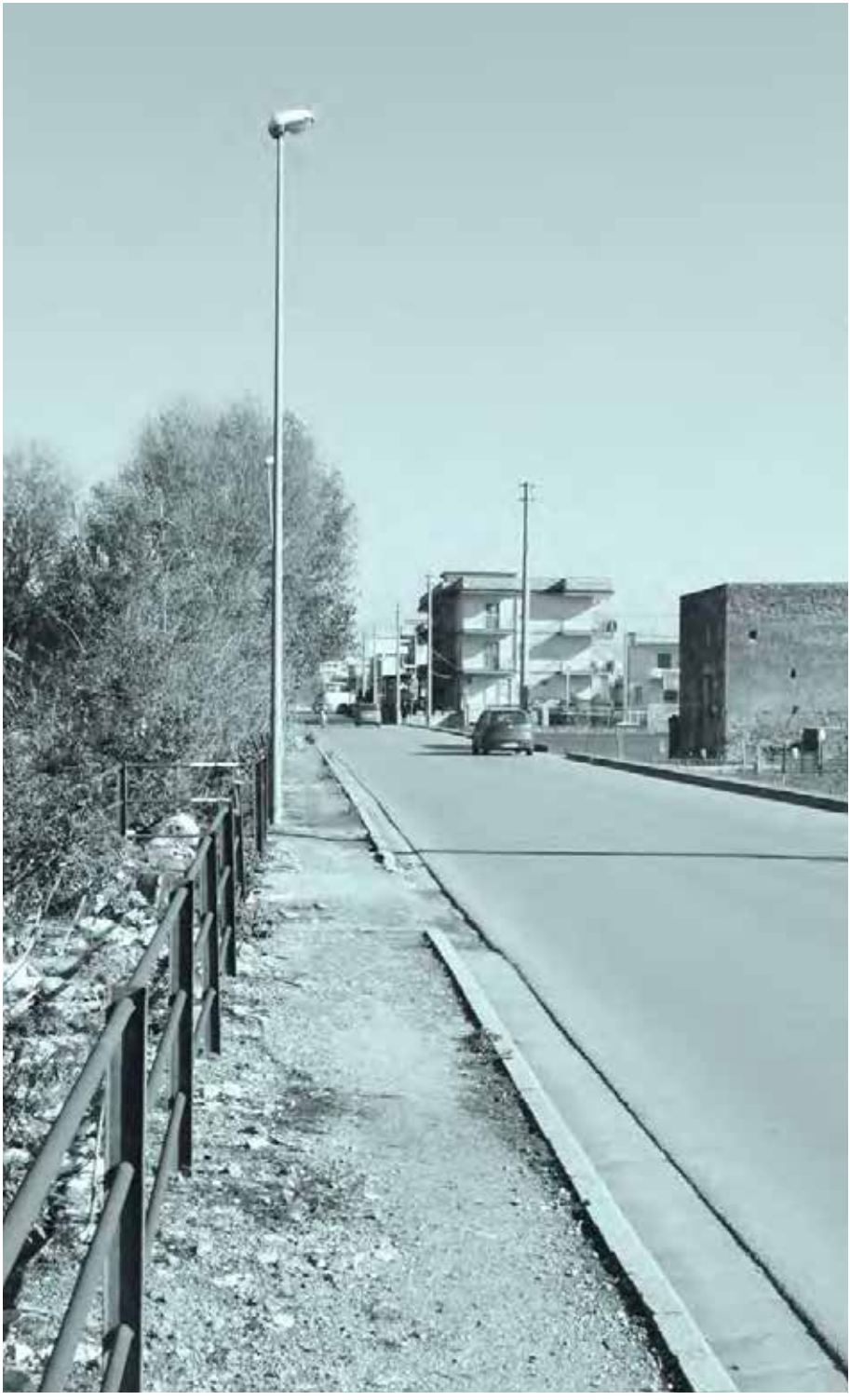


Fig. 1.3 Waste and wastescapes in the Metropolitan Area of Naples. Photo: courtesy of V. Vittiglio.

Resource scarcity, environmental challenges, and socio-economic issues are interwoven into contemporary territories. The spatial configurations, (waste) infrastructures, and related urban and territorial connections found in these territories could represent difficult issues to be tackled in a period of resource scarcity. It is important to add that these current environmental problems are the manifestation of a more problematic relationship that exists between people and natural systems. An inappropriate management of the limits and biodiversity of our ecosystems is an additional factor to consider that has generated an actual worldwide environmental crisis (Mang and Haggard 2016, XXIII).

It is for this reason that there is the necessity to restore this relationship back to a balance. This needs to be done in order to cope with the abovementioned problems, which will have to be achieved with the redesigning of new integrations and relations. By reinterpreting these daunting challenges as new opportunities, the circular regeneration of wastescapes emerges as an innovative strategy for the creation of sustainable cities. Through the adaptation of circularity, a natural resilience could develop over time. By doing so, cities could more easily recover from any external changes and trauma that could potentially be inflicted upon them.

It is therefore necessary that local associations, national institutions, urban designers, planners, architects, and creatives in general, be asked to urgently develop innovative and place-based solutions to regenerate wastescapes. Doing so will both reduce the exploitation of natural resources and the production of waste. This will allow for us to move towards a kind of growth that is based on circular economy principles (EC 2014; Ellen MacArthur Foundation 2013; EEA European Environment Agency 2016). The implementation of this growth model must work within a territory by using local resources that are available in the surrounding area. It should not just focus on the principles of a circular economy and the closed loops of material resources that it demands, but they must also include a focus on the reuse of land and its regeneration.

Towards the territory: from waste to wastescapes

Previous research that we have seen so far has pointed out that a significant shift towards circular economy (CE) principles is necessary in order to create circular urban and territorial metabolisms (Ellen MacArthur Foundation 2015a, 2013; EC 2014). A vast amount of literature about circularity already exists, and is applied to both material waste and building components. However, there are very few studies that try to develop a more holistic approach by scaling up the problem from a focus on materials, to a perspective on territory (see for example: Williams 2019; ARUP 2016; City of Amsterdam et al. 2016).

In addition to this observation, research shows that the current definition of CE is inadequate because it fails to interpret the current issues of our cities (Williams 2019), which underlines the necessity of a spatial approach to circularity. From now on, it is

imperative that the focus be on circular cities rather than only on the actual circular cycles. Henceforth, we need to go beyond traditional design processes that are based on the linear model of 'take-make-dispose.' Conversely, a systemic way of thinking should be applied to these processes in order to develop unanimously acceptable and informed decisions. The latter must also take into account both the perceptions of consumers and their consumption patterns (Moreno et al. 2016).

This book therefore argues that adding a spatial dimension to circularity can not only help us go beyond the recycling of material waste, but will also help in engaging the regeneration of wastescapes (Fig.1.3). Doing so will achieve the creation of an improved quality of life and well-being for all citizens. The reuse of land and the recycling of wastescapes are important gaps in the current definition of circular economy, which is suprising when it is considered that land is one of the most relevant resources in contemporary cities (Williams 2019).

The focus of this book is therefore on the reuse of land and its integration with circular economy principles. This will be achieved by investigating how the recycling of wastescapes can be considered as an innovative strategy for directing sustainable regeneration towards the circular and healthy metabolisms in our cities.

This work aims to deepen knowledge about urban regeneration. It will start from the transformation of unused, abandoned, polluted, and/or (socially) problematic areas, which are also known as wastescapes. The metamorphosis of these places could represent strategies for improving citizens' quality of life and wellbeing. In this sense, an integrated recycling of waste and wastescapes could be considered as a way to achieve this goal. Doing so will help preserve the availability of natural resources, while also increasing the ability of eco-systems to regenerate themselves, and without exceeding the global ecological overshoot (Global Footprint Network 2018).

In order to identify and establish a new — and widely shareable — cognitive strategy through the interpretation of processes and life-cycles that generate wastescapes, a different terminology needs to be explored. Examples of this includes issues dealing with wastescapes, urban metabolisms, flows, circular economy, living labs, and peri-urban areas.

'Recycle' is a twofold concept

There exists in literature the necessity to define technological solutions that are able to foresee a reduction (or to even avoid) the production of waste. It is because of this that closing the metabolic loops of resource flows is well explained, however, there seems to be no specific focus on the recycling of wasted land. This conceptual approach is still missing at a policy level, and is not widely shared concept.

In addition to this issue, the idea that matters of waste need to be kept far/away from us is still a widely accepted point of view. This idea can be best understood by looking at the location of a landfill, or the organization of a waste treatment plant. In places such as these, visitors are not allowed, or they are kept to a minimum. It is generally understood

that the facilities for waste management must work in an almost invisible way, even discretely if possible. Conversely, this idea of getting away from waste cannot be pursued any longer, because the areas for waste collection and treatment are very often contiguous with the residential areas of today (Gabellini 2018). Therefore, people can no longer move away from waste places in an attempt to get away from the undesirable. Waste is now part of our everyday life and environment, and this type of treatment is no different for wastescapes.

The aforementioned example shows the importance of considering the concept of 'recycle' from two different perspectives and scales. This must be done in order to eventually integrate these two concepts: the reuse of material resources, and the regeneration of land. Even if these two ways have different origins, the recycling of material waste and the urban regeneration of wastescapes should be considered similar processes (Gabellini 2018). By doing so, this new comprehensive and unique action can therefore able to go beyond just a mere spatial reconfiguration of contemporary territories, but it can modify the urban metabolism of a city by creating new processes within them.

Therefore, this research identifies wastescapes (Amenta 2015; Amenta and Attademo 2016; Palestino 2015; REPAiR 2017b, 2018d; Amenta and van Timmeren 2018) as a holistic concept that includes both scales regarding the circularity of the material and territorial dimensions. Wastescapes are spaces for opportunities to develop sustainable urban regeneration. They are heterogeneous and vulnerable areas, underused, degraded, interstitial, or large industrial areas (generally in decline), and are in need to be transformed and reinvented. It is for this reason that wastescapes (including the infrastructures for waste management) should be brought at the center of the sustainability debate. This needs to be done in order to be able to reverse the idea of waste — understood here in a broad sense that also includes the waste of land — as something that has to be discarded or moved away.

It should be added that the previously mentioned reinterpretation of the new waste geographies (Ghosn and Jazairy 2015) can help to design a transition towards a circular model of growth, while also contributing to a substantially reduced amount of resource consumption. Moreover, this transition should also contain future land consumption by transforming what already exists, which is a recommended approach based on the ideas of modification (in Italian 'modificazione') that was introduced by Secchi in the 1980's (Secchi 1984). New perspectives on the consideration of existing resources, as new values for change and growth, are at the foundation of this approach:

"Learning from the existing landscape is a way of being revolutionary for an architect. Not the obvious way, which is to tear down Paris and begin again as Le Corbusier suggested in the 1920s, but another, more tolerant way; that is, to question how we look at things" (Venturi, Scott Brown, and Izenour 1977).

The complex system of metabolic processes (waste, people, goods, biota, food, waste, energy, goods, etc.) (GeementeRotterdam et al. 2014) actualizes within wastescapes,

and are also understood to happen in (also ordinary) landscapes (Council of Europe 2018). Among all of the aforementioned flows, waste is the most problematic:

"in the European Union (EU), the amount of municipal waste generated per person in 2016 amounted to 480 kg, down by 9% [when] compared with its peak of 527 kg per person in 2002, and roughly comparable to the 483 kg recorded in 2015" (EC 2018a).

Waste flows are crossing and severely impacting the urban and peri-urban landscape, which is physically considered to be infrastructure (Bélanger 2013, 2016b, 2016a). This work intends to focus on the intrinsic possibilities of creative transformations of contemporary landscapes, starting from the local resources:

"[…] trash creates issues that we must address, and seeks creative, alternative, and magical solutions through the grounding of research and design in political, economic, and geographic specificities" (Ghosn and Jazairy 2015, 133).

Nature is circular

In the processes of nature there is no waste (as we understand it) and everything is upcycled thanks to circular metabolisms that exist within it. This is not the case in our cities, as the combination of an extreme production of (toxic) waste with an inappropriate political agenda in charge of its management has had a profound negative effect on both human health and the environment.
It is for these reasons that the development of future proof, resilient, and regenerative cities is one of the primary and most urgent challenges that local municipalities, central governments, investors of the private sector, urbanists, urban planners, designers, architects, and researchers have to face today. To achieve this daunting task, an integrated approach to urban decision making seems to be the major precondition that can help create resilient and prosperous cities that are shaped from different economic, social, and ecological angles. The analysis and design of cities as complex systems is a holistic approach that considers all the interrelations between the different urban systems to investigate their possible evolution. Doing so will allow cities to be adaptive and resilient to foreseen and unforeseen sharp changes and disturbances of the future (Eraydın and Taşan-Kok 2013). This should be done examining the contexts of urban and regional economies, the globalization of markets, spatial organization, and climate change.
Strategies for sustainable cities can take inspiration from various forms of natural systems in order to avoid further damage caused by environmental footprint (e.g the quick spread of 'horizontal' urbanization).
To achieve this aim, it is possible to consider wastescapes as a resource for both the creation of new urban-recycling-processes and the development of sustainable urban environments. Moreover, the regeneration of wastescapes can deal with the first

phase of remediation, which is to remove pollutant substances from the soil. This transformation can represent an efficient way to prevent environmental hazards from penetrating the ground, and in doing so preserving human health. For example, the recycling of polluted soil — a particular kind of wastescape — is a universally recognized objective for everybody's well-being and even survival (Gabellini 2018). The recycling of wastescapes can help solve environmental aspects (e.g. quality of the landscapes, biodiversity, use of local resources), social aspects (such as quality of life, accessibility, good health), and economic challenges (e.g. decarbonising the economy, increase prosperity). Using them in this way can lead to a "circular, vital, and connected city" (Amenta and van Timmeren 2018) (Figure 1.4).

Fig. 1.4 Wastescapes dimensions. The regeneration of wastescapes can lead to a circular, vital, and connected city. Source: Amenta, Van Timmeren 2018. Graphic: by V. Vittiglio and L. Amenta.

2. Metabolism and the definition of wastescapes

An urban metabolism perspective

"Urban metabolism [...] is a framework for modelling material and energy streams as if the city were an ecosystem. This approach allows the dynamics of cities (beyond 'traditional' mobility and the relationship between built/(un)cultivated environments) to be studied in relation to scarcity, carrying capacity and conservation of mass and energy" (Timmeren 2014, 5).

The concept of metabolism was conceived in 1935 by the English ecologist and botanist Arthur Tansley. The term was first used in the field of biology to describe the processes of living organisms, but this notion was also used to explain the processes of cities (Tansley 1935). This term came into being as he studied the mataerial and energy flows of settlements, and considered the whole complex of living organisms as part of an ecosystem being in a constant condition of dynamic, yet relatively stable equilibrium.
Later on in 1965, American researcher Abel Wolman (Wolman 1965) introduced the concept of urban metabolism, describing cities as entities defined by incoming and outgoing flows. Energy, water, materials, and wastes were described as the major flows of a city-region that holds at least million inhabitants. According to Wolman, urban metabolism is composed by infinite processes of input and output. To give an example, if the inbound flow is characterized by energy, then the related output will be eventually become environmental pollution.
Successively, Christopher Kennedy in 2007 (Christopher Kennedy, Cuddihy, and Engel-Yan 2007) studied the changes in the metabolism of several cities around the world, such as Brussels, Tokyo, Hong Kong, Sydney, Toronto, Vienna, London, and Cape Town. The intent of this study had a specific focus on the different flows of water, materials, energy, and contaminants, and analyzed the variation in these parameters that characterize the urban metabolism.
After going through a metabolic framework, it is immediately clear that contemporary cities consume great amounts of environmental resources, therefore producing great amounts of waste that have a major impact on the health of any ecosystem. To overcome this situation, Herbert Girardet (H. Girardet 2010) proposed in 2010 to focus on the development of various political, financial, technological, and environmental strategies, in order to once again enrich the resources of both the landscape and of the territory which cities depend on. By working these strategies in an integrated way, broken relations between cities and ecosystems could be repaired, and once again connected. Through the lens of metabolism and the circular economy, cities are equated to ecological and economic systems (H. Girardet 2010), and are related to the metabolic flows of their local economies.
Urban metabolism refers to the biological way that the dualities of input/output can be analyzed. It is also linked to resource/waste related to the urban settlements, and in a wider sense, to the economic dynamics of settlements and their overall livability (Acebillo, 2012). Metabolism is the precondition of life, but is also a lens that can be used to observe and interpret new phenomena in complex urban systems. It can help analyze

where the flows of energy and materials come from, therefore defining the structure of cities as living ecosystems (Timmeren, Henriquez, and Reynolds 2013). In this way, metabolism embraces all the different socio-economic, political, and environmental aspects that define a city.

Interpreting the fragility of today's territory

Many of the most urgent global challenges that face us today are the result of linear metabolism processes, unsustainable resource consumption, and soil scarcity. Today, the depletion of global fertile soil is still ongoing because of the growth caused by rapid urbanization processes. Contemporary cities are perpetually expanding, even as far as to become 'megacities' (Bishop 2017), which are settlements that contain more than ten millions inhabitants. These urban areas are mostly unsustainable because their model of growth is in principle a linear process that follows the steps: 'use-consume-discard'. This system of consumption is based on the wrong assumption that natural resources are unlimited.

Wastes are increasingly being produced faster by urban ecosystems, which are in turn negatively affecting the metropolitan territories. The latter are becoming much more vulnerable and fragile, because of the impossibility to naturally process waste faster then they are produced. Metropolitan areas are also facing various environmental and socio-economic threats. The current challenges that can be encountered in contemporary cities revolve around the consumption of virgin resources, which then produces environmental pollution, and even economic crises.

The complexity of today's territories is defined by novel processes and events that require systemic changes in order to be fully sustainable and resilient, in other words circular. In a circular city, waste can be considered as the natural outcome of urban metabolisms and of the natural life-cycles of urban eco-systems (Lynch 1990). Waste will become the new resource that can assure a future of sustainable transformation and growth.

The conceptualization of urban metabolism (GeementeRotterdam et al. 2014; Timmeren 2014), which focuses on resource flows involved in urban processes (Ferrão and Fernandez 2013; Christopher Kennedy, Cuddihy, and Engel-Yan 2007; C. Kennedy, Pincetl, and Bunje 2011), could also help recognize the problems related to waste management. It could also help identify urban contractions, which include the abandonment of buildings, infrastructures, marginal areas, and polluted soils. In doing so, an approach based on the concept of metabolism allows us to pinpoint an impending crisis and discover the fragility of our socio-economic systems, especially when they are in relation to environmental issues. The idea of wastescapes are therefore emerging from these kinds of analyses.

In this way, the concept of metabolism is revealed as a compelling method to evaluate urban sustainability (Codoban and Kennedy 2008). It is in a wider sense also investigating the socio-economic dynamics of settlements and their related quality of

life (Acebillo 2012). An improved quality of life can also be achieved through an efficient use of non-renewable resources within metropolitan areas, which includes an effective management and appropriate use of land resources.
This can be achieved through the recycling of wastescapes, and an identification for a new role for these spaces within urban and peri-urban territories. Doing so can positively contribute to a foreseeable and sustainable future for our contemporary cities.
The metaphor of urban metabolism is utilized to understand complex processes within our cities (Barragán-Escandón, Terrados-Cepeda, and Zalamea-León 2017). As outlined previously, urban activities are interpreted as complex flows when following this type of analogy. Moreover, urban metabolism is an emerging field of study focusing on the growth, contraction, and the death of cities – or of their parts - that are undergoing different processes. It is in this sense possible to connect the byproducts of urban dynamics and complex flows to the production of wastescapes. In short, the studying of urban metabolism is a way to understand the opportunities available for designing more sustainable and circular cities, therefore reducing the inbound flows of energy and materials that are needed for the functioning of cities.

Urban growth and contraction

Today's cities have evolved from Modern compact cities into widely dispersed settlements (Choay 1992), and are now growing towards a contemporary "post-metropolis" (Soja 2000). They are in a crisis (Oswalt and Rieniets 2006) caused mostly by economic changes, de-industrialization, and unsustainable amounts of urbanization (Ravetz et al. 2013; Nilsson et al. 2013). At the same time that these changes are occuring, resources are becoming even more scarce, and are often used inefficiently. 24 billion tonnes of fertile soil is destroyed every year as the cities of today continue to grow and expand (Unmüßig and Töpfer 2015). In addition to this loss, waste is recognized as a direct and inevitable consequence of growth (Lynch 1990), is perceived as the dystopic symptom of a consumer society (Ghosn and Jazairy 2015), and therefore it is acceptable to expel waste away to peripheral areas of a territory (e.g. in landfills). In spite of this, researchers have foreseen the coming catastrophe of resource scarcity (Ferrão and Fernandez 2013, 28), and the need for a change of approach before it becomes too late. However, as stated previously, 'waste' does not only refer to the material output produced by cities but includes wastescapes result from the linear system.
In many contemporary European cities, the 'metropolisation'[1] process of territory is related to the formation of wastescapes in inner cities and in peri-urban spaces (Amenta 2015). This is also because of the simultaneous phenomena of 'cities' explosion' (F.

1 In 2003 Francesco Indovina defines he term 'metropolisation' as the tendency of the urbanizations of the metropolitan areas to integrate and merge to each other; this integration happens thanks to economic activities, social relations and everyday life activities. The whole territory is organized in metropolitan areas, not necessary connected to a large urban core but structured in variable hierarchies.

Indovina, Fregolent, and Savino 2005) which happens often together with urban contraction caused by economic crisis, deindustrialization, political, and/or demographic changes.

This cycle of expansion and contraction can generate a large amount of vacant lots, forgotten areas, buffer zones, logistic spots, and so on. The spread of settlements in the countryside — better known as urban sprawl — is still a growing phenomenon which shapes the contemporary metropolitan regions. Cities are therefore becoming less and less compact and dense. Due to this low density urbanization process mixed with shrinkage (Oswalt and Rieniets 2006), these territories very often appear like a palimpsest of waste and drosscape (Berger 2006a). When suburbanisation is accompanied by the shrinkage of a cities' population density, the result is the abandonment of a large amount of buildings and infrastructures. These phenomena produce, in addition to other problems such as pollution and contamination, a high quantity of wastescapes that are not compatible with urban and natural life-cycles. Moreover, wastescapes, which can vary in dimensions, age, and (former) function, can be generated by de-industrialisation and dereliction processes in inner cities as well.

In summary, wastescapes can result from the variation of cities' spatial and socio-economic structures, such as the reorganisation of factories that either shrink in size or become dispersed. Wastescapes can also be caused by the quick spread of 'horizontal' urbanisations, combined with the abandonment of various and determined urban areas. Being residual spaces in the contemporary European context, wastescapes in this work are understood as a specific kind of waste. As such, they are studied and categorised through the identification of specific typologies. Eventually, they can be recycled so that they can be reinputted back into the urban metabolic flows. This can be achieved through the identification of site-specific Eco-Innovative Solutions. In this way, the recycling of wastescapes can be considered an efficient way to manage scarce environmental resources of contemporary cities. It is therefore evident that we need new ways to understand the places in which we live now, and to design new tools to work successfully with wastescapes.

Peri-urban areas and new waste geographies

"Europe is an urbanized continent. It is largely made of 'middle landscapes', or 'hybrid geographies'. 'Urban' areas can be found in rather rural landscapes (urban sprawl in major metropolis, large food processing districts, and clusters…), while 'rural' areas can be found within urban environments. This is not to say that the traditional distinction between urban and rural is completely vanished, they are now extreme cases: still predominantly rural regions can be clearly recognised (e.g. interior or remote sparsely populated zones in the Iberian or the Scandinavian Peninsula), as well as urban (e.g. small and medium size cities surrounded by countryside)" (Mcrit 2010, 41).

With the industrial revolution and the development of the 'Pertropolis' (H. Girardet

2010), cities became global hubs for economy and transportation, and in a way detached them from their local hinterlands. Today, high-density cities like the global metropolis can suffer from having a difficult physical integration with their surrounding territories, with the latter becoming more and more complex. These low-density areas that are contiguous to compact cities — namely peri-urban areas — are very much car centered, and they have been shaped accordingly to a vast availability of petroleum resources. Today, this linear and unsustainable model of growth produces a very high amount of negative externalities that cannot be ignored any longer.

Peri-urban landscapes are low-density territories that have emerged in recent times all around Europe, and they can be defined as discontinuous and fragmented because of many factors. Charactersitics such as heavy infrastructures, large industrial areas, big structures, tertiary buildings, and a multiplicity of single-family-houses give shape to these peri-urban areas. They can therefore be described as 'hybrid geographies' (Mcrit 2010; Wandl, Rooij, and Rocco 2012).

In many cases, these hybrid geographies shape a specific landscape where different functions are only juxtaposed without really being inter-connected with each other. They exist without ever sharing any facilities, resulting in a combination of parts that generates ignored areas. For example, open residual spaces that are excluded from urban plans. These geographies often generate wastescapes when they come to the end of their life-cycle, or in this case, not being integrated with other urban elements.

Many common characteristics that define peri-urban areas include a low population density, low density settlements, mixed functions, a car-based structure requiring time for commuting, physical and social fragmentation, and also a lack of spatial organization. In the context of peri-urban areas, it is easy to identify neglected areas from a physical and social point of view. They usually represent places where the problems of the urban and rural scene merge.

Peri-urban areas can represent vulnerable territories because they are mostly damaged by recent urban growth processes. Generally it is here where changes in social, economic, and spatial reorganization occur as peri-urban areas are often places that exhibit chaotic urbanization and sprawl. It is not simple to define peri-urban territories because they are not only transition zones from urban to rural, but they can also be considered a new type of territory with a variety of functions. Among these functions are the legal (but also illegal) activities that are generally found in peri-urban areas where waste management takes place, which in turn affects the surrounding landscape and its values. Usually, peri-urban areas have hybrid features that are defined by unbounded, low density, and dispersed settlements (città diffusa in Italian) (Soja 2000; Forman 1995, 2008; Francesco Indovina et al. 2009). In fact, it is not possible to define them by the characteristics of compact cities, not even by the structures of suburban villages. They are defined by the "interconnection of commuting areas and infrastructure networks, excluding the urban continuity" (Rigillo et al. 2018, 155). Moreover, this research understands that peri-urban areas are locations where urban and rural elements are interrelated. Therefore, this relationship gives rise to new functions, practices, and way of living (Wandl et al. 2014). Peri-urban areas are:

"landscapes [that are] characterised by a patchwork of dispersed urbanised areas, agricultural land, open space, and high-density residential areas within a discontinuous countryside" (EC 2016).

The waste geographies of peri-urban areas (Figure 2.1) clearly shows the intermingling of very different problems such as urban dispersion, inefficient high-density areas, land consumption, fragmented local governments, planning systems, landfills, polluted areas, low quality public spaces, and wasted resources. However, these characteristics represent the Reverse Land (Amenta 2015), that is to say, territories that offer many opportunities to implement a circular approach to resource consumption in order to create sustainable urban regeneration. This applies even more to the peri-urban areas and in other less dense territories, which are spaces characterized by uncertain use and exist in a condition of waiting for potential future transformations.
It is interesting to notice that various eco-innovative solutions and strategies could possibly be developed for peri-urban areas. They could eventually be applicable to different contexts by being adaptive to spatial characteristics that belong to both urban and rural spheres (EC 2016).

Different ideas involving waste

For the purpose of reaching a better understanding of wastescapes, and how they exist as an additional kind of waste that could be used for achieving circular cities, it seems useful to mention various definitions of waste by multiple authors throughout the years. Kevin Lynch wrote the first treatise about waste in his last book entitled "Wasting Away," published posthumously in 1990. He considered decline, decay, and waste as a necessary part of life and growth. In this book about wastes and the environment, he suggests giving the right value to wastes, while also acknowledging their importance to human life. The processes of waste and decline were deemed valuable and necessary in people's lives, things, and places. According to Lynch's definition, waste is something that is 'left-over':

"Waste is what is worthless or unused for human purpose. It is a lessening of something without an apparently useful result; it is loss and abandonment, decline, separation and death. It is the spent and valueless material left after some act of production or consumption, but can also refer to any used thing: garbage, trash, litter, junk, impurity, and dirt. As we have seen, there are waste things, waste lands, waste time, and wasted lives" (Lynch 1990, 146).

In the book Wasting Away, Lynch also described 'The waste of Place'. With this definition, he referred to buildings that are abandoned or demolished, and to settlements which are deliberately wasted. There are even waste spaces that appear useless and marginal. 'Derelict land,' another of Lynch's descriptions of waste spaces, is a more extensive

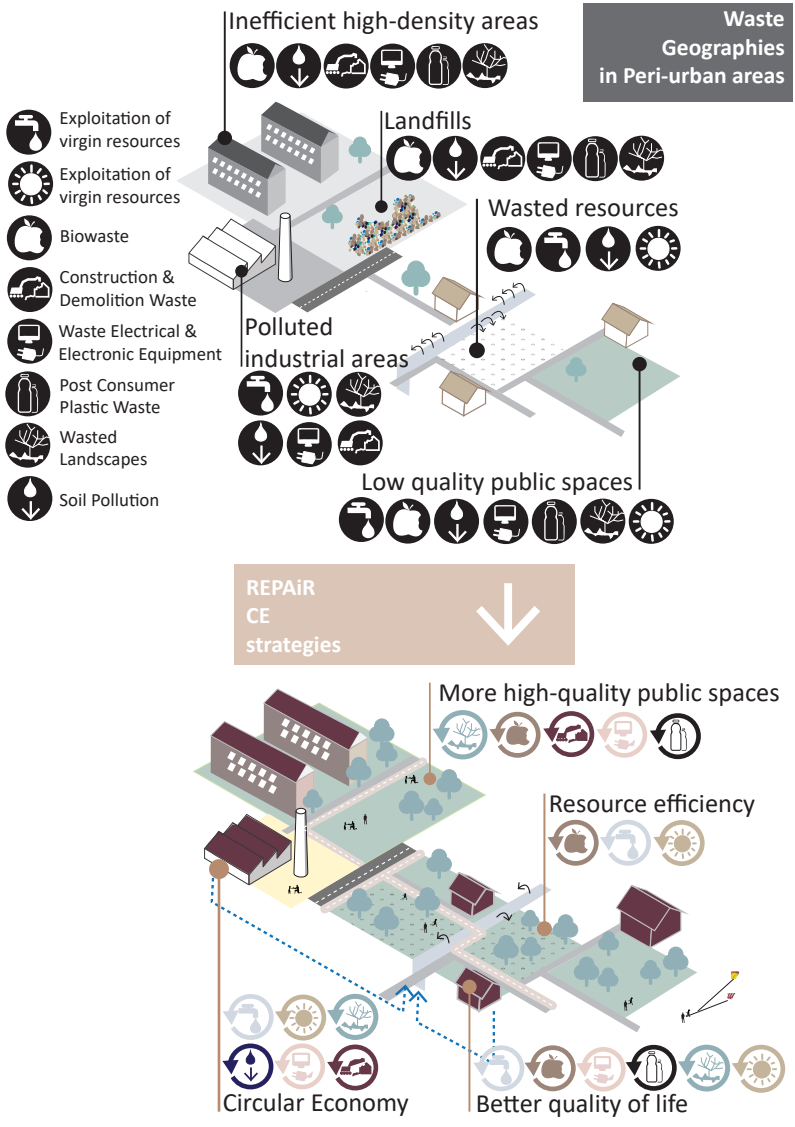


Figure 2.1 Waste Geographies and 'circular futures' in Peri-urban areas. Source: REPAiR project proposal 2016 (EC 2016). Graphics: done by author, adapted by V. Vittiglio.

concept when compared to derelict buildings. In addition, he noticed that in the city there are, for example, abandoned transport infrastructures that are not welcome in any settled community. Projects such as highways, airports, and heavy industries are essential for the functioning of a larger region.
Lynch recognised the ecological and environmental significance of urban wastelands and drosscapes. When these places are abandoned, they become a refuge for wild fauna and uncultivated plants. Lynch also stressed the presence of wastelands in the city centre, which take the form of vacant lots, scraped cars, and exhausted slums. By stating this fact, he is underlining the state of neglect of space has caused the creation of waste in the urban scene. Lynch uses the term 'wasting' as a generic term to indicate decline or deterioration. He considers waste as both the 'dark side of change' and 'a necessary part of life' (Neuman 1992).
One of the most important essays about the waste of land is entitled 'Stim & dross.' It was written by Lars Lerup. He saw the enormous potential of the 'in-between' surfaces left over by the dominant economic forces of urbanisation. He theorised about the urbanised landscape of cities as a 'holey plane', through which he clarifies the relationship between landscape and urbanization. According to Lars Lerup's definition, cities are dynamic ecological systems that produce drosscapes as a natural component of every urban system:

"The holey plane seems more a wilderness than a datum of a man-made city. Dotted by trees and criss-crossed by wo-men/vehicles/roads, it is a surface dominated by a peculiar sense of ongoing struggle: the struggle of economics against nature. Both the trees and machines of this plane emerge as the (trail or) dross of that struggle" (Lerup 1995).

Gilles Clément also followed this ecological approach to vacant spaces. He defined the Third Landscape ('tiers paysage' in French) (Clément 2005) as residual landscapes, abandoned, or uncultivated lands that represent a biological necessity for cities. These marginal areas that are without a specific function are described as 'uncertain spaces,' (which is the author's translation from the Italian definition: 'spazi indecisi') (Clément 2005, 10). He considers the fragments of the landscape at the edge of forests, along streets and rivers, and in the forgotten interstices of cultivated lands where there is no traffic, as refuges for biodiversity. By following this definition, waste can also be acknowledged as the marginal areas where biological diversity is preserved, creating a possibility for changing the landscape.
A year or two later, in 2006, Alan Berger defined 'waste' as a term related to the description of contemporary horizontal urbanisation, in the book 'Drosscape:'

"The words waste and vast [are] two terms frequently used to describe the contemporary nature of horizontal urbanization, as well as connections to the words vanity, vain, vanish, and vacant, all of which relate to waste through the form of empty gestures" (Berger 2006b).

He considered the Latin term 'vastus': the root for both modern terms 'vast' and 'waste,'

which represents that which is left over from a combination of natural and man-made processes (Berger 2006b). He also made a distinction between the definition of 'waste,' 'wasted places,' and 'wasteful places':

"Waste landscapes mean actual waste (such as municipal solid waste, sewage, scrap metal, etc.), wasted places (such as abandoned and/or contaminated sites), or wasteful places (such as huge parking lots, retail malls, etc.)" (Berger 2006b).

Michael Southworth defined 'wastescapes' as marginal abandoned areas that are present both in the city centre, and at the urban edge at different scales:

"Cities are filled with waste spaces - derelict land, vacant buildings, unused rooftops, abandoned factories, rail yards, and the spaces under and around the freeways. The process of urban wasting operate throughout the metropolis, from center to edge, and at multiple scales" (Southworth 2001).

Recycling cities through the lens of the landscape

There are different reasons behind the urban decline of certain urban and peri-urban areas: environmental problems, spatial and socio-economic challenges, low degree of use, planning incoherence, and lack of management. Understanding these areas in decline utilizing the lens of landscape, can help re-defining them, to be finally able to identify appropriate and site-specific recycling strategies.

"<<Landscape>> means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe 2018).

This research assumes the lens of landscape (Waldheim 2006, 2016) in order to interpret and design wastescapes in contemporary urban areas, while following the logic of circular urban metabolism (H. Girardet 2010).

"To study the urban landscape as a system of dynamic actions, and as a system of the interaction of space and process, opens up new perspectives of interdisciplinary spatial intervention" (Nijhuis and Jauslin 2015, 30).

The new and holistic sense of landscape, adopted by the European Landscape Convention in the 2000s, overturns the usual definition of landscape, which mainly refered to areas of great natural or landscape value, now also includes all ordinary territories and spaces of everyday life. Therefore, the contemporary landscape is all territory created by human interventions in the natural environment (Council of Europe 2018). This is

also as a result of their inter-relation with eachother. Therefore, outstanding, degraded territories, and also everyday life areas fit into this interpretation, together with the spontaneous and natural reserves of biodiversity of the "third landscape" that is defined by Gilles Clément (Clément 2005).
This understanding makes it necessary for planners, designers and architects to interact with all kinds of landscapes. These include also degraded areas with social, spatial and environmental problems such as dereliction, abandonment, damaged environments, and characterised by a low quality of life.
Landscape can therefore be considered as a lens through which to interpret, and work in, contemporary cities (Waldheim 2006, 15) from a multidisciplinary point of view. Moreover, it could be a medium that makes it possible to face quick temporal changes and transformations of the metropolitan conditions:

"Landscape is a medium capable of responding to transformation, adaptation, and succession" (Sijmons 2013, 31).

Different landscapes shape local cultural heritage as it changes over time (Ministry of Agriculture Nature and Food Quality, Ministry of Housing Spatial Planning and the Environment, 2009). Hence, it can be argued that landscapes reshape local culture. Therefore, the redesign of wastescapes asks a particular attention to both the specific local contexts, and to the related time and space. Indeed, as is the case with landscape design:

"(It) is always contextual, connected with the spatial and temporal aspects of nature, with the physical environment, with the topography of the landscape" (Steenbergen and Reh 2003, 381).

In this new framework, wastescapes can be understood as the "next landscape of our daily living environment" (Landschapstriënnale 2017). By exploring the new waste geographies, we can identify the operational landscapes of waste. This includes the incinerators, the composting plants, the landfills, the large waste management operations, and the transformation plants. They emerge as the new landmarks of our contemporary spatial configurations, which are:

"logistic landscapes […] critical junctions in the global circuitry of twenty-first century capital" (O'Shea, Hegeman, and Bennett 2016).

The holistic concept of landscape takes into account various scales and disciplines in order to deal with the complexity of contemporary urbanization. It has the "synthetic capacities" to merge dimensions of ecology and infrastructure, while also allowing for the regeneration of misused areas by providing "the intensification of new ones" (Bélanger 2013, 290).


RESIDUAL Space
ILLegal
Inhabitable space
Lost space
Rejected space
TERRAIN VAGUE
new land
Industrial ruins
MARGINAL SPACE
Drosscape
AND
without IDENTITY vacuum
Wasting LAND
Vulnerability
DERELICT LAND
edgeland
Neglected space
Fragile space
Nameless
FRICHE
POLLUTEDSPACE
Decay
BROWNFIELDS
WASTED SPACE
Liminal space
TERRA NULLIUS
ugly space
Hybrid
Interstitial space
inaccessibility
MIDDLE LAND
PROBLEMATIC
discarded
degraded land
BROWNFIELD
UNDER USED LAND
UNINTENTIONAL
Under-used space
MARGINAL SPACE

Wastescapes: understanding and analytical definition

From the period between the last decades of the 19th century until today, the effects of the linear development of contemporary cities has been characterized — among other factors — by the erosion of fertile soils and the abandonment of certain types of landscapes. During these years, cities started losing their boundaries, appearing to be confused, chaotic, and without a precise or defined shape. Their configurations became unpredictable and were not completely understandable when compared with modern cities. As a consequence of this type of growth, contemporary cities seem to be a "confused mix of heterogeneous fragments" (author's translation from Italian) (Secchi 2000, 77) that is difficult to be understood.

The limits of growth, and the scarcity of environmental resources within our ecological systems, are revealing that this model of expansion of urbanized areas is not sustainable anymore. This form of growth is causing loss and dissipation, proving that waste flows can strongly influence the structure of our landscapes. These are also interlinked with polluted soils and also disused, underused, or inaccessible areas/buildings, all of which result in the generation of wastescapes. For this reason, it is necessary to go beyond the concept of material waste by considering the residual spaces in contemporary European territories as a specific kind of waste.

Wastescapes are the spatial consequences resulting from unsustainable linear growth processes. They represent the operational infrastructures for waste management and include Drosscapes, which generate complex relations with their surrounding territory (Amenta and van Timmeren 2018).

Wastescapes, which are the typical result of linear metabolic processes, are slowly but surely characterizing our territories. It is because of this that we need to categorize them in order to reinterpret them in an organized way. By doing so, their understanding can become clearer, which could lead to the identification of eco-innovative solutions and strategies for their regeneration. Currently, several studies exist that deepen the concept of drosscape, as well as of wastescapes (Amenta and Attademo 2016; Amenta and van Timmeren 2018; De Leo and Palestino 2017; De Leo, Lieto, and Palestino 2017; EC 2016; REPAiR 2018d; Amenta 2015; Berger 2006b; Gasparrini and Terracciano 2016). However, in spite of these sources, a widely acknowledged definition of what wastescapes are is still missing in scientific literature. This concept is still in an experimental phase, and is not yet based on uniform definitions and/or homogeneous value systems (Fig. 2.2). In order to identify wastescapes as resources for the regeneration of urbanised territories, it is necessary to recognise what their hidden values are. It is also important to recognize what are the possible implications of recycling them for design and planning activities in contemporary cities.

At first, this research was grounded on Alan Berger's definition of 'waste landscapes,' elaborated in his book "Drosscape, Wasting land in urban America" (Berger 2006a). His concept has been applied to both the case-study of the metropolitan area of Naples and

Fig. 2.2 Wastescapes definitions. Graphic: by V. Vittiglio.

Fig. 2.3 (above) and 2.4 (below) Spatial fragmentation in peri-urban areas. Naples Metropolitan Area.

of the Amsterdam metropolitan area, which will be later verified in other contexts. By focusing on the case-study of Naples, it was possible to define an initial categorization regarding the typologies of wastescapes (Amenta 2015; REPAiR 2017a, 2018d; Amenta and Formato 2016).

For the most part, wastescapes are polluted (industrial) areas, vacant lands, under programmed or abandoned areas, interstitial spaces, and places that have lost all their vitality or identity, etc. They can be forgotten open spaces or buildings at the end of their life-cycle. On the one hand, they represent urban and peri-urban hybrid and fragmented landscapes. On the other hand, they represent an ecological and economic reserve for urban and landscapes recycling, usually having hidden implicit values.

Recycling wastescapes can help restore the lost sense of identity of certain spaces; indeed it is through this practice that new public spaces can be given back to the community. This approach to contemporary cities has unfortunately been overlooked for too long in the debate about territorial regeneration. Despite that, it currently seems to be a very fertile field to conduct experimentation and research in.[2] Wastescapes, being spaces generally enclosed, interstitial, or discarded, are of great interest for urbanists. This is because they often represent the most transformable and modifiable parts of a territory (Formato and Russo 2014).

Metropolitan areas do not only deal with the complexity of handling waste, but also face challenges with the management of wastescapes. Wastescapes are twofold (REPAiR 2017b, 2018d). On the one hand, they are drosscape (Berger 2006b) that are namely brownfields, abandoned, underutilized areas (e.g. industrial areas or former agricultural lands), and "middle lands," (Russo 2012) which are residuals of main urbanization processes. They can be interstitial areas, disused infrastructures, and other kind of spaces that have reach the end of their planned life cycle. On the other hand, they are operational infrastructures of waste (Brenner 2014; De Leo, Lieto, and Palestino 2017; De Leo and Palestino 2017), namely all the infrastructures for the management of waste that usually create spatial fragmentation (e.g. landfills, waste treatment plants, etc.).

A first classification of wastescapes can regard that drosscapes have undergone different spatial, environmental, and social conditions (Fig. 2.7, 2.8 and 2.9).

2 For example, TUDelft students of the courses Minor "Neighborhood of the future" and precisely the Studio "BK7263 Future Proof Urban Project", and of the R&D Studio AR2U086 Spatial Strategies for the Global Metropolis, that I could follow so far as a tutor in the academic year 2018-2019, seem to be very interested in deepening the topic of wastescapes, being the central issue in many of their project experimentation. They studied this theme in the case studies of Rotterdam and Amsterdam.

Fig. 2.5 (above) and 2.6 (below) Buffer zones of the infrastructures. Naples Metropolitan Area.

1. SPATIAL FRAGMENTATION

diffuse settlements and related public spaces

Outside the historic centres of contemporary metropolitan areas, many buildings that were built after the early seventies have a molecular appearance. They are isolated buildings that sit within (large) lots of land. They exist as a multitude of solitary and accumulated constructions, which have resulted in the creation of new suburban patterns. In some regions, particularly in the Italian context, they create like a homogeneous, 'do-it-yourself' landscape (Fig. 2.3 and 2.4) (Bianchetti 2003).
In this fragmented structure, public spaces are sacrificed in favour of an uncontrolled individualism, and the spaces in-between buildings are very often just left over as residual places. These areas are considered to be wastescapes because there is a lack in quality of both buildings and open spaces. In this particular situation, the result is that the potentially various and diversified landscapes of Europe are ultimately and seemingly fragmented, appearing similar in terms of spatial characteristics.

2. ILLEGAL PROCESSES

waste deposits and built entities

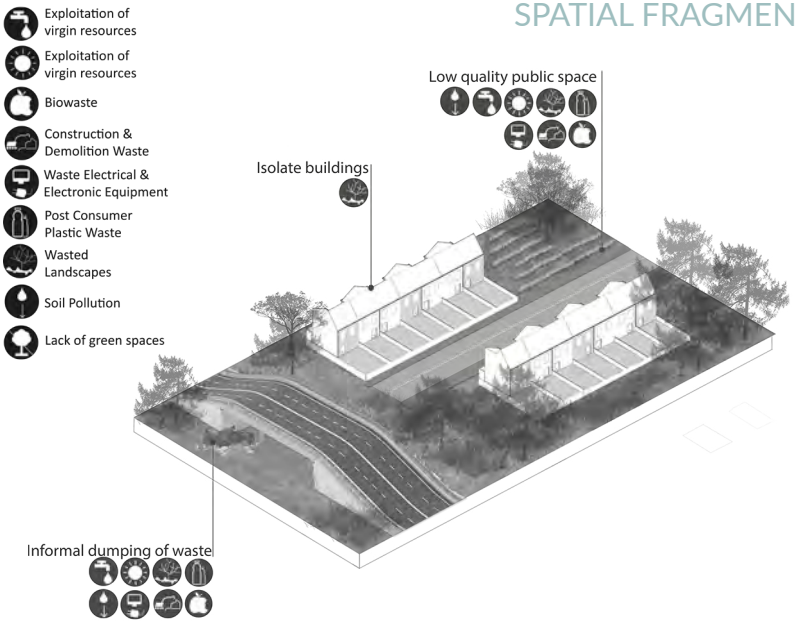
Different illegal processes may occur in wastescapes; they can be open spaces where an illegal dumping of (toxic) waste happens, or illegally constructed buildings that do not adhere to any city plan. Indeed, in many cases, the chaotic and disorganised structure of the territory is primarily due to the gap existing between established urban plans and the realised buildings. Unauthorised developments, better known as 'illegal constructions,' mostly occured in the countryside or other peri-urban areas. They are low-quality developments that exist with a lack of (green) public spaces. It is because of this that working with this kind of territory is an important challenge for contemporary planners. It is important to design and re-organise these chaotic urban structures by increasing the percentage of public spaces and facilities in these 'illegal landscapes.' They could provide necessary services that are now lacking for the current local population in these areas.

3. WAITING CONDITIONS

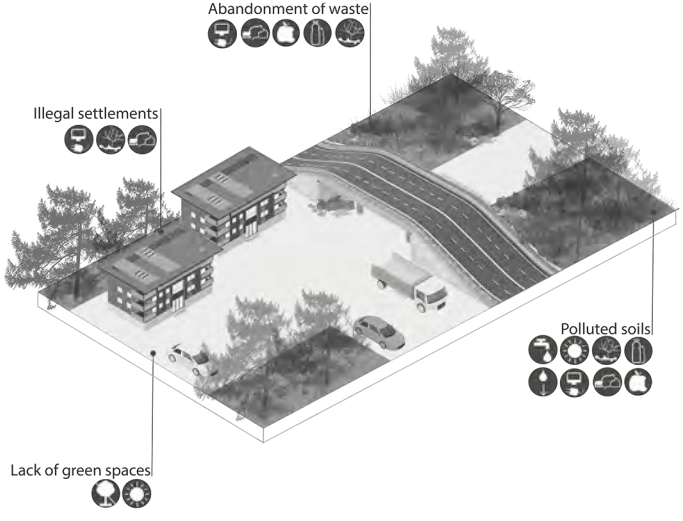
land in limbo, buildings and infrastructures

Today, planning tools are often too rigid, and are not flexible enough to adapt to the dynamic changes that, nowadays, are taking place. The rigidity of these plans and the sluggishness of the bureaucratic process, together with the dynamism and complexity of the stakeholders involved, can create 'land in limbo' (De Martino 2016). In this way, certain buildings or infrastructures can be in a suspended state for a long time. They are

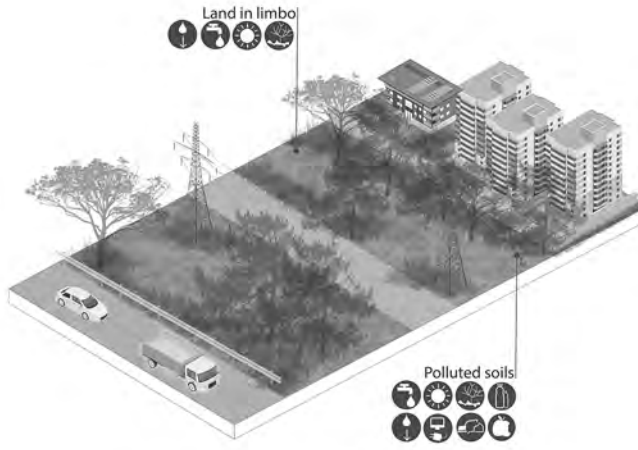
SPATIAL FRAGMENTATION



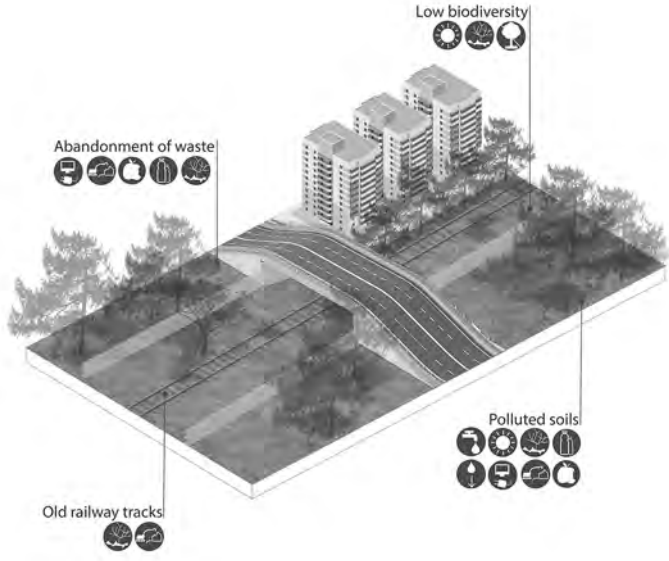
ILLEGAL PROCESSES

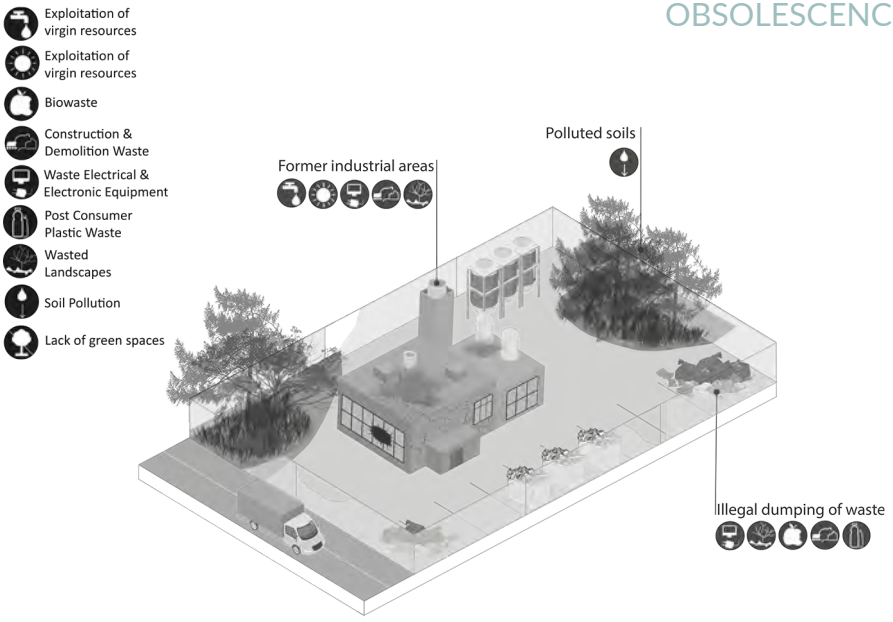


WAITING CONDITION



OVERLAPPING





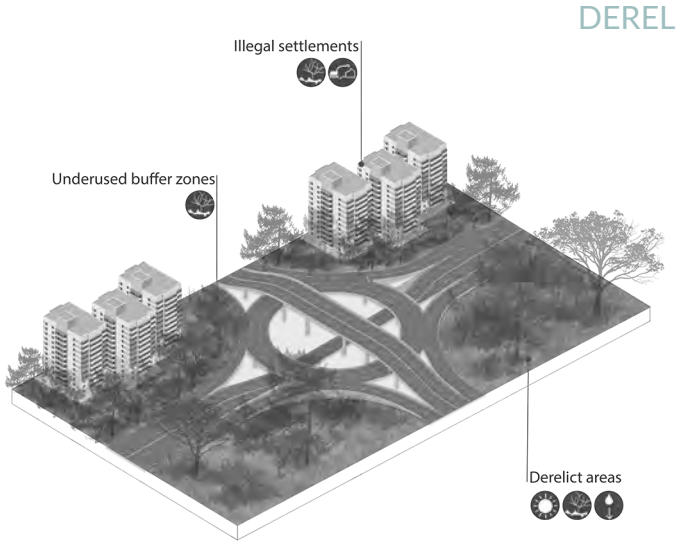
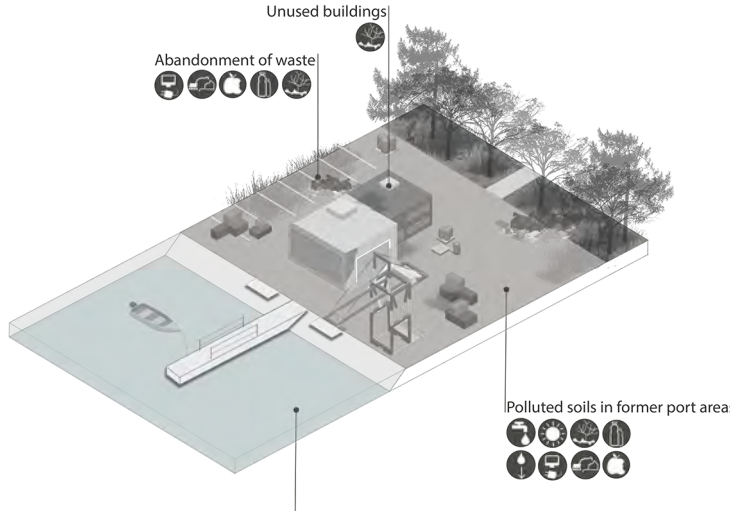


Fig. 2.7 (Current and previous pages) Different spatial, environmental, and social conditions of wastescapes. Graphics done by V. Vittiglio.

CONTAMINATION



ABANDONMENT

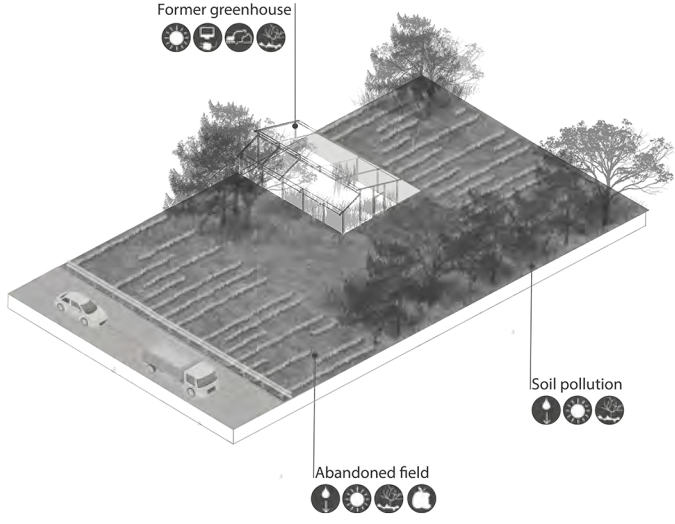


Fig. 2.8 Dereliction. Naples Metropolitan Area.

Fig. 2.9 Abandonment. Greenhouses. Dutch context

usually waiting for the completion of their construction, or for the realisation of plans and projects for their modification. The latter may have been stopped due to, for example, economic problems. These areas are generally highly impervious, fenced, empty, and forgotten, waiting for possible future regeneration. In these spatial reservations, spontaneous biota can take hold. Heavily polluted areas can follow under this category too, since their decontamination presupposes long and expensive processes that are not always compatible with public (and sometimes temporary) uses. In this case, the biodiversity is very low because of the severe pollution of the area.

4. OVERLAPPING

buffer zones of the infrastructures

One of the most important components of the process regarding metropolisation is the development of fast railway and motorway transport networks. Generally, urbanisation and infrastructure development processes mutually influence each other. In spite of this, these network structures quite often simply overlap the territory without creating a clear relationship with the urbanised landscape. This combined lack of attention and design for both landscape elements and the existence of urban sectorial policies can generate wastescapes (e.g. underpasses, old railway tracks, infrastructure lines that create separations in the urban structure, etc.) (Fig. 2.5 and 2.6).
In this way, roads, motorways, and railways create landscape fragmentation in Europe. This could potentially lead to negative consequences for flora and fauna that cannot easily survive when the landscape is fragmented into smaller pieces (as it happens, for example, in the buffer zones of infrastructures). Therefore, biodiversity can be threatened in these areas (EEA European Environment Agency 2017).

5. OBSOLESCENCE

buildings

Underutilised or unused buildings, former and abandoned industrial areas, dismissed or empty logistic constructions, former abattoirs, former wholesale market halls, outdated offices, etc., are the wastescapes of a phenomenon of urban decline that is caused by different factors and changes in the economic organisation of territories. These wastescapes tend to cross over densely urbanised territories, and generates a substantial loss in spatial quality. This phenomenon also includes the periphery of cities, and in general, the specific constructions that are not used any longer for the functions for which they were planned. In these types of wastescapes, the architecture has to be regarded as a resource for new uses. These spatial systems ended their planned life-cycle, and a project for re-utilisation is needed for them to be used once again.

6. DERELICTION

open spaces

Derelict areas are residual open spaces that have been left over by different sectorial methods of planning (Fig. 2.8). They can be interstitial and unplanned. They usually are not utilised, and they result from the overlap of different processes dealing with the organisation of the territory. They are like islands in the midst of infrastructures. They are the forgotten spaces amongst the industrial and commercial enclaves, the areas in-between airports and other large gated areas, and even illegal settlements. These types of wastescapes are vacuum spaces that emerge as a result of non-designed processes, and are usually perceived as being ugly.

7. CONTAMINATION

port areas and (former) industrial zones

Nowadays, cities and their surroundings are undergoing different transformations. This is caused by economic contraction caused by the shift away from the industrial era, to the post-industrial and information era. Consequently, large (former) industrial areas are in a waiting condition because they need to be decontaminated and reclaimed. Other examples of wastescapes caused by contamination can often be located in the degraded peripheries of cities, in-between disused factories, and oversized road infrastructures that trucks do not circulate through any longer. In these areas, which can be defined also as brownfields, the illegal dumping of different types of waste (including chemical waste) can be observed. For this reason, their ecological systems can be put under pressure from potential environmental hazards that are related to both polluted groundwater and superficial water (rivers, canals, etc.). The left-over areas that are in-between port and city can be also understood as wastescapes. The linear model of growth has historically generated, and still generates, high amounts of wastescapes in many port-areas. They tend to exist in these in-between areas, which are comprised among both port and city. They occur in the form of polluted lands such as brownfields, buffer zones of (port) infrastructures, as well as neglected buildings not anymore suitable for the functions they were intially planned to perform. Also included in this characterization are the areas that are in a waiting condition for new life cycles to begin.

8. ABANDONMENT

former rural areas and greenhouses

Former (and sometimes polluted) agricultural areas are distributed throughout the landscape (Fig. 2.9 and 2.10). Very often, nature is starting to take possession of them in the form of a “Third landscape” (Clément 2005), erasing the rigid and regular organization

of rural territories. Since these areas are not utilised anymore for cultivation, they can be important reserves for biodiversity.
These territories are in a 'suspended' condition in-between urban and rural functions. From an ecological point of view, these rural abandoned areas represents a strategy for the re-design of networks defined by recycled landscapes. Among those underutilised or abandoned strips of rural landscapes, there are new processes for urban agricultural development, which in recent times represents various types of latent economies (e.g. abandoned glasshouses, uncultivated areas, etc.). This is due to the dereliction of those structures, and to the necessity to build larger and more technologically advanced structures.

9. SOCIAL PROBLEMS

Due to various social problems (such as social segregation, unemployment, poverty), some urban areas can be seen as unattractive, and sometimes separated or distant from other vibrant urban functions. These issues are creating urban fragmentation, particularly in the most fragile areas of cities.
The gap between the poor and the rich is increasing; poverty and social injustice are often interlinked with several forms of spatial injustice (Bernardo Secchi 2013).
Great quantities of inequalities can lead to economic crisis and unsustainable growth. Income and wealth inequities can cause a greater risk of poverty and social exclusion: "ensuring inclusive and sustainable growth in the EU requires a combination of cost-effective social protection and support services, good education allowing equal chances for all, and well-functioning labour markets supported by effective labour market policies" (EC 2017).

After a reiterative process carried on within the two pilot case studies of Amsterdam and Naples, where two Peri-Urban Living Labs (PULLs) are implemented, a better understanding of wastescapes and a more specific/concise definition of wastescape has been developed (REPAiR 2018d, 2018c, 2017b). Another matter emerged from the work carried on within the PULLs, which asserts that a new and shared taxonomy of wastescapes was necessary to understand the complexity of these areas. It is also imperative to effectively understand, map, and redesign them, resulting in a reduction of the indetermination that characterize them. Therefore, the concept of wastescapes was further delineated, and it is comprised of the landscape's various opportunities and territorial conditions. Wastescapes can be grouped into six different categories (REPAiR 2017a, 2018d; Amenta and van Timmeren 2018):

- Degraded land, impoverished from the point of view of soil fertility caused by human activities;
- Degraded water, including both properly polluted or compromised water bodies,

Fig. 2.10 Abandoned fields. Metropolitan Area of Naples. Photo: courtesy of V. Vittiglio.

and territories under hydraulic pressures;
- Declining fields, consisting of vacant/under-used and abandoned fields, vacant parcels and vulnerable soils;
- Settlements and buildings in crisis, comprising vacant/underused, neglected, or obsolescent buildings and settlements, as well as illegal/informal ones;
- "Dross" of facilities and infrastructures, including dismissed or underused infrastructures and facilities;
- Operational infrastructure of waste, related to waste management facilities, such as incinerators and landfills.

The challenges regarding wastescapes

Through this description, it emerged that wastescapes intercepts all sort of challenges (Amenta and van Timmeren 2018, 4), which are specifically related to:

- Environment (EEA European Environment Agency 2010), when it is about polluted or compromised land, as well as unproductive soils.
- Landscape (Berger 2006b), in presence of spaces not connected or integrated within the neighbouring landscape, therefore fragmented and often perceived as hideous.
- Management: in presence of strict regulations that do not allow creative uses of abandoned/left-over areas.
- Social cohesion: wastescapes can be the result of frictions such as confiscated, illegal or informal settlements, and/or illegal landfilling processes.
- Economy: difficulty to define convincing business models for circular regeneration of wastescapes and lack of funding; lack of trust towards other values in addition to economic ones.
- Individual perception: inaccessibility, abandonment, and often hazardous waste in polluted areas, unsafety are all factors which are negatively affecting life satisfaction of the inhabitant (Krekel, Kolbe, and Wüstemann 2016).
- Awareness: a shared understanding of waste and wastescapes as innovative resources for developing site-specific Eco-Innovative Solutions is still missing in many political and institutional contexts.

NAPLES | Understanding and working with wastescapes

Setting the context: the Metropolitan Area of Naples

The Metropolitan Area of Naples (MAN) is part of the continuous high-density conurbation of the Piana Campana, in the Campania Region, located in the South of Italy. From an environmental point of view, it is an extremely compromised territory due to the significant influence of criminal organisations in the area (Laino 2013: 5). This territory is suspended in a state in-between "beauty and the threat":

"The specific dealing with nature has created an area of tension between beauty and threat that is not given by nature in itself, but is a result of the way urbanization is regulated. Illegality, and hence the widespread breaching of rules and regulations that allows for higher profits, has to be understood as a constituting element of the planning system of the Naples region" (Kastani, Schmid, 2013: 32).

The MAN is organised following a multi-centric structure, in which urbanised high-density poles are recognisable; it extends from the hills of the Sorrento Coast to the Northern Plain, towards the Regi Lagni Rivers, and surrounds the Vesuvius Volcano. This multi-centric structure, developed in the palimpsest of several consolidated and historical centres, did not evolve in a polycentric system because of the strong economic and physical interdependence between the weak centralities and the territories. This development occurred due to, inter alia, a large-scale and inefficient infrastructure system that crosses the territories, and yet is scarcely interconnected. In other words, a well-connected and networked infrastructure with a distribution of functions on a territorial scale does not properly exist in this territory (Belli and Russo 2005, 192). In addition, among the factors that did not allow the formation of a really polycentric structure, it is important to mention that the strong influence of Naples, capital of the region Campania and the third-largest municipality in Italy, after Rome and Milan.
The so-called Piana Campana is a territory, characterised by a very marked contradiction. On the one hand, it is a very fertile environment with a strong history. This territory embeds an exceptional concentration of historical, artistic and architectural heritage. It is constituted by a palimpsest of tracks remained throughout the years. Indeed, the Roman settlement patterns are still recognizable. On the other hand, the Piana Campana is affected by a deep ecological crisis consisting of high levels of pollution in the area, and of altered relationships between the inhabitants and their living environment. For instance, wrong behaviours are indeed registered in the waste management sectors, leading to an uncontrolled abandonment of waste along the streets. Wastescapes due to flawed human habits occur mostly in the peri-urban spaces of the MAN.
In the MAN the territories where housing settlements and industrialised areas are mixed with the rural landscapes are growing (Belli and Russo 2005, 194). Frequently, peri-urban areas are connected to agricultural lands and high valued landscapes. Very often, legal and illegal landfills are spread into the peri-urban territories. In addition,

there is a large presence of illegal buildings (Belli and Russo 2005, 192).
Therefore, it is possible to say that the MAN is an area that consists of a large amount of wastescapes that creates a network of spaces to be recycled. More specifically, problems of pollution, illegal dumping, and abandonment of urban areas are interwoven.

Wastescapes in the Metropolitan Area of Naples

The Metropolitan Area of Naples (MAN) is affected by the very serious problems of ecological crisis, degradation, waste of resources (Belli and Russo 2005) generated by pollution, and illegal dumping of (toxic) waste.[1]
Moreover, the use of concrete to make river banks of the Regi Lagni Rivers safe — made possible by the public financing "Cassa del Mezzogiorno", after the Second Word War (Amenta and Formato 2013) to redevelop the economy of the South of Italy — contributed to the environmental degradation of the peri-urban areas.
In recent times, in the MAN, the economies that were based mostly on agriculture have become industrialized economies, in addition to the development of large industrial areas (so called ASI). Nevertheless, the role of agriculture in the Campanian economy is still strong. However more innovative policies would be needed to sustain its status.
Life cycles of buildings and landscapes derive from economic, productive, and development models, all of which are typical of the local territorial palimpsest of the region. In Campania, the majority of landscapes that can be categorised as 'wasted' are due to the crisis of two main cycles. Firstly, one crisis caused by the Fordist Industry is that a surplus of empty spaces and warehouses were created. Secondly, the challenges related to the haphazard organisation of the part of the territory constructed according to illegal interests. Moreover, the life-cycles of ASI industrial areas, infrastructure and agricultural land are going through a moment of crisis. After the earthquake in 1980 in Campania large industrial areas, namely ASI areas, were developed, under a special law n.219/1980 (Belli and Russo 2005), creating large clusters and gated areas in the countryside or at the edge of big cities. Nowadays these ASI areas are going through a moment of crisis and they have been abandoned. They are critical urban areas in which most of the internal space is disused or underutilised. Also the buildings recently

1 The situation of the illegal dumping of toxic waste in the Campania Region is very well described in the movie 'Biutiful cauntri', the Italian transcription of the pronunciation of the English expression "Beautiful country". It is structured as a documentary film and it was realized in 2007 by Esmeralda Calabria, Andrea D'Ambrosio e Peppe Ruggiero (cfr. https://it.wikipedia.org/wiki/Bi%C3%B9tiful_cauntri last date of access: 10 February 2019). Watching the movie, it is obvious that the spillage of a large quantity of toxic waste is happening in wastescapes that are forgotten areas in which the urban planning did not work at all and where Mafia organisations are operating. Most of the areas affected by the accumulation of rubbish are former agricultural areas abandoned by farmers allowing these criminal organizations to use their land as illegal landfills. This fact generates a decline of the economies related to the residual agriculture and farm animals still present in the territories and the increase of problems related to human health.

Fig. N.1 and N.2. Wastescapes in Naples Metropolitan Area.

constructed are very often not utilized (Provincia di Caserta 2012).
Big infrastructures are just over-lapped in the territory without considering their relationship to their surroundings; they appear like barriers, non-integrated into the landscape. Also the agriculture can encounter moments of crisis because of illegal dumping and diffused pollution that is transforming some of the soils — previously considered the most productive in the Region — into unproductive lands.
Particularly, the presence of wastescapes in the Campania Region — both in the urban and peri-urban areas — highlights an urgent need to improve the quality of their environment and the quality of citizens' lives.
Another factor that is worth recalling is that in Campania criminal organisations have a big impact on the urbanisation processes. Illegal real estate development for unlawful property subdivision became even like a norm shaping the territory. This generated a low-density and irregular city in which density and dispersion are alternated (Belli and Russo 2005).

"[…] Urbanization of Vesuvius proceeds just like any other urbanization process in the region. As illegality is a permanent and almost constitutive element in this process, and criminal organizations are becoming endemic and even an important element of the local economic system, the areas around the volcano are treated like any other piece of land-as potential assets and as instruments to generate extra profits. As a consequence, the system of illegal construction also invades the risk zones, and even more so, create new risk zones. In this logic the deposit of toxic waste is just another form of the illegal use and transformation of the land. The urbanization of Vesuvius and the production of space where illegality plays a key role and where organized crime succeeded in getting control over parts of the territory" (Kastani and Schmid 2013, 57).

For these abovementioned reasons, the MAN can be considered as an interesting laboratory in which to experiment with the new challenge of reusing wastescapes as a resource for sustainable urban and territorial regeneration (Fig. N.3 and N.4). Wastescapes in the MAN (as for example in the Fig. N.1 and N.2 and as shown in the map Fig. N.5) may be caused by different factors, as listed below.

1. SPATIAL FRAGMENTATION

Urban expansion of peri-urban areas of the MAN happened mostly in the last 40 years, as a sequence of detached houses. These diffuse settlements are generally characterized by a similar design constituted by a maximum of three floors above the ground. In addition, the quality of built environment is generally quite low and interests both the buildings themselves, as well as the related public spaces. The spatial fragmentation of these settlements in the MAN significantly consumed former agricultural land. In this way, public open spaces became more and more as leftovers.
Settlements are generally separated from the public spaces and from the contiguous

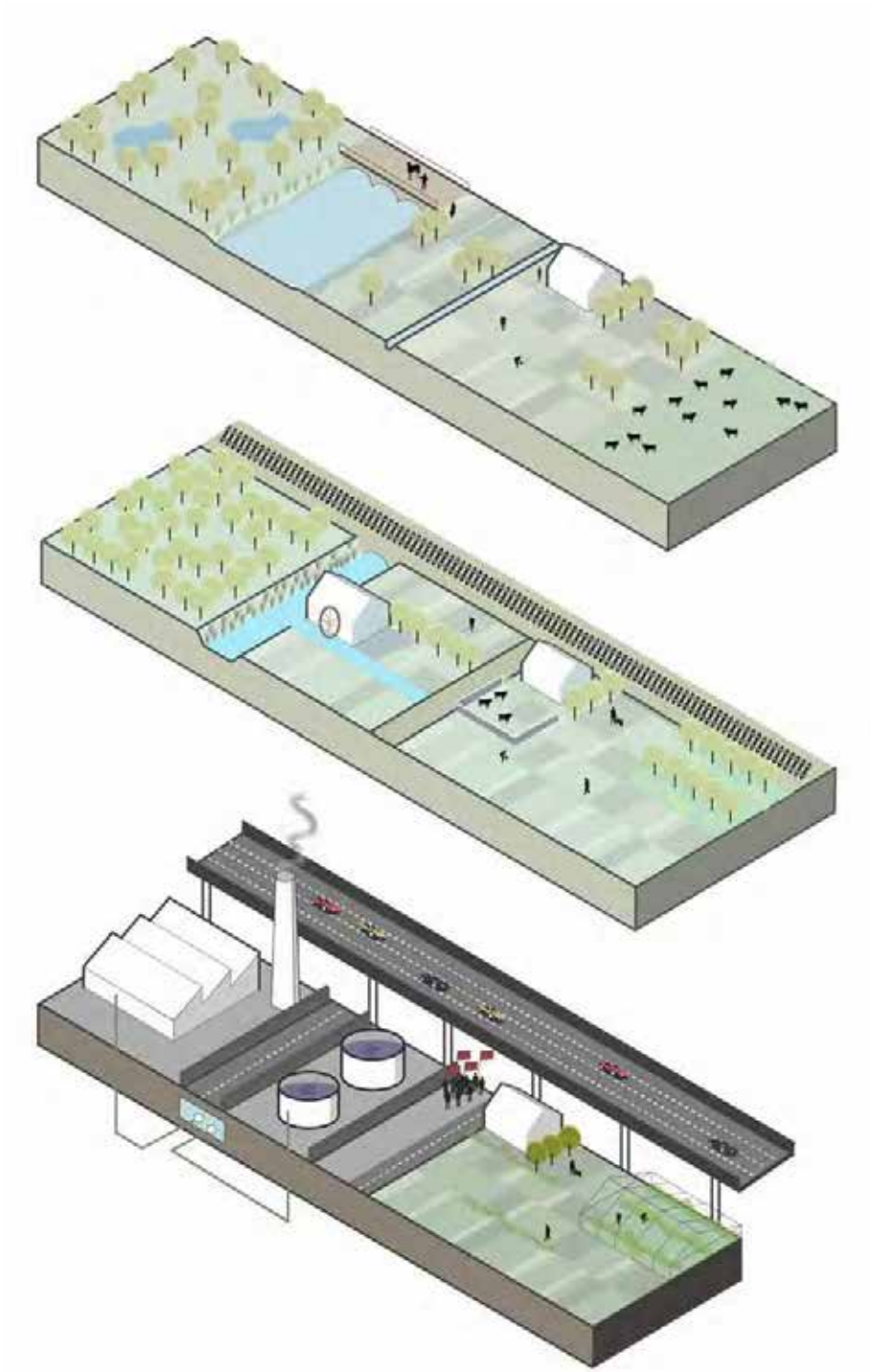


Fig. N.3. The evolution of the territory of East Naples. Marshes and woods (1400). The reclamation of the countryside (1890). The industrial city (1966). Image source: author's elaboration within the framework of the PRIN project 'Re-cycle Italy', Unity of Naples. For further information see the website at the link: http://www.recycleitaly.it/.

streets by high railing or gates. The result is that public spaces are negatively affected by such organisation of the settlements. In addition, due to the maintenance problem, they also lack in quality being somehow forgotten or incomplete.

2. ILLEGAL PROCESSES

Illegal waste dumping is affecting many open spaces in the MAN. Due to behavioral problems and to other illicit activities, waste is accumulated very often along the roads, and under bridges. This causes those areas to be isolated, unsafe and unpleasant to cross on foot.
In the peri-urban areas of the MAN a “latent city” (Federico Zanfi 2008) developed. It is composed by illegal and low-density settlements. This condition of illegality is one of the major causes of their low quality. Their development generally eroded green areas. As a result, they lack in infrastructures and related public spaces, as explained above. These common characteristics influence also the image of the entire territory.

3. WAITING CONDITIONS

In the peri-urban areas of the MAN, the diffusion of the settlements gave rise to a number of uncertain spaces that generally turn into abandoned, empty or just fenced areas. The enclosed areas of specialised functions that are present in the peri-urban territory not only delimit empty strips and lots, but also large amount of in-between spaces as well.
Unfinished residential buildings can be found within the MAN region. Generally, they remain unfinished for economic reasons or, more likely, because the Judiciary has seized them.

4. OVERLAPPING

The rigid infrastructural system is overlapped in the MAN with large gated areas (e.g. industrial areas), with agricultural areas as well as with settlements. For example, in the East of Naples, organisation of the territory through multifunctional enclaves has given rise to a succession of barriers represented by the walls or the fences of enclosed areas. These alternate with each other and characterize the roads system, devoid of the urban character. Buffer zones of infrastructures are also following under this wastescape category.

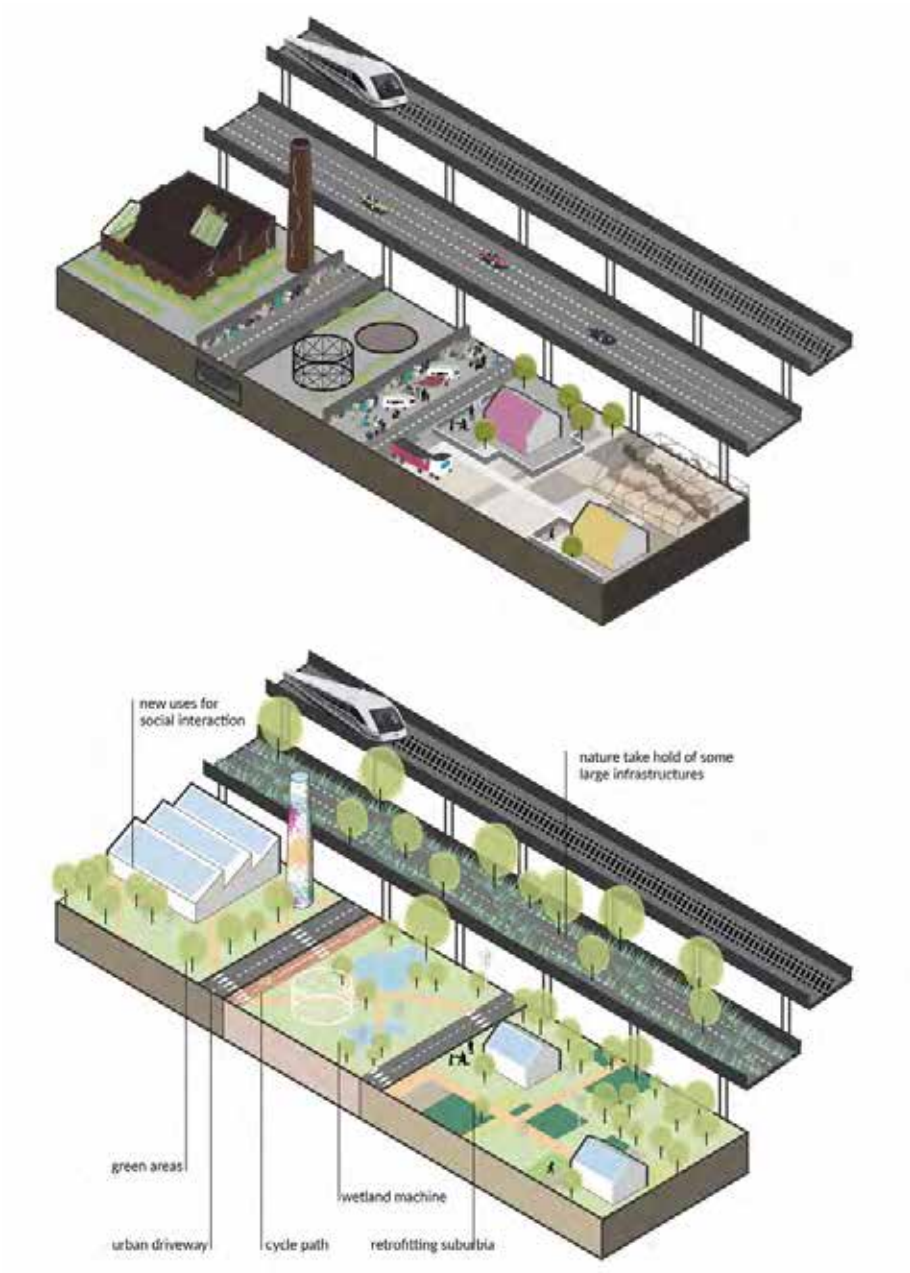


Fig. N.4. In the "waiting city" (today) illegal waste dumping is combined with former industrial zones, fragmented agriculture and fenced built areas. Vision 2030: The industrial past co-exists with marshes; the residential future is connected to urban agriculture. Image source: author's elaboration within the framework of the PRIN project 'Re-cycle Italy', Unity of Naples. For further information see the website at the link: http://www.recycleitaly.it/.

5. OBSOLESCENCE

Obsolete buildings in the MAN are mostly result of the de-industrialisation process. A physical and social decay characterise the remains of the industrial era. The obsolescence of buildings is often in combination with the contaminated sites of (former) industrial areas.

6. DERELICTION

In industrial areas of the MAN, derelict and open spaces can be found. They are determined by the crisis of different productive sectors. These open spaces represent a potential resource for urban regeneration avoiding further soil consumption, and recreating ecological connections.
Among different kinds of derelict areas, we can observe wasted former agricultural zones. Often, they are micro-areas, ignored by decision makers and investors, in between the 'hard' urban parts (e.g. former industrial areas and other enclaves of bigger projects). Anyway they can represent possibilities for reconnecting the existing urban fabrics through green paths or temporary uses, representing possible forms of new economies.

7. CONTAMINATION

According to the regional agency for environmental protection of the Campania Region (ARPAC)[2], contaminated sites are characterised by the environmental pollution caused by the ongoing or past anthropic activities. According to the Regional Plan for Decontamination (Piano Regionale di Bonifica, Delibera di Giunta Regionale n. 129, 27.05.2013, BURC n. 30 del 05/06/2013), we can firstly distinguish that the contaminated sites in Campania have already undergone a process of decontamination and environmental restoration, with potentially contaminated sites being cleaned afterwards.
Among the abovementioned categories, there are landfills, waste management plants, caves, and areas in which there is an unchecked deposit of waste, and provisional areas for (waste) deposits where productive activities are located.

2 ARPAC is the regional authority in charge of the environmental protection of the Campania Region. It is the agency in charge of the monitoring and the conservation of the territory, in order to prevent its quality. Moreover, ARPAC works to overcome the environmental challenges of the Campania Region. See more at: www.arpacampania.it.

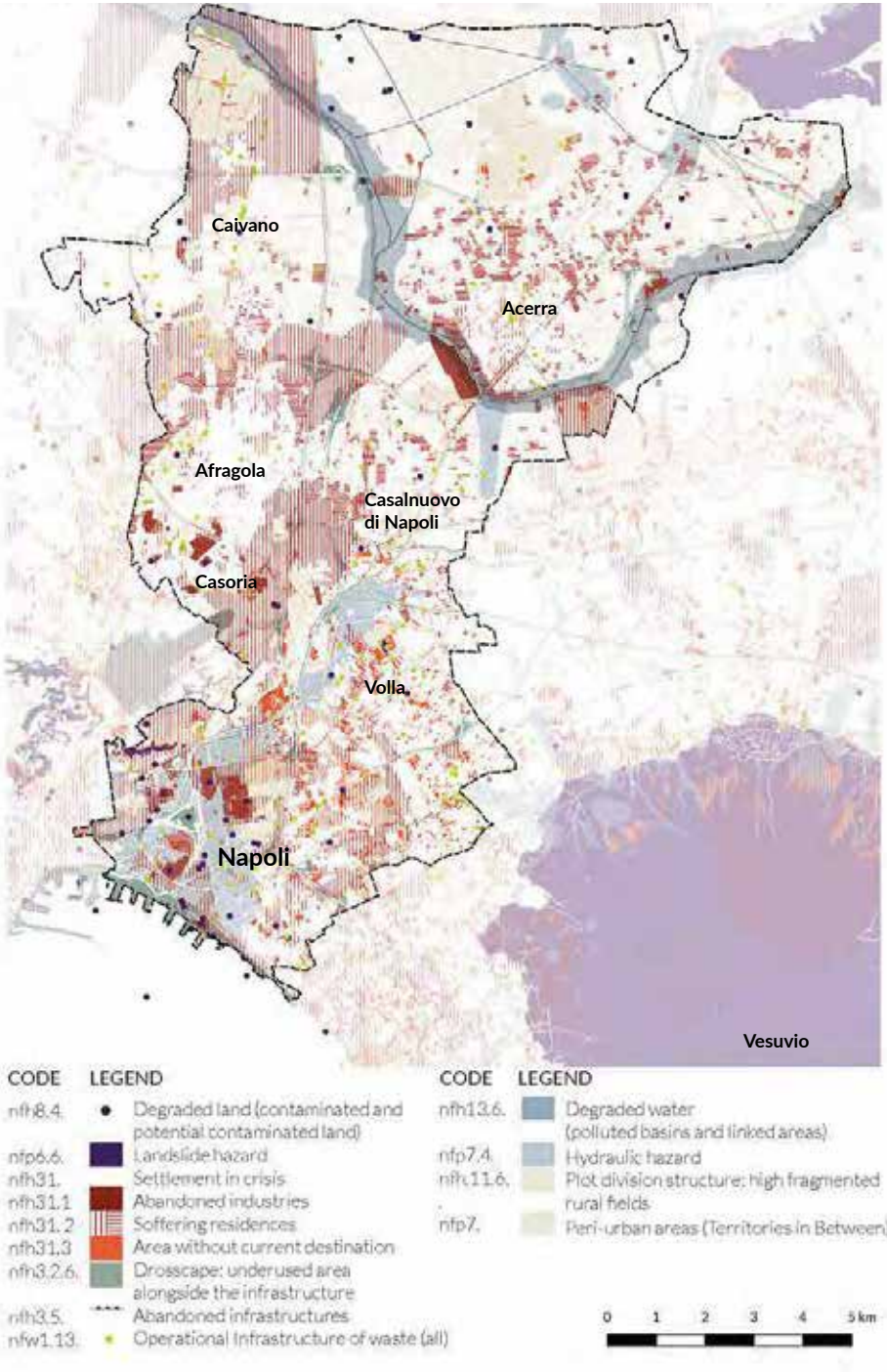


Fig. N.5. Naples wastescapes map. Source: REPAiR Deliverable 3.3 “Process model for the two pilot cases”, Annex 2, p.30, UNINA Lab REPAiR Team.

8. ABANDONMENT

In the Campania Region the agricultural landscape is in a state of suspension between abandonment of rural areas and valuable permanence of precious agriculture. Within the former agricultural areas, it is possible to identify several degraded areas, defined in the Territorial Coordination Plan of the Province of Caserta as 'denied areas' (in the definition of the plan they are 'aree negate') (Provincia di Caserta 2012) without any uniquely defined function. Very often they can be found in private properties. Specific policies to renew such denied areas do not exist yet.

9. SOCIAL PROBLEMS

In the MAN, it is not uncommon for public spaces and spaces for social interactions to be replaced by shopping malls. The latter establishes themselves as out-of-scale objects in the territory, and is only accessible by private car. In relation to that, it should be noticed that, in some peri-urban areas, there are almost a total absence of a public transport network. This can generate separation between individuals and urban places, which are mostly crossed by car. For pedestrians they become ugly areas of little interest, and even unsafe areas. In the peri-urban areas of the MAN, the public spaces consist of streets and squares bound by walls, without a smooth transition between private and public spheres. Conversely, the presence of surveillance cameras on top of the fences or walls of the private properties is a symbol for the need for safety for private properties.

Eco-innovations dealing with material waste and wastescapes

Eco-innovations are tools that can help decision makers to make a transition towards circularity. Innovations can interest different features of the planning process and of the management of territorial resources such as technical, social, and political aspects, and to all the processes related to that. They are the result of a co-creation process that can take place within territorial laboratories, which envisages the participation of many stakeholders. Eco-innovations are composed by elementary solutions (that respond to the question 'What?') and by territorial strategies (that are the response to the question 'How?'). Moreover, innovations are generally site-specific because they should be able to cope with the local challenges that have been identified within the territorial labs (REPAiR 2018b; Formato, Attademo, and Amenta 2017).

Particularly, for developing eco-innovations for the case study of Naples, within the MAN a focus area has been selected where a large amount of wastescapes is interwoven with the complexity of the peri-urban areas' structure. The focus areas is a representative sample for the whole metropolitan area since it consists of a complex

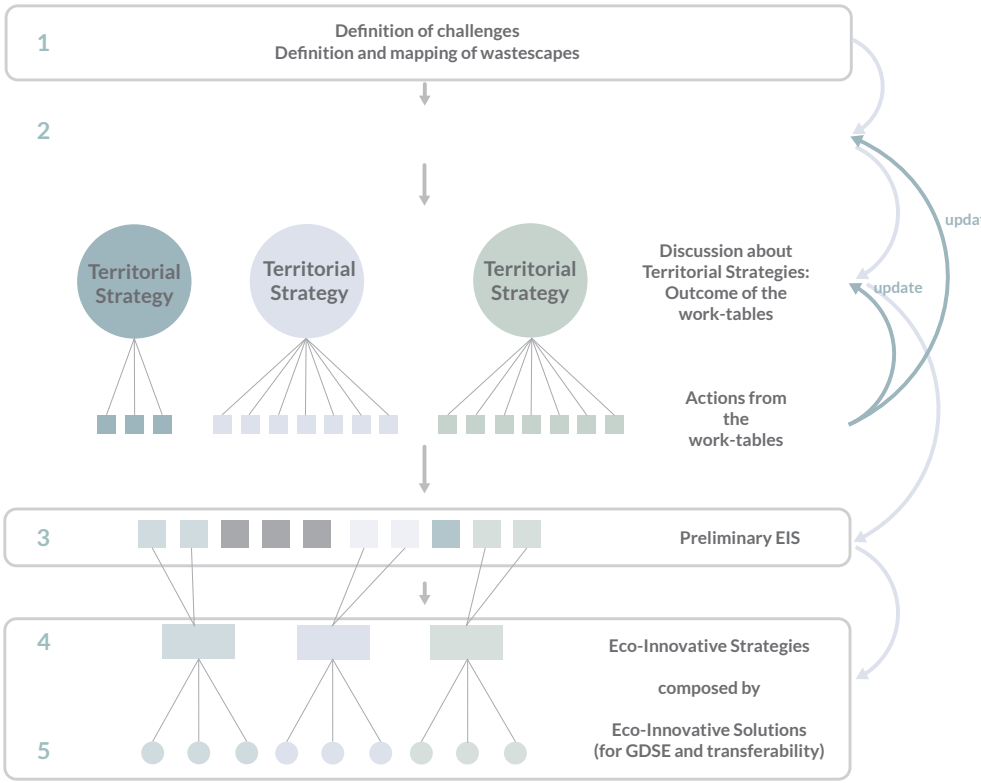


Fig. N.6. Methodology for defining the EIS in the case study of Naples. Source: REPAiR UNINA Team, 2018, Deliverable D5.3, p. 20. Graphyc adapted by V. Vittiglio.

mix of urban and peri-urban areas with different features, wastescapes, logistic hubs, industrial areas, large scale infrastructure networks. It is a challenging area due to its homogeneous geographic and landscape characteristics. It is possible to define the focus area by administrative boundaries that allow the possibility to collect the necessary data for developing eco-innovations. More specifically, the focus area is composed by 11 municipalities, namely Naples (areas of Ponticelli, Barra, San Giovanni a Teduccio), Casoria, Afragola, Acerra, Caivano, Casalnuovo, Crispano, Cardito, Frattaminore, Volla e Cercola. This study area is composed by a population of around half million inhabitants and it has an extension similar to the entire municipality of Naples (REPAiR 2018d; Formato, Attademo, and Amenta 2017; Rigillo et al. 2018).

The key problems discussed so far of the wastescapes in the MAN regards all sorts of wastes (e.g. construction and demolition waste, tyres, waste from electrical and electronic equipment, household waste, and so on) that are illegally dumped along the infrastructure axes and within certain abandoned areas. Furthermore, several confiscated assets (previously owned by criminality) are dotted around the territory, in a waiting condition towards new possible uses. Moreover, citizens feel unengaged with the territory. The latter appears in some cases to be peripheral and not properly managed from the local authorities. Some of the pathways are perceived as unsafe to be crossed on foot and therefore are in need to be rehabilitated for this purpose. A huge amount of construction and demolition waste (CDW) is produced in the focus area of the MAN, object of this study. Particularly, the realization of the new railway tracks and the High-Speed Train station of the city of Afragola generate them. In addition, citizens' mistrust on public institutions in the matter of waste management has a negative effect on the local situation of the MAN (REPAiR 2018b).

Together with the local stakeholders, and after the identification of the abovementioned challenges, a preliminary list of objectives was developed for overcoming this situation of wastefulness. Afterwards, a process of co-creation carried out within the territorial laboratory of Naples (REPAiR Peri-Urban Living Lab - PULL) produced three territorial strategies for solving the problems previously mentioned. Successively, identified territorial strategies were further elaborated within the laboratory, in collaboration with all the stakeholders, in order to develop Eco-Innovative Solutions for wastescapes, while always staying interconnected with a better management of the waste flows (Fig.N.6.) (REPAiR 2018b).

In several workshops of the PULL laboratory of Naples, the participants, with the help of the researchers — split in three worktables — developed three territorial strategies, starting from their own topics of interest. The first territorial strategy namely 'Homogeneous collection sites' aims to reduce/solve the illegal waste dumping and repurpose the confiscated assets by implementing new functions. This strategy combines the possibility to collect CDW in specific and designated sites, with the identification of further suitable areas to collect organic waste and to implement a 0-km composting activity (REPAiR 2018b).

The second territorial strategy namely 'The Green Mile' aims to involve citizens in the regeneration of existing cycle-pedestrian path along the provincial road, which connects

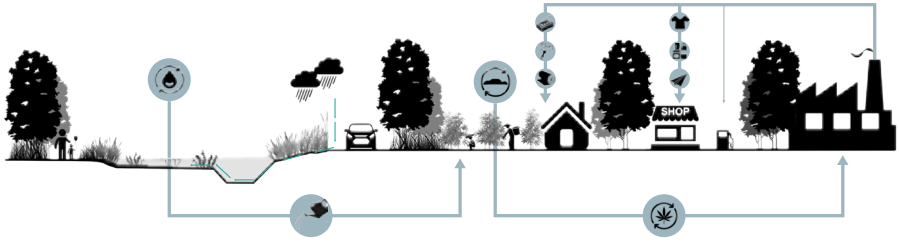


Fig. N.7. RECALL. Systemic section. The regeneration of polluted wastescapes by applying phyto-technologies Source: UNINA Team, 2018, Deliverable 5.3, p.44. Adapted by V. Vittiglio.

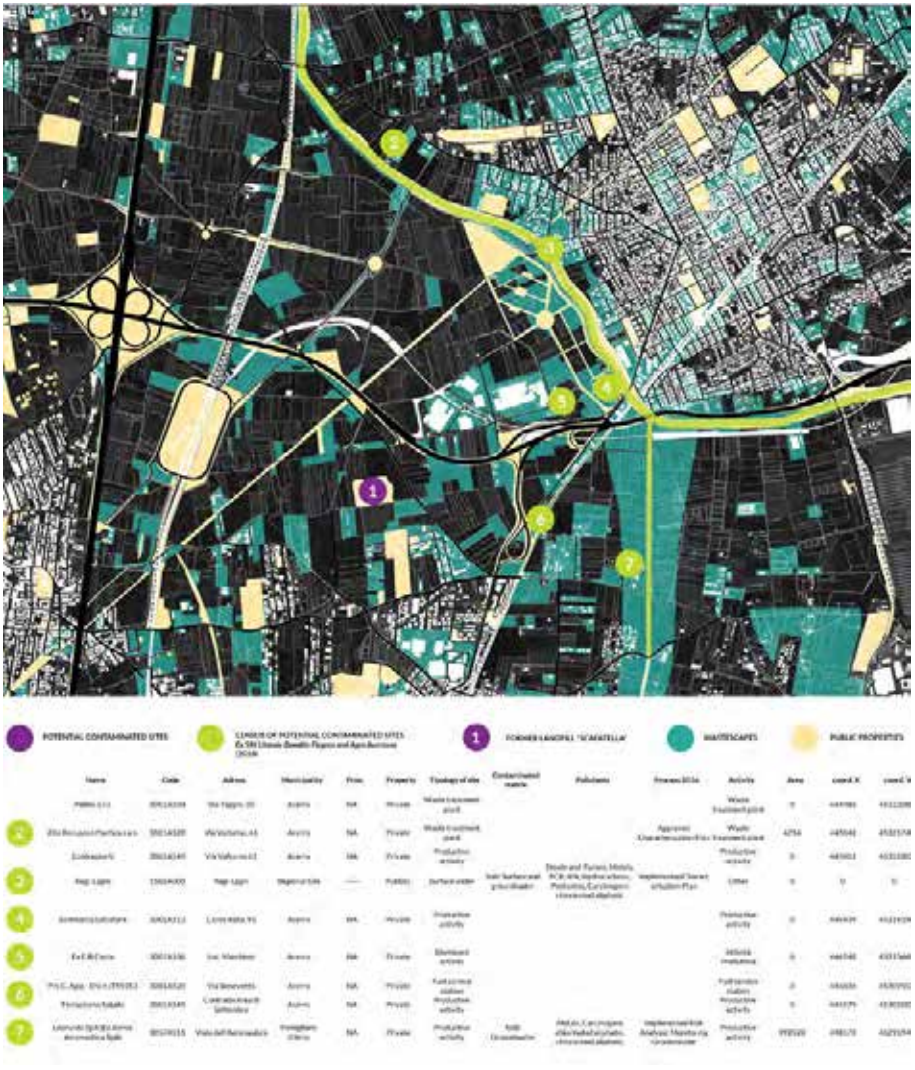


Fig. N.8. RECALL. Work- table New Land. Possible sites where to apply the solution. Source: UNINA Team, 2018, Deliverable 5.3, p.37.

the cities of Acerra and Pomigliano D'Arco for leisure activities and sustainable mobility. This is combined with the solutions to discourage citizens from depositing waste along the streets illegally. In addition, educational activities are promoted to increase awareness towards the recycling of CDW and organic waste (REPAiR 2018b).

The third territorial strategy namely 'New Lands' aims to reuse locally CDW and to regenerate the neglected productive area of the municipality of Acerra. To do so, the latter is ecologically restored. Moreover, a protected natural park is created, and afforestation along the main roads is provided. An experimental recycling point is designed in some wastescapes within the area to experiment circular and local recycling processes. More functions are provided in addition to the malls, by densification and regeneration of abandoned buildings (REPAiR 2018b).

The abovementioned territorial strategies are composed by several actions, which have been selected and grouped together, within the Naples PULL, to develop eventually four Eco-Innovative Solutions (EIS) for the main problems related to wastescapes, organic waste, and CDW. Specifically, the EIS are the following (REPAiR 2018b):

1. 'RECALL. REmediation by Cultivating Areas in Living Landscapes', aims to recover wastescapes and wastewater through the cultivation of local crops that helps to remove pollutants from the ground. This solution aims to create a circular economy and good jobs by engaging the local community (Fig. N.7, N.8, N.9, N.10).
2. 'Re-compost Land. Short supply chain of organic waste', has the goal to implement a short supply chain to recycle organic waste locally. Eventually, the compost produced will be used to reshape the landscape of wastescapes, e.g. along the buffer zones of the infrastructures, as well as to recover the agricultural fields.
3. 'Beyond INERTia. Circular supply chain for CDW waste', with the objective to improve the flow of inert waste.
4. CIRO. Integrated Center for Optimal Reuse of durable goods' has the purpose to prevent the illegal dumping of durable goods by implementing the possibility of up-cycling them.

These solutions have the general ambition to develop a new territorial green infrastructure where organic waste is recycled, water is purified, biodiversity is increased, and the fragmentation of peri-urban territory is minimized. New soils are produced thanks to the composting of organic waste, in combination with the reuse of inverts from the construction and demolition of waste cycles. They are utilized for reshaping of the wastescapes of the MAN's peri-urban areas (Fig. N.11 to N.16).

The regeneration of polluted wastescapes

The regeneration of polluted wastescapes can be carried out through the use of crops as bio-accumulator of heavy metals. As previously stated, an example of such eco-innovative solution for the polluted wastescapes in the Metropolitan Area of Naples

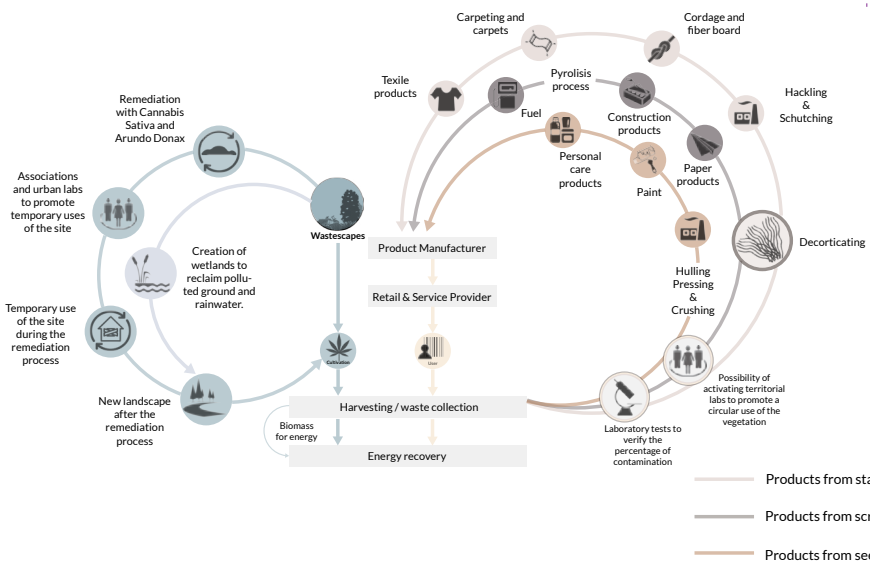


Fig. N.9. RECALL. Circular process scheme on the circularity of wastescapes during and after the remediation process Based on the graphic of Ellen MacArthur Foundation https://www.ellen-macarthurfoundation.org/ Source: UNINA Team, 2018, Deliverable 5.3, p. 44. Graphic adapted by V. Vittiglio.

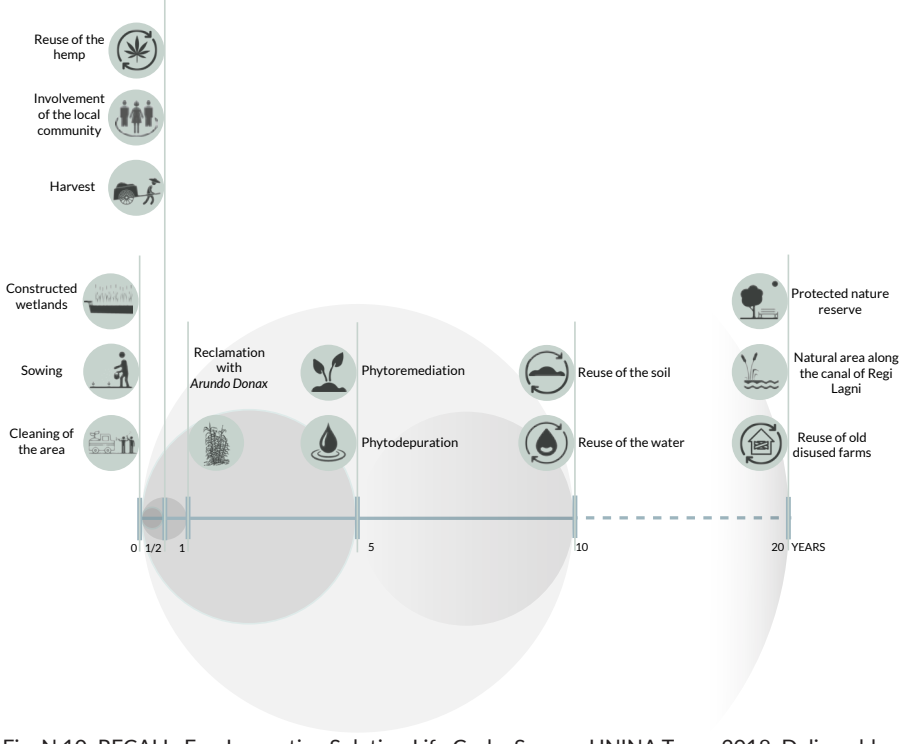


Fig. N.10. RECALL. Eco-Innovative Solution Life Cycle. Source: UNINA Team, 2018, Deliverable 5.3, p. 43. Graphic adapted by V. Vittiglio.

has been developed within the framework of the REPAiR project (REPAiR 2018b).[3] In wastescapes of the MAN, environmental and social decline, inaccessibility, and abandonment are interwoven (Fig. N.11 to N.16).

In this solution the Economic, Environmental, Technological, and Legal aspects of the PESTEL Analysis framework (Professional Academy 2017) have been tackled. From an economic point of view, this solution has the objective to promote new forms of circular economy for wastescapes, by restoring the former agricultural tradition of cultivating hemp in Campania. Moreover, this solution will improve the employment situation by involving the local community in the agricultural activities. Environmentally, it aims to activate reclamation of polluted soils and water by applying phytotechnologies, which envisage the use of crops to decontaminate soil from heavy metals.

Phytechnologies — together with phytoremediation and phytodepuration — are a valid and circular alternative to the usual remediation processes. This is true both in economic terms as well as for coping with environmental issues. These techniques have several outcomes. Firstly, they are able to purify the soil by heavy metals locally. Secondly, they generate biomass that can be used for different purposes. Thirdly, they create added values to ecological and landscape matrices with no harm to the environment.

The research demonstrates that flax, hemp, and cotton are suitable crops for the decontamination of industrial polluted soils (Angelova et al. 2004). However, among them, hemp is emerged as the most appropriate plant for the phytoremediation activities because it is capable to grow on contaminated sites, absorbing heavy metal such as lead, nickel, cadmium, zinc and chromium, as well as being used as a raw material for the production of natural fibers (Ahmad et al. 2016, 195). Moreover, hemp has an added value on the market, from an economic perspective, because many products can be created out of hemp that can be commercialized (Linger et al. 2002).

In addition, hemp cultivation seems particularly appropriate for the case study of the Metropolitan Area of Naples. In Campania and specifically in the provinces of Naples and Caserta, hemp cultivation was one of the principle agricultural activities until the late 90s. This agricultural activity was based strongly on the water network of the Regi Lagni that were heavily utilised and therefore polluted by these activities.

However, these kinds of techniques require a longer time period to decontaminate the site compared to the traditional reclamation processes. Indeed, there are many pros and cons of the use of Cannabis sativa (hemp); on the one hand studies show that the

3 This Eco-Innovative Solution is developed within the framewrok of the Horizon 2020 project REPAiR (Grant Agreement number 688920). Moreover, it is also part of the PhD Thesis of Valentina Vittiglio, which I am co-supervising together with professors Michelangelo Russo, Maria Cerreta, Massimo Fagnano, Enrico Formato University of Naples Federico II, and with professor Arjan van Timmeren at TU Delft. The abovementioned PhD Course is part of the program: "Dottorato in Architettura", 32° cycle financed within the framework "Programma Operativo Nazionale Ricerca e Innovazione 2014-2020 Fondo Sociale Europeo, Dottorati Innovativi con caratterizzazione industriale." Moreover, this solution has been the object of international Knowledge Transfer events within the REPAiR Peri-Urban Living Lab of Amsterdam, and it will be further developed in an international workshop that will be held in Brussels for the final conference of the European project Horizon 2020 UrbanWINS, for which I am part of the European Advisory Board.

phytoremediation of highly contaminated soils by hemp can be a very slow process; on the other hand, hemp is a very versatile crop, able to grow in different kind of soils and in different countries characterized by distinct climate (Citterio et al. 2003).
This solution has been applied as an experiment in the area located between the High Speed Railway Station (TAV) and the PIP (Plans for production settlements) zone across the canals of the Regi Lagni, in Acerra.
In addition, the solution regards the area related to the cycling and pedestrian route along the provincial road namely Pomigliano-Acerra (2,5 Km) and its contiguous spaces.
Several local actors could be involved for the development and the implementation of this solution. They are: Campania Region Authority, farmers, landowners, institutions, environmental organizations, enterprises, researchers, associations that are active in the territory (e.g. citizens' association namely: Donne 29 Agosto, Acerra).
Specifically, this solution, in coherence with the Ecoremed project (Ecoremed 2017), proposes the use of phytotechnologies to decontaminate the soil, by cultivating Cannabis Sativa (hemp) and Arundo Donax (cane). The latter are the crops selected for the implementation of this solution, in accordance with the decisions taken during the REPAiR Peri-Urban Living Lab of Naples. The cultivation of Cannabis Sativa is alternated with one of Arundo Donax, a perennial cane. In this way, the reclamation process can continue over time without interruptions.
During the phase of remediation, the site can be temporarily used. In the area, there could be implemented urban living labs, initiated or supported by local citizens' associations. This solution — in line with the Dutch project "De Ceuvel" (DeCeuvel 2018; Space&Matter 2019) includes the installation of a suspended pedestrian path that allows pedestrians to keep a safe distance from the polluted ground.
After harvesting the level of contamination should be tested in specific labs. In this way it would be possible to evaluate which parts of the hemp plant could be reused.
Specifically, from stalks, seeds, and leaves derive textiles, paper, construction materials, body care products, animal bedding, mulch and compost. The production of bio-based construction materials from hemp is a very interesting outcome of this solution (e.g. hempcrete). In this way it would be possible to eventually reduce the construction and demolition waste generated by the usual concrete-based materials used in the construction sites. However, this implementation is still to be tested because a winning business model for this kind of application is still to be developed.
In the long term this solution can be scaled up for the creation of wetlands, which will allow the overflow of the Regi Lagni Rivers, in case of heavy rains. This strategy could help to start a cleaning process for the polluted river water and rainwater. Later on, these clean waters could be re-used for irrigation or for recreational purposes.
The recycling of wastescapes through the cultivation of hemp for the remediation process is in line with a circular perspective. The reuse of land and the possibility of implementing local production supply chains are strictly connected.
This solution was conceived for the Metropolitan Area of Naples. However, it demonstrated to be adaptive to other contexts too. In particular, within a REPAiR workshop of the laboratory of Amsterdam this solution was applied in the context

of the Metropolitan Area of Amsterdam (AMA). Several areas were identified for its implementation such as the port areas, and the territories in the noise contour of Schiphol airport. However, to be adaptive to the AMA context several adjustments were proposed by the various stakeholders that were present at the workshop. The adaptation proposed was concerning mostly the provision of the combination of hemp cultivation with other uses of the soil such as recreation or energy production landscape (e.g. solar panels). In Amsterdam the possibility of utilising hemp cultivation to decontaminate polluted soils was explored together with the idea of utilising the fibres — after harvesting — for the production of bio-based construction materials (e.g. hempcrete that seem to have good insulating properties).

In need of widespread eco-innovations

The eco-innovations developed in the co-creation sessions within the Peri-Urban Living Lab of the Metropolitan Area of Naples (REPAiR 2018b) can represent valuable alternatives to the usual processes of urban and territorial regeneration carried out currently in the region. This method, involving several stakeholders, can indeed have positive impacts on the decision-making processes of the actors involved. The integrated recycle of material and territorial resources (Formato, Attademo, and Amenta 2017) can eventually lead to environmental, economic, and social benefits for citizens that can create new alliances with the local and regional institutions. Awareness campaigns associated with the eco-innovations proposed that they could ensure a long-term improvement of the waste cycle management. In this way, waste and wastescapes become the new resources and tools for the contemporary urban projects and processes.

Fig. N.11. Illegal deposit of waste in the infrastructures buffer zones in the MAN.

Fig. N.12. Agriculture in crisis. Naples Metropolitan Area.

Fig. N.13. Illegal deposit of waste along the streets. Naples Metropolitan Area.

Fig. N.14. Agriculture in crisis. Naples Metropolitan Area.

Fig. N.15. Agriculture in crisis. Naples Metropolitan Area.

Fig. N.16. Illegal deposit of waste. Naples Metropolitan Area.. Photo: courtesy of V. Vittiglio.

3. Developing eco-innovation in Living Labs

Peri-Urban Living Labs for the regeneration of wastescapes

Wastescapes are characterized by complex problems that require multidisciplinary, multiscale, and systemic approaches to be appropriately reinterpreted. Where vast wastescape areas are concentrated, the related territories are therefore fragmented from a spatial, social, and functional point of view. Environmental degradation also occurs in these areas. For example, industrial areas that are polluted, fenced, and/or abandoned; they are either in a condition of change, or under a transition process moving towards different configurations. In cases such as these, the traditional approaches to urban design and planning are not always effective, since generally they work in a sectorial way. They tend to not include all the stakeholder needs, and do not consider the perspectives of all the different disciplines. Therefore, territorial Living Labs (Steen and Bueren 2017; Leminen, Westerlund, and Nyström 2012; ENoLL 2016; REPAiR 2018c, 2017b; Cerreta, & Panaro, 2017), seem to be appropriate environments to solve these issues. Indeed, applying circularity in urban contexts requires a multidisciplinary approach, which can be implemented in Urban Living Labs environments (Fig. 3.1). These make it possible to tackle complex problems by answering to the needs of all the involved stakeholders. In Urban Living Labs, the processes of co-creation involves a wide range of stakeholders, which makes it easier to deal simultaneously with challenges related to environmental, economic, social, cultural, demographical, and complex metabolism changes (that generate wastescapes). It is for this reason that (Peri) Urban Living Lab environments make it possible to describe, map, and re-conceptualize wastescapes, all while making sure to include different stakeholders' perspectives.

Experimenting in Peri-Urban Living Labs means to implement a procedural and iterative approach, where processes of social interaction, decision-making, and the innovative project of the territory are interwoven. Therefore, a multiplicity of combined subjects is able to motivate participants to rethink these relationships. This collaboration occurs in co-creation sessions where members consider the specificity of the project of territory and landscape at the centre of the debate.

In this light, the necessary knowledge and specific data sets can be collected in Living Labs. The solutions eventually identified in Living Labs are generally place-specific. This is because they concern the context in which the lab operates, allowing the focus on potentials of places, rather than on problems. Moreover, insights on challenges and objectives for the interpretation of the case-study areas are collected during the consultation of different stakeholders. In addition, the process involved in Living Labs can be considered a transferable methodology for learning. It can also be used for producing innovation that can be adapted to further cases, through the identification of specific guidelines. Living Labs allow stakeholders to go beyond institutional lock-in situations — that means overcoming an institutional rigidity based on a path dependence (David 2007) — and instead ensuring a constructive dialog among the involved stakeholders.

This research therefore applies to a multidisciplinary and systemic approach to urban

Fig. 3.1. REPAiR Peri-Urban Living Lab. Amsterdam case study.

challenges. It allows stakeholders to holistically understand the complexity of problems in contemporary urban and peri-urban areas that are related to (spatial and material) resource scarcity. In this way, the foundation for this study recognizes that there no more exists a difference between the concepts of resource and waste, with the latter being "a resource to recycle, reuse, and recover raw materials" (EC Horizon 2020 2019). Therefore, waste is considered as the starting point for new and different life-cycles. In fact, any material, object, or even space is left discarded by a specific subject because it is not considered valuable anymore in that specific socio-economic context (e.g. because it is at the end of the planned life-cycle). However, they can still represent a resource and a value for somebody else, allowing for said waste to start a new virtuous life-cycle. Within this context, the act of recycling materials and spaces/land is highly valuable process. By modifying or by inverting the usual life-cycles as normally planned, it is possible to generate new economic, spatial, social, and environmental perspectives for the waste as the output of urban metabolism (Wolman 1965; Timmeren 2014; Ferrão and Fernandez 2013; Christopher Kennedy, Cuddihy, and Engel-Yan 2007; C. Kennedy, Pincetl, and Bunje 2011).

Therefore, the circular regeneration of wastescapes that are considered as "potential territories" (Russo 2018) is composed by different economic, spatial, and environmental aspects that should be taken into consideration. In particular, the recycling of wastescapes, which are too often overlooked and not valued by institutions and developers, could be seen as potential new public spaces. This allows us to reconsider them as new and valuable areas in the metropolitan territory for urban projects, while also preventing further soil consumption and the transformation of unbuilt and agricultural soil for urban purposes.

Furthermore, by implementing a Living Lab approach, the regeneration of wastescapes can cross over to different scales, from a large territorial vision, to a small scale/bottom up intervention. In fact, it has been proved that small scales public open spaces can also enhance the livability of certain regions, thus improving human health by providing restorative environments (Peschardt and Stigsdotter 2013).

In summary, the cure for abandoned, underused, vacant, polluted territories found in the global metropolis can apply in the recycling of wastescapes. Seeing them as territories of opportunities is a starting point to design more resilient and sustainable landscapes, from both a social and environmental perspective (Russo 2018). In this way, the pressure on the ecological equilibrium of our planet, and the consumption of virgin resources can be reduced to a minimum, stimulating the principle "doing more with less" (Russo 2016).

In Urban Living Labs, local authorities, citizens, and other relevant stakeholders can discuss and develop Eco-Innovative Solutions (EIS) for the management of waste and wastescapes in a collaborative environment . This happens more explicitly in the co-creation sessions of the Living Labs (Fig. 3.2), as the specific challenges related to waste flows and wastescapes are addressed in order for us to move towards circularity in our cities (REPAiR 2017b; Steen and Bueren 2017).

Generally, Living Labs (Mitchell 2003) are platforms that network together different

actors, stimulate communication with residents, and finally develop eco-innovative solutions with the involvement of everyone.

A Living Lab can be understood both as an environment (physical and/or virtual), or as a methodology for generating innovation (Ståhlbröst and Holst 2012). The latter has the potential to contribute to the innovation of both services and products (Core Labs 2007; Amenta and van Timmeren 2018).

The co-creation process developed within the Living Labs is an effective tool for the interpretation and design of wastescapes in contemporary cities. This is because it allows to address multiple problems from the different perspectives of the various stakeholders involved. Wastescapes are very often the result of a sectoral way of thinking about the structure of the territory. Therefore, in order to provide an effective recycling of wastescapes, it is necessary to involve not only urban planners and architects, but also public administrations and citizens. By doing so, it will be possible to generate integrated visions that were created with the involvement of different disciplines involved in the various work phases of the Living Lab. This allows for the creation of long-term (institutional) shared visions that are capable of modifying the unfunctional metabolisms that gave rise to wastescapes in the first place.

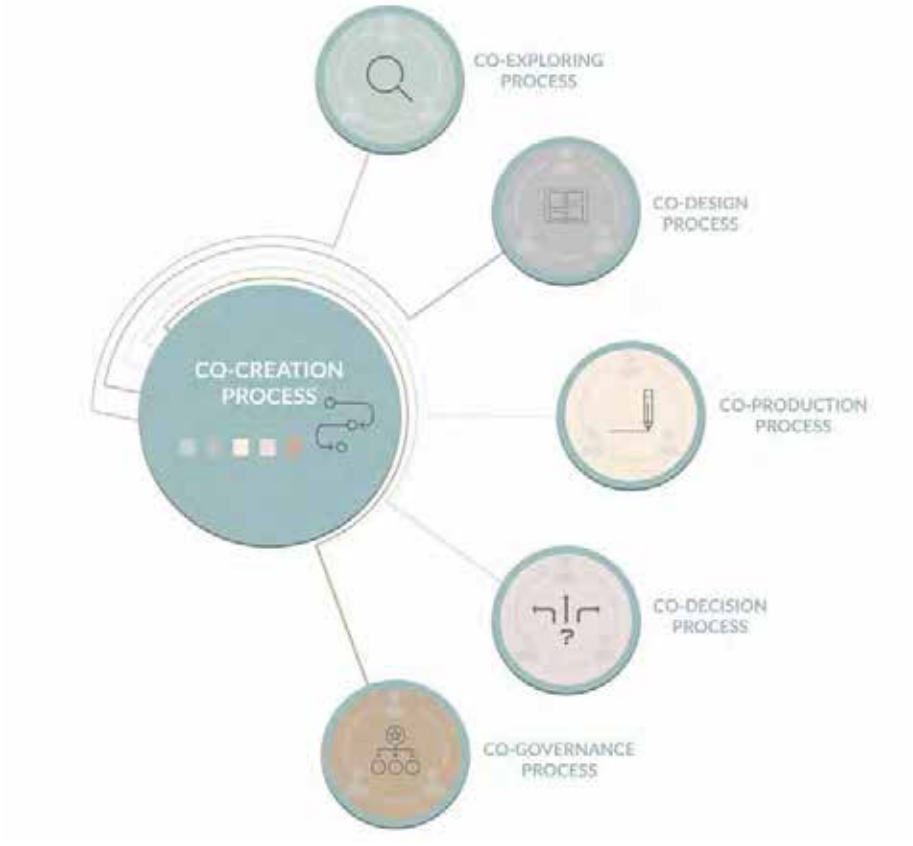


Fig. 3.2. Co-creation process within Urban Living Labs. Graphic made by V. Vittiglio.

The innovative aspect of this type of recycling project lies precisely in the approach of going beyond the sectoral organization of the territories, by tackling spatial problems together with social and environmental ones, while also paying attention to the landscape, its economies, and its ecologies. This is particularly true for the definition of EIS for peri-urban areas, as they are the most fragile territories because they are predominantly affected by waste flows and wastescapes.

The "operational infrastructure of waste" (REPAiR 2018d) includes the facilities used for waste management (e.g. incinerators, landfills, waste disposal/recycling plants, waste-water processing plants). Generally, these waste infrastructures mostly take shape in the peri-urban areas.

A series of co-creation sessions (in form of meetings or workshops) took place in two pilot Peri-Urban Living Labs (PULLs), where multiple eco-innovative solutions were jointly elaborated with all involved stakeholders. More specifically, Amsterdam and Naples were the guiding cases that defined Eco-Innovative Solutions (EIS) to help provide for a better management of waste and wastescapes. The partnerships implemented in these PULLs included representatives from both public and private sectors (e.g. government and industry), from academia (researchers as well as students), and even people from various civil societies (e.g citizens' associations) (REPAiR 2018c; Voytenko et al. 2016).

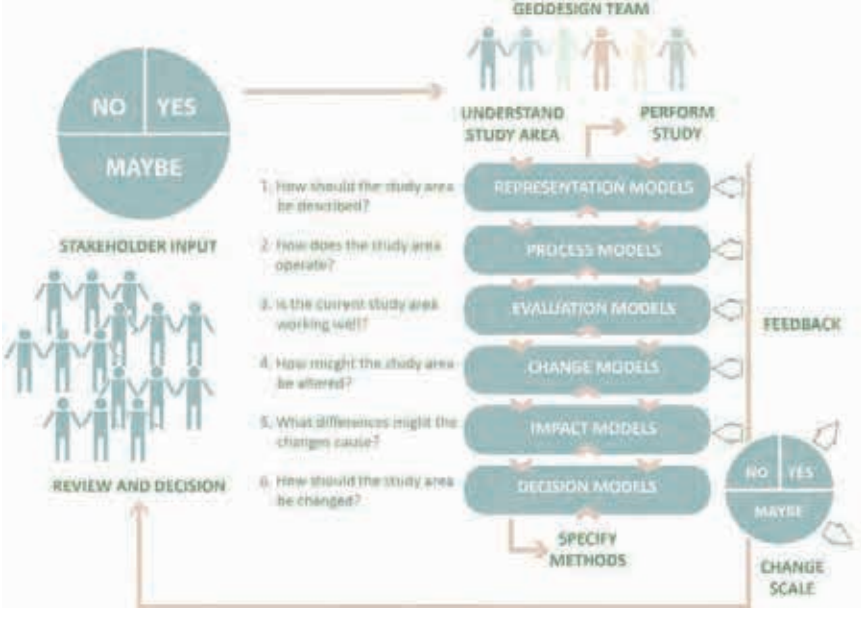


Fig. 3.3. The six questions and three iterations of Steinitz's geodesign framework. Source: REPAiR project proposal 2016, p.6. Graphic: Made by the author, and adapted by V. Vittiglio.

By involving all these types of stakeholders, this research applies a co-creation process within a total of six Peri-Urban Living Labs (PULLs) (REPAiR 2018c, 2017b), in order to develop multiple sets of EIS. The latter aims being to regenerate wastescapes, to reuse waste towards sustainable developments, and to face other challenges regarding the complexity of urban systems (Webb et al. 2018). Hence, the PULL methodology is comprised of five phases: co-exploring, co-design, co-production, co-decision, and co-governance.

In a later stage of the two pilot PULLs — in addition to the abovementioned PULL meetings and workshops — several design sessions with local experts on the topic took place, which even more deepened the EIS developed beforehand. These profound interactions made it possible to specify all the necessary technical details and other requirements (e.g. economic feasibility) that would help towards their possible implementation.

In summary, the project of recycling wastescapes can be tackled within the co-creation sessions of the (Peri) Urban Living Labs, which gains knowledge from the different points of view of the different disciplines that participate in them. The identified solutions and strategies must be adaptive, inclusive, flexible, and must operate at different scales. In this way, the regeneration of wastescapes does not only involve the environmental sphere, but also various cultural and economic dimensions of these places (Mang and Haggard 2016, 2).

Eco-innovative responses for recycling wastescapes

For the elaboration, testing, and implementation of eco-innovative solutions and strategies, it is necessary to collect a vast amount of data. They will better allow for the analysis of spatial and material flows, also including any study related to social aspects. It will also provide information necessary to define multiple local impacts of the imagined change models (Steinitz 2012), which is also in relation to the sustainability assessment of these models. The understanding of the study area follows an iterative process that crosses the representation, process, evaluation, change, impact, and decision models of Steinitz's geodesign framework (Fig. 3.3) by responding respectively to these questions (Steinitz 2012):

1. How should the study area be described?
2. How does the study area operate?
3. Is the current study area working well?
4. How might the study area be altered?
5. What differences might the change cause?
6. How should the study area be changed?

Using the Steinitz's framework allows for the designing of multiple Eco-Innovative Solutions that respond to specific local challenges. EIS can also be tested in real-life environments that involve urban designers, planners, policy-makers, and governance representatives, who work together in a cooperative and transparent decision-making planning process (EC 2016).

By looking at the abovementioned categorization of wastescapes, it is possible to identify different solutions and strategies for their circular recycling, determining the actors that should be involved in the process, and the basic and local resources to be utilised as bases for the implementation of eco-innovations.
According to the European Commission, an Eco-innovation is:

"Any innovation resulting in significant progress towards the goal of sustainable development, by reducing the impacts of our production modes on the environment, enhancing nature's resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources"(EC 2012).

This study comes in the wake of a similar approach, which involves understanding Eco-Innovative Solutions (EIS) for waste (scapes) as ways to modify citizens' behaviours related to resource consumption, waste production, and waste management:

"Eco-Innovative Solutions are creative and smart ideas aimed to innovate and improve a specific and fixed process that is in relation of the management of waste (scapes) as a resource" (REPAiR 2018c, 12).

Eco-innovative Solutions and strategies for recycling wastescapes are:

- **Adaptive.** The reuse of existing resources is interlinked with a possible reclamation process for polluted and environmentally compromised territories.
- **Flexible.** Time plays a crucial role in these kinds of recycling processes, making the identification of compatible uses possible in the meanwhile land is reclaimed; in this way avoiding long waits for the reuse of polluted land. These solutions are able to change along with changes in both existing situations and related challenges.
- **Valuable.** The recycling of wastescapes has an overarching symbolic value that extends well beyond the functional reuse of certain spaces, which can be perceived instead as places for new identities and a citizens' sense of belonging.

Different criteria should be specified for the definition of eco-innovative solutions and strategies, namely the involvement of stakeholders, the scales of application, goals, (reduced) impacts, etc. This can be done by following the so-called PESTEL analysis (Professional Academy 2017) Political/organisational (P), Economic (E), Social (S), Technical (T), Environmental (E), and Legal (L).
The recycling of wastescapes (Fig.3.4) can have positive impacts on various environmental

conditions, on health, safety, saving virgin resources from being overexploited (e.g., soil, construction materials, et cetera). Therefore, Eco-Innovative Solutions and strategies can be considered as potential drivers for a more sustainable and circular model of growth within (peri-)urban areas. By identifying Eco-Innovative Solutions and strategies for the recycling of wastescapes, it is possible to ensure value creation while meeting the stakeholders' needs. EIS, which are based on and inspired by nature, they can assure the design of resilient and sustainable settlements, while increasing individual and social well-being (Amenta and van Timmeren 2018). The Eco-Innovative Solutions and strategies identified within the PULLs aim to achieve more circular peri-urban areas through the designing of new products and services that can positively impact both the waste flows and the regeneration of wastescapes.

Solutions should be developed in collaboration with local communities, because learning and using their knowledge can help to develop a better project. This can be done through a regenerative design that uses the peculiar characteristics of a specific place and/or community as its starting point. By working in specific places, there is the possibility of understanding the opportunities that are intrinsic to that place, which could provide better solutions that are specific, rather than one that is generally applicable everywhere (Mang and Haggard 2016).

In summary, the most fragile areas of the peri-urban territories in the two case studies of Amsterdam and Naples are zones where waste management related challenges (at larger scales) and wastescapes are merging together.

The conceptualization of wastescapes was at first developed from the case study of Naples. This is a place where social problems are mixed with informal, and sometimes illegal activities that are related to waste management, which culminate in generating complex geographies of waste. These first analyses and researches have been successively transferred to the case study of Amsterdam, where they have been specified in a more comprehensive way. This process has been carried out in two Peri-Urban Living Labs (PULLs) (REPAiR 2018c, 2018b, 2017b), whose approaches can be transferable to other cases, even if it is subject to any necessary place-specific adaptations (Amenta and van Timmeren 2018).

Within the PULLs of Naples and Amsterdam, there are very particular wastescape variants that have been identified. They have been analyzed from a multi-scalar perspective, ranging from a large metropolitan scale, to a much smaller scale (even down to the building scale). The cooperation between authorities, citizens, and other stakeholders creates a multidisciplinary environment. This collaboration is secured within the environments of the Living Lab, whose sole purpose is to provide ways to shift from the current linear economic model to a circular one by considering resource scarcity and environmental problems as issues of primary importance.

Water treatment

Conservation of virgin resources

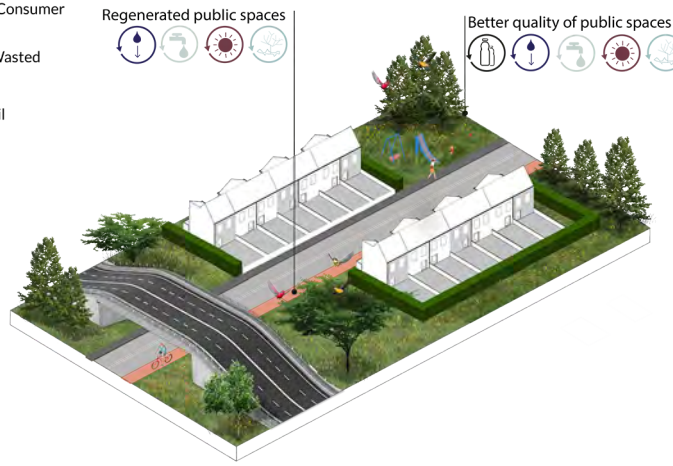
Recycling of Construction & Demolition Waste

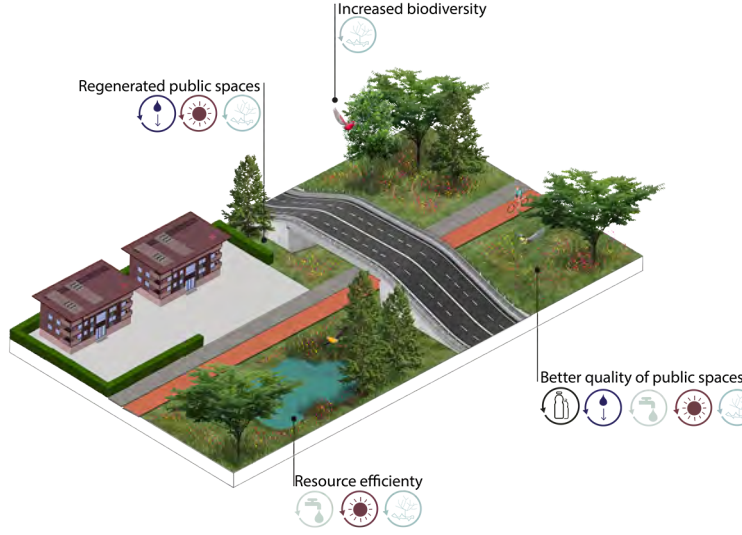
Recycling of Waste Electrical & Electronic Equipment

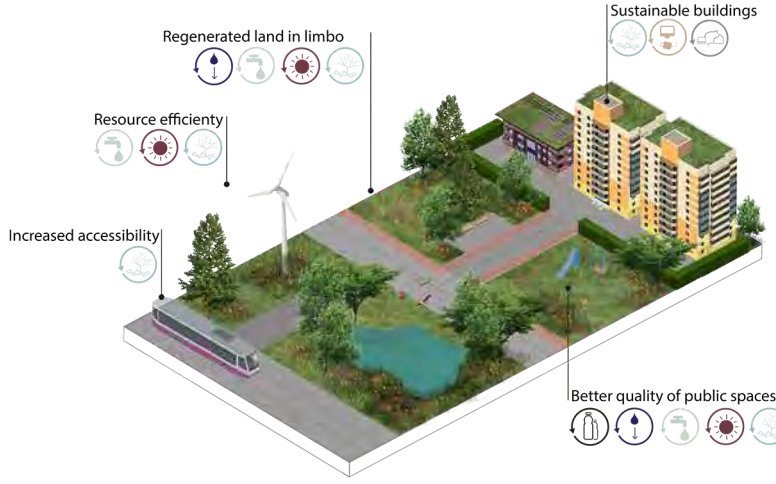
Recycling of Post Consumer Plastic Waste

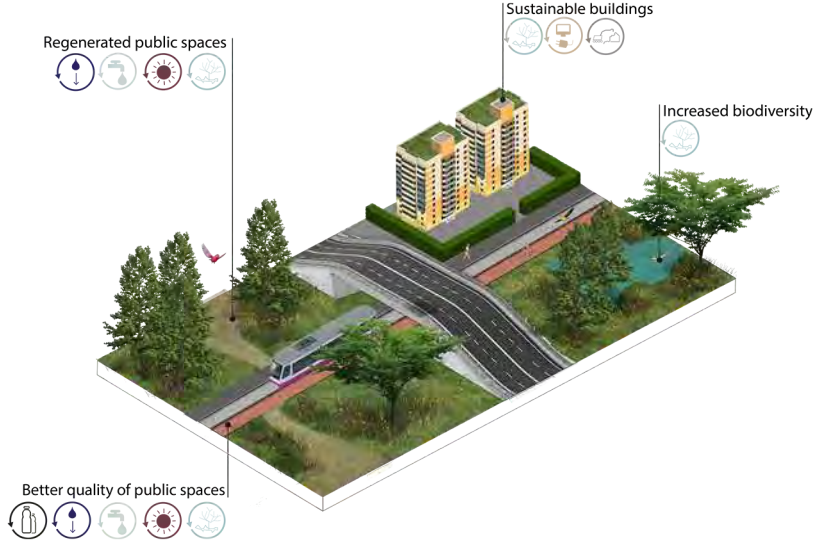
Regeneration of Wasted Landscapes

Reclamation of soil






Sustainable buildings
Regenerated land in limbo
Resource efficienty
Increased accessibility
Better quality of public spaces


Sustainable buildings
Regenerated public spaces
Increased biodiversity
Better quality of public spaces

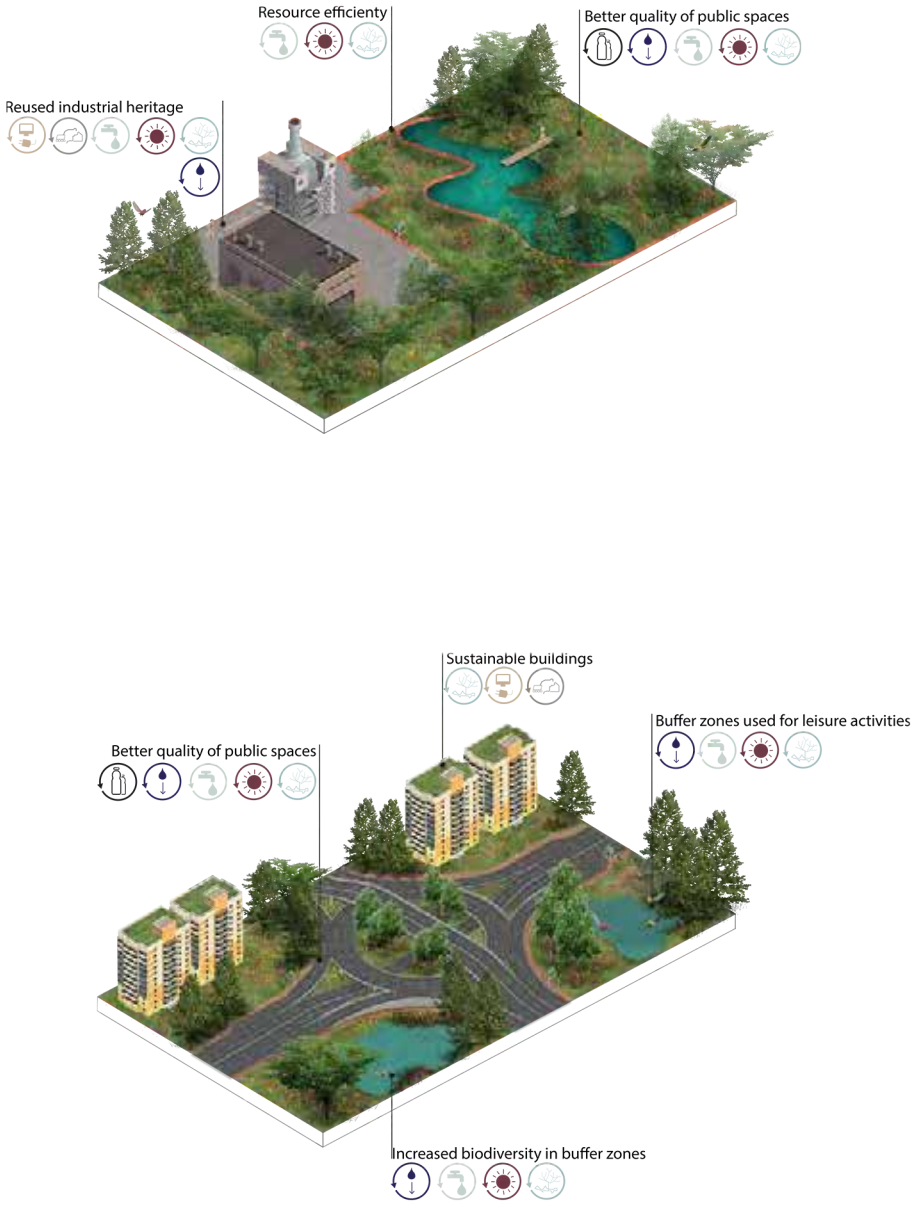
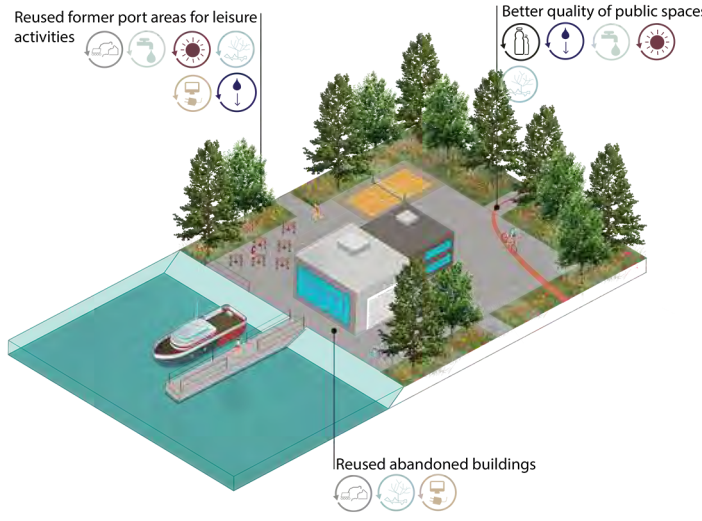
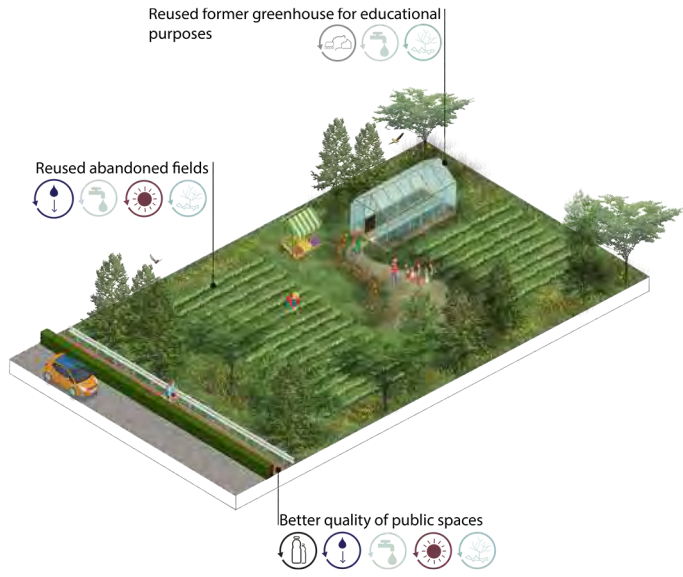


Fig. 3.4 (Current and previous pages) Regeneration of wastescapes. Graphics done by V. Vittiglio.


Reused former port areas for leisure activities
Better quality of public spaces
Reused abandoned buildings


Reused former greenhouse for educational purposes
Reused abandoned fields
Better quality of public spaces

AMSTERDAM | Wastescapes as opportunities

Setting the context: the Randstad Region

The Amsterdam Metropolitan Area (AMA) is located in the polycentric Randstad region. The latter includes four provinces in the western part of the Netherlands: Noord-Holland, Zuid-Holland, Utrecht and Flevoland. The Randstad can be defined as a polycentric metropolis with a very efficient infrastructure network, which creates good interconnections within the region. In this sense it cannot be considered as a single city or like a conglomeration around a single city. Conversely, it can be seen as a regional cluster composed by large and midsize cities (Huis van de Nederlandse Provincies 2016). It is a complex territory composed by various spatial, functional and administrative realities, which are all interconnected. The Randstad can be interpreted as a polycentric metropolitan system with strong urban cores. The Hague is the administrative district, Amsterdam is the business core, Rotterdam, due to its important port, is the industrial hub, and Utrecht is an important cultural location.

"Patterns of linkages and interdependencies between and among the cities, towns and villages of the Randstad area have correspondingly become more complex. As a result the Randstad has become a complex, multi-layered mosaic of places, markets and flows, rife with implicit and explicit intra-regional interdependencies and hierarchies and connected to the rest of the world in intricate ways" (Lambregts and Pimsuay Co. 2009, 30).

The Randstad conurbation is economically very strong. It is indeed the fourth largest economic urban region in the European Union (EU) after London, Paris, and Milan (Centraal Bureau voor de Statistiek 2008).
However, in the Randstad certain phenomena like urban dispersion and shrinkage contributed to the appearance of wastescapes in the urban and peri-urban areas. In the Randstad urban and non-urban realms have coalesced producing new kinds of "hybrid" types of landscapes that resist the existing characterization methods (Tisma et al. 2013). The Randstad has emerged as a continuous conurbation:

"The traditional compact city, surrounded by an empty hinterland, no longer exists, especially not in the Randstad. Traditional cities have merged into continuous urban agglomerations. We are witnessing the formation of metropolises, with growing contrasts between regions. […] The connections between urban green networks and peri-urban landscapes are often poor in quality and interrupted by infrastructural barriers. This should be dealt with more consistently, through law enforcement and measures to prevent a cluttered landscape" (Boelens 2011, 243).

The Randstad could be also described by using the term 'low-density carpet metropolis'. Willem-Jan Neutelings coined the latter in 1989 to describe and design the low-density southern periphery of The Hague. He exemplified that a large amount of new grey areas

was growing in between cities and they needed to be transformed from non-places into places. With his carpet each area can acquire a specific character and function (Neutelings 1990). The 'carpet metropolis' is an interesting model applicable also to other contemporary metropolitan areas, a way to go beyond the territorial fragmentation that characterizes a complex territory. With this concept Neutelings wanted to stress:

"The colorfulness, the fragmentation, and the potential of this stretches of porous urbanity" (Sijmons 2014, 188).

With the 'carpet metropolis' or the patchwork metropolis, Neutelings aimed to transform contemporary spatial chaos into a new and much more complex order that allows a greater richness of experiences. However, a planning vision needs to be reinterpreted, since it is shaped by a fragmentation that needs a new planning idea.
The Randstad is characterized by a ring structure, which defines its settlements; here the Green Heart is conceived as a green area protected by the law of urbanisation forces.
Randstad and Green Heart are two Dutch planning concepts developed within the national spatial planning and they are focused on urban concentration and preservation of green areas (Ministry of Infrastructure and the Environment 2012).
However, nowadays the Green Heart is becoming more and more urbanised and affected by the attack of suburbanisation of larger and smaller settlements and by development of the new infrastructures (Fazal, Geertman, and Toppen 2012, 116).
Consequently, we can state that there is a great pressure of urbanization on the rural areas of the Randstad. This fact has generated a peri-urban character in the continuous urban agglomeration of areas in between the denser cities.
Moreover, in the fragmented, complex, diverse/heterogeneous, and dispersed nature of the Randstad, environmental problems (e.g. soil pollution, air quality and noise level) have arisen. Here, agriculture strongly influences the structure of the territory. Indeed, in the Netherlands the agricultural sector is a superpower at an international level, therefore more agricultural land is requested than it was in the past. The entire agricultural sector contributes about 10% to the economy ("The Netherlands in 21 Infographics" 2014). Nevertheless, agriculture is responsible for the majority of greenhouse gas emissions and soil pollution.
In addition, improving accessibility is a current topic on the Dutch agenda. In fact, there are international, provincial and local policies for the transformation of infrastructural systems. Of course, the increase of motorised travel, for the transportation of people and goods leads to very serious environmental problems ("The Netherlands in 21 Infographics" 2014).

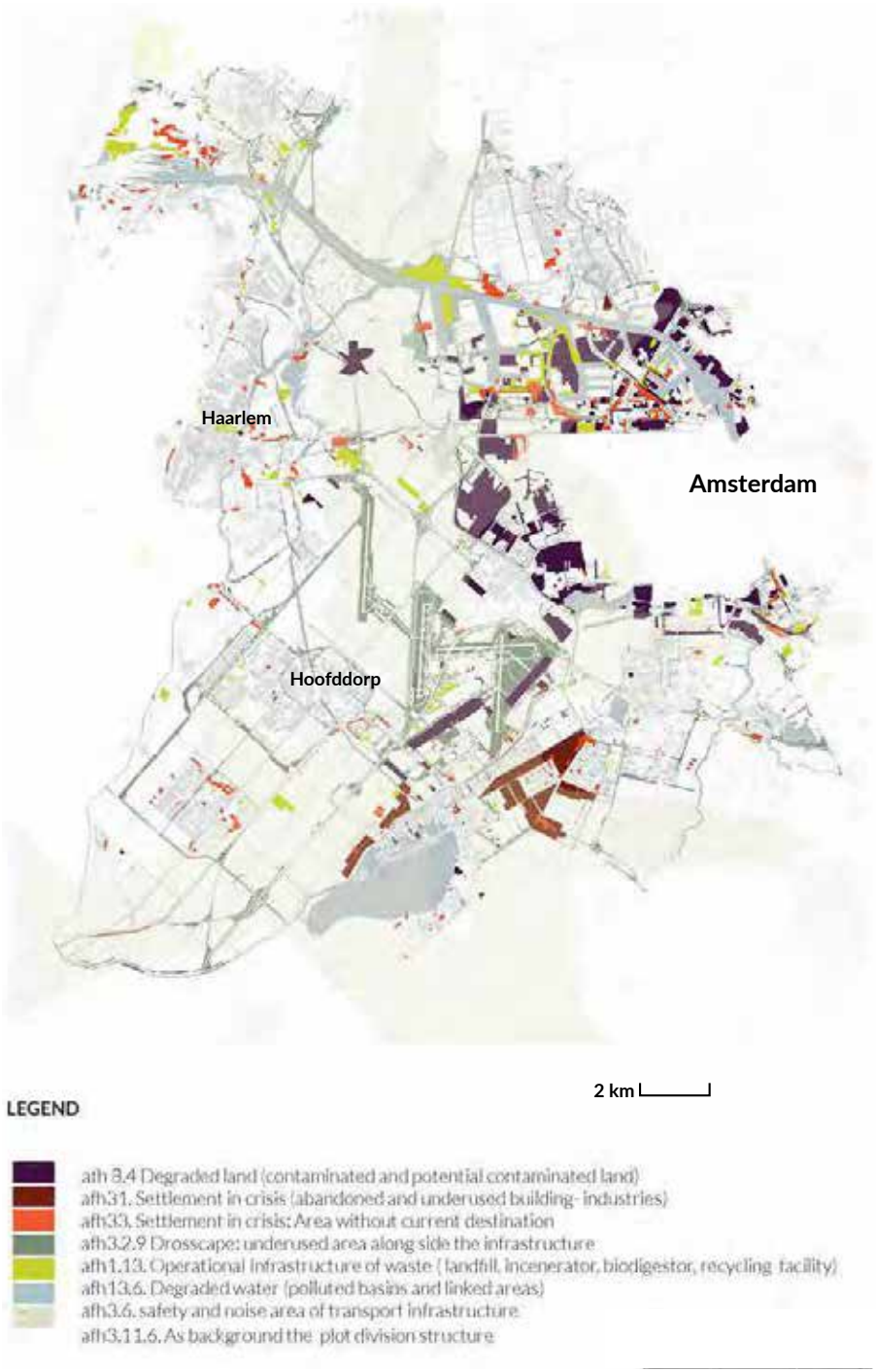


Fig. A.1. Amsterdam wastescapes map. Source: REPAiR Deliverable 3.3 'Process model for the two pilot cases", p. 57, Furlan C. et al., TUD REPAiR Team, UTJ_MapLab, 201. For further information visit: http://h2020repair.eu/case-studies/amsterdam-nl/.

Wastescapes in the Amsterdam Metropolitan Area

The Amsterdam Metropolitan Area (AMA) is located in the Northern part of the Randstad region, between the two provinces of North-Holland and Flevoland. It is a highly innovative region comprising the city of Amsterdam and other 32 municipalities. It includes the territory across the two provinces of Noord-Holland and Flevoland, with a population of 2,4 million inhabitants. The AMA is a highly innovative European region (Amsterdam Economic Board 2019) renowned for its high quality of life ensured by a large provision of various and attractive services, a trustworthy transportation network, and a diverse landscape including urban and rural characteristics (Gemeente Amsterdam 2016).

Although the AMA is a well-functioning region with good quality of life, several kinds of wastescapes can be identified in its urban and peri-urban areas. However, the classification of wastescapes in the Amsterdam Metropolitan Area (Amenta and van Timmeren 2018; REPAiR 2017c, 2017a, 2018d) (Fig. A.1, and Fig. A.8 to A.14)) pointed out the peri-urban territory as the most affected by this challenge. More specifically, the main areas typified by the higher presence of wastescapes are the Schiphol airport area, as well as the harbor. In the first case, many regulations are restricting the possibilities of redevelopment, because of construction restrictions due to noise and safety. In the case of the harbor, wastescapes are mostly polluted areas in need for reclamation and re-functionalising towards new uses. These petroleumscapes , defined also as post-oil landscapes (Hein 2013) constitute actual and possible future wastescapes, that could be transformed, in the very near future, through the implementation of Eco-innovative Solutions and Strategies (EIS).

Moreover, the buffer zones of the major infrastructures are underused and therefore not strongly functioning within the metabolism of the region as they could potentially do. In fact, large infrastructures are the major responsible of landscape fragmentation in the AMA, which is lowering the possibility of a reach biodiversity to take hold on these small territorial parcels. At the same time, in the infrastructures' buffer zones people's access is either prohibited by law, or unpleasant to take place. So, these areas are generally underused or just planned to require a low maintenance. In addition, in the AMA a large vacancy of office buildings, retail, and other enterprises can be identified (Fig. A.3). Therefore, the high presence of many wastescapes categories in the AMA creates a network of spaces in need for Eco-Innovative Solutions (EIS) and strategies for their regeneration (Fig. A.1 and A.2).

To be able to successfully implement EIS in this territory, a key topic regards the necessity to establish trust and collaboration among stakeholders. This is a necessary element for the regeneration of wastescapes. To do so, EIS can be improved thanks to the knowledge developed within the collaborative environments of the (Peri) Urban Living Labs involving all the interested public and private actors (Amenta and van Timmeren 2018; REPAiR 2017b, 2017a, 2018d; Steen and Bueren 2017).

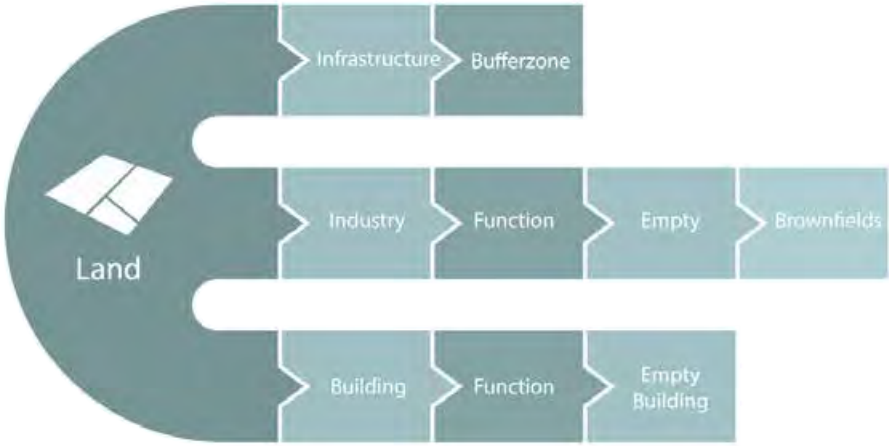


Fig. A.2. Linear flow of wastescapes. Graphic made by: Anubhuti Chandna, Danny Janse, Gwenhwyfar Spil, Jingxuan Xie, Osman Ural. Colors adapted by the author.

Fig. A.3. Vacant Spaces in the Amsterdam area, years 2014 – 2019. Source: City of Amsterdam (City of Amsterdam 2019).

Achieving circularity in the AMA

A circular and regenerative city is able to (re) produce locally renewable energies and goods, as well as all the resources necessary for its functioning, including land resources. By doing so, its own value is multiplied over time. However, a regenerative city cannot function completely autonomously. Conversely, it is connected to a wider resilient system at a territorial scale, in which the metabolic flows of energy, materials, and waste are organized in closed loops:

"Thinking in terms of flows will enable a good interaction between spatial policy and environmental policy" (IABR 2014, 121).

Achieving a circular economy is one of the more urgent goals of the central and local governments in the Netherlands. Many activities related to circularity are already taking place in the Netherlands. Indeed, an approximate number of 420,000 jobs are involved in circular activities. Circular activities and jobs account for 5% and 4% of the whole Dutch economy (PBL Planbureau voor de Leefomgeving 2018).
Among the several ongoing governmental initiatives, it is worth mentioning that in 2016, the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs, also on behalf of the Ministry of Foreign Affairs and the Ministry of the Interior and Kingdom Relations published a report titled "A Circular Economy in the Netherlands by 2050" (GovernmentNL 2016). In this report it is shown that — by 2050 — all use and reuse of resources, and the possible production of new raw materials should follow only sustainable paths. This will also reduce the harm done towards human health and the environment.
This is to say that, in the Netherlands, there is a wide application of the circular model, also in relation to the re-use of land as a resource. Specifically, in the case of Amsterdam, several strategies based on circularity principles are applied at different scales, already since several years. Some of these examples, very often based on a Living Lab approach, are listed below, and they concern the **metropolitan/regional scale**, the **neighborhood scale** and the **local scale (building or plot)**. This is to show that circularity principles are flexible and can be implemented in different contexts and scales.
At the **regional scale**, the vision and action agenda for the city and the metropolitan area of Amsterdam namely "Circular Amsterdam" (City of Amsterdam et al. 2016) underlines the importance of municipality's role and of the government's role to coordinate numerous initiatives that are already going on in the region. In order to scale up these bottom up initiatives, the government should bring parties together, facilitating the overcoming of possible barriers found for example in strict regulations. In the vision "Circular Amsterdam", a method has been developed called "The City Circle Scan" that addressed to decision makers, and aimed to implement a circular economy at the city and regional scale. This method intends to map material flows, in order to understand the current state of the principle material and energy flows in the region, considering

Fig. A.4, and A.5. De Ceuvel. Photo: courtesy of Lei Qu.

their environmental impacts. Moreover, it deepens the knowledge about the relevant chains where the most remarkable impacts of the application of circularity models can be reached. In addition, it provides a vision about the way in which the two identified chains — the construction chain and the organic residual stream — can function in the future, if they follow circularity principles (City of Amsterdam et al. 2016, 13). In this report, a spatial vision is included to show how circularity principles — that characterize an ideal construction and demolition chain, and an ideal circular future for the organic waste in Amsterdam — can be applied to the spatial structure of the region. By developing these visions spatially, firstly it is made possible to identify the locations on the map where to implement circular strategies, as spaces of opportunities. Secondly, the possible links among different strategies that are applied in the spatial context of Amsterdam are shown. Indeed, by spatializing the concepts of circularity, it becomes clear which could be the economic and environmental impacts of circular strategies' application on the territory.

At the **neighborhood scale**, former industrial areas and brownfields can be regenerated through strategies that focus mostly on the implementation of circular economy previsions. These strategies can also include the reuse of land, in combination with the temporary uses. This is the case of Circular Buiksloterham, an innovative Living Lab implemented in a unique neighborhood in Amsterdam, to develop solutions for a Circular, Smart, and Bio-based development (Amsterdam Smart City 2018). Here, bottom-up approaches are combined with traditional top-down planning strategies. Buiksloterham is a former polluted industrial area in the north of Amsterdam, now transformed into a lab where co-creation and co-design processes are experimented, in collaboration with the traditional stakeholders but in an innovative way. It is a large-scale redevelopment characterized by a mixed-use (Steen and Bueren 2017).

The main objective of the interested parties is to develop a sustainable district through a long-term transformation strategy. Certain loops of materials should be closed within the spatial borders of the neighborhood. Moreover, Buiksloterham aims to become an incentive to develop further initiatives in Amsterdam to achieve an actual transition towards circularity, with the use of bio-based materials to feed new urban flows (Metabolic, DELVA Landscape Architects, and Studioninedots 2015).

The stakeholders interested in the development of the area belong to two main categories. Some stakeholders represent the first category with site-specific interests (such as developers, owners, public and government agencies, etc.); the second one includes stakeholders with general interest (e.g. academic and educational institutions, visitors and tourists, etc.). Their aim is to achieve a circular and dynamic neighborhood, composed by residences, offices, and commercial areas, and based on social inclusiveness. A shared network will provide the connection between water, energy and resource flows in the whole area.

At the **local scale**, De Ceuvel is the example of a reclamation of a former brownfield by phytoremediation. Its transformation include the estabilishment of a sustainable urban development on a green site (Fig. A.4, A.5, A.6, A.7, A.8 and A.9). Today, De Ceuvel is a circular and sustainable workplace for creative and social enterprises located in the

Fig. A.6, and A.7. De Ceuvel. Photo: courtesy of Lei Qu.

north of Amsterdam, and a unique urban development in Europe (Steen and Bueren 2017; DeCeuvel 2018).

De Ceuvel's development story starts in 2012 when Space&matter, with a group of creatives, won the competition organised by the City of Amsterdam for the temporary use and regeneration of the contaminated site of the former Ceuvel Volharding shipping wharf.

The preconditions posed by the competition were to temporary occupy the area for ten years with the aim of decontaminating it. Once passed this period, the stakeholders involved were supposed to give back fertile soil to the City of Amsterdam. Following this municipal call for tenders, Space&Matter (Space&Matter 2019) proposed to turn the former industrial plot into a sustainable urban development. The objectives of their concept were twofold. On the one hand, it aimed to reclaim the heavily polluted soil by phytoremediation (through soil-cleaning plants). On the other hand, it aimed to revitalise the area through the creation of creative incubators, located in second-hand houseboats. These temporary structures have been placed around a winding bamboo walkway, that allows keeping a certain distance from the polluted soil. Each one of the upgraded boathouses was destined to become offices, ateliers, or workshops for creatives and social enterprises. The idea of the project was that, after ten years, the boats would be removed from the site without leaving any trace. The result would be valuable land that can be biologically diverse, and free from pollutants.

Flexibility and reuse were the starting point of this project. The latter combined in one unique strategy: the reuse of wastescapes and of waste materials to create something new, beautiful and valuable.

For the redevelopment of De Ceuvel, a systemic approach has been used. Particularly, the technical aspects of the regeneration and soil reclamation are combined with the social needs of liveability of the area. This has been achieved thanks to the cooperation of several stakeholders that through small-scale recovery measures can contribute to achieve a circular model of growth.

In sum, this project can be considered as a good example of a systemic approach that combines the techniques of soil reclamation with the prevision of compatible uses. In addition to that, a circular use of resources is central in this project, which focuses on closing the local cycles of energy and nutrients flows.

Moreover, time is an important factor that characterises this project. Indeed, the area is used while it is in progress through a phytoremediation process, in order to remove the pollutants from the ground. In addition, by revitalising the area, De Ceuvel has the potential to become a catalyst for stimulating further developments of this kind. In principle, it was developed as a demonstrative case for the implementation of a circular economy. Today, it is still a great example of integration of soil reclamation and compatible uses for wastescapes. Currently, De Ceuvel is a former wastescape, located in a strategic position nearby the central station of Amsterdam, in the northern bench of the IJ River, reachable by a free ferry. Because of its location, it can represent one example of an advantageous area to be modified in terms of optimal use of resources.

However, even if many activities are involved in circularity, most of these innovative

initiatives are focused mainly on recycling (in relation with waste management), rather than on rethink, reuse, repair (PBL Planbureau voor de Leefomgeving 2018). This shows that a desirable future where the preconditions are the circularity principles is still to be achieved and much more needs to be done.

The AMA Peri-Urban Living Lab

In the case of Amsterdam private investors together with representatives of the government and policy makers work together with businesses to pursue the objectives of achieving a more circular economy. They can do so in Urban Living Labs too, where the circular strategies can be developed in co-creation sessions together with all the stakeholders.
A practical implementation of a Peri-Urban Living Lab (PULL) to develop Eco-Innovative Solutions and Strategies (EIS) in the Metropolitan Area of Amsterdam (AMA) has been

Fig. A.7. REPAiR AMA Peri-Urban Living Lab

pursued within the framework of the REPAiR project (Fig.A.7).
Precisely, the members of the PULL workshops — aimed to develop EIS towards circularity in the AMA — included researchers, students, local government representatives, policy makers, and local business representatives actors (Amenta and van Timmeren 2018; REPAiR 2017b, 2017a, 2018d).
The work carried out in the AMA PULL focused mostly on objectives related to wastescapes, food waste, and construction and demolition waste. The EIS developed in the AMA PULL for the regeneration of wastescapes focuses for example on the regeneration of polluted land so called brownfields (e.g. soil reclamation through hemp cultivation for producing building materials). EIS also regard other kind of wastescapes that are vacant, neglected, or underused (e.g. transformation of vacant offices for affordable housing).
Among the EIS developed in the AMA Pull (REPAiR 2018a) regarding the regeneration of wastescapes, it is worth to mention two solutions related respectively to the reuse of green buffer zones as biodiversity reserves, and as zones for leisure activities.
More specifically, the first one entitled "Transformation of wastescapes into stepping stones for biodiversity" (REPAiR 2018a, 83) focuses on the green buffer areas along the roads and railway lines. These strips or fragments of lands lay normally underused, even if they embed a great potential of providing ecosystem services for ecological resilience to the region. This solution foresees the possibility to increase the biodiversity in these fragmented green areas and to reconnect them in a larger ecological corridor, in connection with the already existing green corridors.
The second solution, namely "Transformation of green buffer zones into areas for leisure activities" (REPAiR 2018a, 91) in combination with the previous EIS, is about the regeneration of the territories around airports, railways and highways. Normally, in the Netherlands, these areas are protected by law, and are a result of being under programmed. However, this EIS could foresee alternative and temporary uses for infrastructures' buffer zones for leisure activities and temporary places to be. Cycle-pedestrian paths could be also arranged in such buffer zones in order to reconnect with the residential areas of neighboring towns and villages.
These abovementioned solutions have shown a potential to be transferred, with some adaptation to the local context of destination, also to the case of Naples. One specific work session of the Naples PULL was dedicated to the exercise of transferring some of the solutions found for the AMA, and was applied to the Neapolitan local context. This achieved a good result by establishing solutions that are both mostly transferable, and of great interest to the local stakeholders.

Fig. A.8. De Ceuvel, Amsterdam.

Fig. A.9. De Ceuvel, Amsterdam.

Fig. A.10. Crane Hotel, Amsterdam. Photo: courtesy of Lei Qu.

Fig. A.11. Crane Hotel, Amsterdam. Photo: courtesy of Lei Qu.

Fig. A.12. Underused fields and industrial areas. Amsterdam Metropolitan Area.

Fig. A.13. Underused fields and industrial areas. Amsterdam Metropolitan Area.

Fig. A.14. Industrial areas. Amsterdam Metropolitan Area.

4. The next steps towards circularity. Scaling up from materials to territory

Towards a spatial dimension of circularity

Although many efforts so far have been made by local and central governments towards the definition of more sustainable use of resources, the current global economies of today are still based on linear and inefficient use of resources. The consequence of this situation is a significant amount of waste production and a potentially unstable future (Ellen MacArthur Foundation, 2015a). Consequently, in the coming years, many cities may encounter problems related to the provision of supplies. Indeed, there are only a few countries of the world that can solely rely on the possession of large quantities of natural deposits. Clearly, most other countries are constrained to import resources from abroad, such as petroleum, natural gas, and raw materials (Ellen MacArthur Foundation 2015b). This could lead to supply risks for raw materials and competitiveness risks related to high energy costs.

Today, public health issues and other environmental threats are unequally distributed in our territory, more specifically concentrated in the treatment of wastescapes. Wastescapes are the outcome of linear metabolism, unsustainable resource consumption, abandonment and vacancies, as well as depletion of fertile soils caused the rapid processes of urbanization. They can appear in the form of unused, abandoned, polluted, or (socially) problematic areas.

In this respect, the case study of Naples was crucial to develop a complete understanding of wastescapes as a problem. A new taxonomy of wastescapes was defined, and solutions were identified to both face the problem of wastescapes, and to improve the management of waste itself.

Beyond the conventional classification of waste provided within

the European Waste Framework Directive (EC 2008), adding a specific focus on wastescapes means to understand them as opportunities for sustainable urban and territorial regeneration. Indeed, current and future wastescapes can be redesigned in a circular manner, and therefore avoiding further soil consumption. Soil — a non-renewable resource — is understood as the starting point for such transformations. Soil's natural regeneration takes a very long time to be achieved. Therefore, it emerges as a very important aspect regarding the spatial dimension of circularity, which focuses on soil resources beyond the mere consideration of material resources. Different times and conditions of soil renovation and consumption are generated due to the fast development of urban plans and projects, which are considered in this approach. This makes clear the understanding of wastescapes as resources that could help implement the closed loops needed in a circular economy (European Commission, 2014; Ellen MacArthur Foundation, 2015; Lacy, Rutqvist, 2015; European Environment Agency, 2016).

In the context of an increasing urgency to enhance the sustainability and livability of our cities, the current model of linear growth, which is based on the consumption of virgin resources and fertile soils, is considered unsustainable. Therefore, there is the need for a different form of growth (Russo 2014) that — by limiting the pressure on natural resources — will contribute to the shift towards an ameliorated urban and environmental quality.

In fact, current linear growth is leading to substantial losses and wastes that are difficult to manage. Moreover, ecosystems are saturated by waste and pollution, and they are unable to naturally process and 'digest' them in the usual metabolisms.

The transition to achieve a more efficient and circular resource use (EC 2011) can also be accomplished through the implementation of programs and policies that are aimed to prevent waste, which, as a result, will bring important environmental and socio-

economic benefits (European Environment Agency, 2015). The result confirms that globally, the circular economy model will cause an appraisal of waste by providing an intrinsic value for new productive cycles, while avoiding any losses in value. In addition, a circular model can contribute to the stability and economic growth, of metropolitan systems that can finally depend on local resources to function, thus reducing the necessity of importing goods. Circular economy is understood as new planning instrument that needs to be implemented in the long term. By doing so, the maintenance and reuse of products and materials will keep/increase their value over time (Zanotto and Amenta 2017).

This is in spite to the fact that, in the last few years, research have developed more than one hundred definitions of circular economy. However, they do not always reflect the need to adopt a systemic shift for a sustainable future for future generations that is not only based on environmental equity, but on social equity as well (Kirchherr, Reike, and M. Hekkert 2017; Balanay and Halog 2016). Utilising an ecological perspective is an effective way to face the fragility of our territories (Pasqui 2017). By looking through this mindset, the presence of public open and green spaces is a necessary precondition for designing healthy cities. This is also effective from other different perspectives, such as environmental, social, and accessibility. Therefore, recycling wastescapes for healthy cities can contribute to the improvement of the quality of life, especially in contexts of poverty. In addition to the economic aspect, poverty is also understood in a wider sense, which includes the lack of accessibility to spatial capital. It can be also related to social, cultural, professional, and political deprivation (Bernardo Secchi 2013, 16).

The reuse of wastescapes is therefore pursued in light of an opportunity for sustainable urban and territorial regeneration (Amenta and van Timmeren 2018; Amenta 2015; Amenta and Attademo 2016; REPAiR 2018d), which should provide the necessary flexibility to be adaptive to multiple uses over time.

In this sense, waste and wastescapes are the new raw materials for urban regeneration, which could have an unprecedent value for new production cycles. These are potential places where the use and reuse of resources can be optimized as much as possible, according to the logic of urban circular metabolisms (Herbert Girardet 2000; Amenta and Attademo 2016).

"There can be no transition to renewable energy, no resilient ecosystem, and no caring and solidary living environment without the actual transformation of our urban landscapes" **(Alkemade, Broeck, Decklerck, Brugmans, 2017).**

The integrated, systemic, and sustainable regenerations of wastescapes can be developed in co-creation sessions within (Peri)Urban Living Labs. In these contexts, change models towards circularity can be co-designed by handling together the implementation of technological and engineering solutions with economic, political, and administrative innovations. This facilitates the involvement of all stakeholders (Steen and Bueren 2017; REPAiR 2017b, 2018c) who want to participate in the transition towards circularity, and also helps the city to be flexible and adaptive to further and unforeseen changes.

Applying these principles to the city means affecting their flows of materials, water, energy, and eventually waste. These flows constitute towards urban metabolism by both reducing them and closing their loops through the reuse of local (material and immaterial) resources as inputs. To achieve these goals, it is necessary to implement a paradigm shift by widely applying these principles of circularity worldwide. This could question – and eventually change - the current economic model of linear growth by triggering a transition towards a circular system; overcoming the gap between research for innovation and its effective implementation (Zanotto and Amenta 2017; Alkemade et al. 2017). However, this transition towards a circular city can be critical, since the shift will require a collective effort to rethink about the whole body of policies and regulations, as well as

about the practices and the small-scale interventions that aims to both reduce resource consumption and the consequent harm on the environment in order to improve the citizens' well-being. To achieve a more circular economy, eco-innovations are needed, especially in relation to the reduction of resource extraction and mineral mining. In addition to this, the elaboration of eco-innovative strategies and solutions (REPAiR 2018b) that can enable the prevention and management of waste generated in the production processes are needed, as well as the stimulation of re-use and re-cycling activities (Zanotto and Amenta 2017). Subsequently, the importance of stocks emerges, underlining the necessity of a better use of what we currently have (Circle Economy 2019). The development of systemic, circular, flexible, and adaptive Eco-Innovative Solutions and Strategies can help create an effective shift towards a circular model of growth. In a circular city, there is no waste and everything is upcycled. Discarded land and materials become, in this way, the new resources for healthier metabolisms.

In the case of Amsterdam, many initiatives are already in the process of tackling circular economy principles, which also involve the regeneration of wastescapes. However, many examples such as these are merely focusing on recycling, meaning that their interventions are too late as waste has been already produced. In other words, we are still dealing with waste management, but it is not yet done with a completely circular approach.

To conclude, a perspective that considers the spatial dimension of circularity, including the regeneration of wastescapes, seems to be a winning perspective. This is because it can both contribute and achieve, in a relatively short time, an intelligent use of resources for a more desirable future. In summary, Eco-Innovative Strategies for achieving circular cities regard the design of systemic changes by having an integrated and multidisciplinary approach. Moreover, they can contribute to improve the quality of life, while also addressing simultaneously the issues related to economic spatial and social capitals.

Afterword

Planning for the circular city

by Enrico Formato

I. Territory as a new resource stock

This work primarily focuses on how the new challenges regarding circular economy can be applied to the territory, while also understanding the changes that will be needed in order to modify the regulations and methods of urban planning.

It is well known that the origins of modern urban planning can be traced back to the nineteenth century, and was born out of necessity in order to face the new dimensions, scales, and densities of the industrial cities, as well as to cope with the new needs created by the growth of the urban middle class (Benevolo, 1963; Aymonino, 1964).

The majority of twentieth-century urban planning history can be read through the same interpretative lens: the pursuit for new solutions and models that can handle urban growth and the formation of settlements at the metropolitan scale (Torres, 2004). This process of urban expansion developed in a linear way that meets the demands of population growth and the increase of production. However, this process eventually stopped in the second half of the last century and did so for several reasons. Nevertheless, many contexts and cities continued to expand, but did so without any real productive development or increase in demographic growth. This happened because these urbanizations were based on the Keynesian economic model, and were utilized to help their respective economies in times of crisis. Processes that cause urbanization require a high consumption of local resources — both physical and financial — that were taken away from potential agricultural cycles or technological innovations.

Moreover, these processes also transformed the property market into a derivative of the financial market. This resulted in the creation of 'speculative bubbles,' which is a phenomena that started at the beginning of the nineties , with each new bubble becoming increasingly tragic.

In countries such as Italy (but also in Belgium or Spain), the system that both eroded their territories and use them as new resource stock for boosting economic development, started to show a plethora of striking characteristics. This treatment of their territories literally transformed them into consumable products. It is because of this that income regarding this type of development is much higher when compared to one that could be obtained by other capitalist approaches, such as investing in the manufacturing and/or tertiary sectors (Benevolo, 2012; Lanzani, 2014).

From the point of view of urban planning, land reparcelling was missing. Therefore, urbanizations started to rely on a fragmented cadastral microstructure, whose forms generally coincide with preexisting agricultural structures. Thus, the extension of settlements became spread out, acting like a parasite that feeds off of historical and environmental resources (Boeri, Lanzani and Marini, 1993; Choay, 1992; Indovina, 2009). One example of these phenomena can be seen in the way that historical settlements

eventually became the urban cores of our contemporary cities (Belli, Formato, 2015).
In other countries such as the Netherlands, France, Great Britain, and Germany, the state managed a much more appropriate urbanization process when compared to Italy. This is mainly because that the provision of developments occurs on a preventive basis. This approach to urban planning was able to rationally address the expansion process of their cities. These cities mainly followed a polycentric model, and can be derived from the Greater London Plan, which was developed by Patrick Abercrombie (1944).
Furthermore, the new expansion of neighborhoods found a unitary structure, which had all been priorly obtained through the land consolidation of sites that were previously destined for expansion.
The case studies presented in this volume - Amsterdam and Naples - give a full account of this polarization in development, whose effects both increased the diseconomies of scale in regard to production, and degraded the state of the environment (including our contemporary landscapes) are today dramatically evident. However, the most radical changes can be experienced more specifically in the weakest and most distressed territorial contexts. Therefore, a functional and efficient system undoubtedly offers a greater obduracy to change.
In the Campania plain of Italy, for example, the urbanization support structures of today — in particular those linked to the waste cycle or the purification of urban and industrial wastewater — present a much lower level of efficiency, when compared to the urban region of Amsterdam. However, in the context of Amsterdam, since these processes are characterized by a low problematic nature, the city shows resistance to innovations that are aimed at increasing their environmental sustainability.
In Amsterdam, for example, the great efficiency regarding their waste-to-energy cycle has enabled the inceneration of a large portion of organic waste that has been produced by homes for decades. In comparison, the organic fraction of domestic waste in Naples is now completely treated in composting plants, which follows a completely irrational cycle that involves transporting it outside the region. The solution to this problem could generate an innovative response, which could potentially be more sustainable from an environmental point of view, even more than the one that is currently operating in Amsterdam today. This idea could involve the equipping of settlements with treatment plants, and even the recycling of urban waste at the neighbourhood scale.

II. Peri-urban areas as a secondary resource stock

Since the 1970s, while cities continued to grow outside their boundaries by consuming non-reproducible resources (soil, water, rural and natural landscapes), some urbanized areas between the city center and the expanding suburbs began to shrink in regards to inhabitants, functions, and economic activities (Beauregard, 2006). Thus, these areas, defined as peri-urban or fringe areas, have been losing both their vitality and local identity. At the same time, they have been gradually taking on the typical characteristics of "transition areas", which are generally found between the center (or centers) and outer edges of cities. These peri-urban areas are generally crossed by large infrastructures

(roads, railways, plants, et cetera) and by large flows (of commuters, energy, goods, et cetera).
The consequence of these characteristics is that today, while the edges of external urbanities are generally characterized by a uniformly distributed low density and high mono-functionality, the properly peri-urban fabrics are distinguished by variable densities made up of discontinuously placed functions, which can sometimes be inconsistent. Moreover, these places are also marked by the presence of both functional 'folds' and high population densities. They are also combined with 'tears', which are constituted by absence, inactivity, and waiting conditions.
In general, the topological condition of per-urban areas is discontinuous, and the relationships between its elements and parts are based on the connections of driveways. These are shaped according to routes and are not really connected with the adjacent territory (for example: highways). These fringe areas have great potential for transformation, both in their character of contiguity to the urban center, and for the presence of (underused and/or vacant) wastescapes (Bergevoet, van Tujil, 2016; Attademo, Formato, 2018).

The **first condition** regarding wastescapes in peri-urban areas requires a margin of contact between the center and the outer periphery, making it possible to think of the reactivation of the peri-urban areas through a device capable of transforming the flows moving through the territory and into valuable energy. The connotation extracted out of metaphor means trying to put into place systemic innovations that are aimed at closing loops of the metabolic processes at a local scale. This can be achieved using waste, residues, and secondary raw materials as basic materials for their new reactivation processes.
The **second condition** that makes it interesting to work wastescapes in peri-urban areas is linked to their particular fragmented and hybrid spatial condition. Peri-urban areas are dotted with unused and underused spaces that are marked by conditions of high vulnerability, both from a social point of view, and from a natural risk perspective. These spaces, namely wastescapes (Amenta, van Timmeren 2018; Amenta, Attademo, 2016; Formato, Attademo e Amenta, 2017, Geldermans et al., 2018), present recurring spatial typologies and geographies. They are reticular, like the network of buffer zones that run along the large infrastructures, or the shores and riparian areas of polluted and/or highly artificial waterways. Wastescapes are similar to plaque, such as districts that are in socio-economic crisis and the subdivisions that have arisen in the absence of planning, which are generally characterized by functional inadequacy and low urban and environmental quality (e.g. shopping centers that are surrounded by large parking spaces). Finally, wastescapes are point-like, as in the dispersion of service artifacts and technological artifacts that are characterized by various sizes and natures. These are diffused in a territory and may sometimes even be purely rural (such as a waste-to-energy plant, a landfill, or a power plant in the cultivated countryside).
All these spaces are prone to be reused in a smart way, and within the context of a process regarding the rationalization of urban metabolisms (waste, energy, goods,

people). Furthermore, their geography allows us to imagine a topological condition that sees them as a natural, ecological, and public re-connection network within the peri-urban areas, and also between themselves and the rural or urban areas. For example, all these buffer areas that exist along large gray infrastructures (highways, railways, power lines, aqueducts, oil pipelines, etc.) can be reactivated and combined as green infrastructures, creating positive consequences on the landscape and also on the environment.

The characteristic of being in-between areas makes easy to understand peri-urban areas that are in relation to both the cycle of organic waste (OW), and the cycle of construction and demolition waste (CDW). The idea is to work on new relations between the city and the countryside. Therefore, starting from the size of a hybrid cluster that is formed by a city neighborhood, a transitional area where to build infrastructures, and a rural area, it is in fact possible to trigger a virtuous collaboration device that the waste of a system can become a resource for each of the other two. For example, the compost resulting from the recycling process of organic urban waste (differentiated and sewage sludge) can be used to amalgamate the soils of new woods near the infrastructures. In addition to this, the food that is produced in the countryside, and consumed in the city, can return to the countryside. This can happen in terms of both high-quality compost, and as useful energy to move irrigation pumps or supply agricultural machines. The waste from demolition and construction, when properly collected and treated, can be helpful in the conformation of new soils within peri-urban environments. This can be used to create public and ecological spaces, while also providing topological continuity to these environments.

III. The impacts on urban planning

Some thematic innovations that contemporary urban planning has to face have been briefly reviewed in the preceding paragraphs. In summary, it can be argued that the attention of the urban project moves from the external areas of expansion, to the intermediate ones. These places can therefore be considered as areas of transformation, from the shape of objects, to the space between things (Secchi, Viganò, 2011).

The questions that still remain unanswered are: how do we try to ensure that this transformation process is governed within a framework of urban plans that are capable of holding together? How can we provide a transparent and concerted framework of choices that combine systemic efficiency with the necessity to improve territorial and landscape qualities? In other words, the answer to these questions could focus on how to modify the features of the urban plan in order to make it adequate to the characteristics of complexity and changeability of contemporary peri-urban areas. One of the most significant problems regarding this issue is related to the contrast between the ambitions of expected transformations, and the actual availability of resources. This question is not only limited to economic terms, but also in terms of social and political sustainability. Another considerable problem deals with the need to raise a wide interest for the reclaiming of abandoned and/or decayed urban areas.

Both of these problems can be tackled by innovating urban projects in a procedural format. It is necessary for cities to move from a linear design model, in which the plans are defined by a small group of experts, to a flexible one. This new system will require institutions to renounce their traditional regulatory role and be in favor of a more active and facilitating role that promotes experimentation with participatory tools. In this way, designers will abdicate part of their authorship, and therefore deconstruct the prefigurative logic of urban plans.

Therefore, the territorial project takes on a temporal dimension (in addition to the spatial dimension) as its field of work, experimenting with rhizomatic and multi-scalar regulatory forms. They are based on the distinction between non-negotiable structural elements and flexible spatial conformations, which can be specified over time, due to the conditions of the implementation plans (Attademo and Formato, 2018).

Among the structural elements of the new urban plan, the propensity for continuity required to guide the project towards spatial, ecological, and public reconnections plays a fundamental role. It seems quite useful to work towards understanding and designing the complexity of central urban areas. This can be achieved by multiplying the range of comparable functions, weakening the typical regulatory status of zoning plans and pushing for a hybridization and mix of uses (even within the same building). The aim of doing these things is to promote the introduction of new building functions and densities, without affecting the quality of the natural soils that are still present in peri-urban areas. Conversely, the focus of this work could also be on the densification of already built up settlement areas.

Finally, the spatial model of a hybrid cluster, composed by fabrics of different natures, and by non-urbanized areas, is based on a new deal between the countryside and city, which seems to give shape to new forms of systemic efficiency. It is a territorially defined deal in areas of conformed dimensions that short supply chains take on a physical sense, which is within a renewed logic of self-sufficient clusters. In this way, eco-neighborhoods of the contemporary metropolis can be autonomous from both an energetic and a functional point of view.

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Reference projects

former wastescape

CONTAMINATION

EMSCHER LANDSCAPE PARK

Duisburg-nord

The Emscher Landscape Park is located in the Ruhr Region in Germany. In the past, the Ruhr Region economy was heavily dependent on the coal industry. Over the years, this fact created a severe pollution problem in the whole area. After the industrialization process took over the region at the end of 20th century, the river Emscher became very polluted, and lost both its ecological and landscape functions. This large industrial area is comprised of huge manufacturing structures and factories that are now considered as post-industrial monuments. Moreover, after this region saw exponential growth created by the mining industry, several residential areas were built in order to house the workers of these new industries. After the 1960s, one by one the mines began to close, leaving behind many disused industrial buildings. Once the processes of de-industrialisation commenced, the Ruhr Region needed to be regenerated and transformed into a sustainable environment. This was accomplished through a landscape project that included various methods that included the ecological reconstruction of the Emscher River, the reusing of industrial structures, and the use of art as a creative approach to give new purpose to various former industrial sites.

The first director of the Ruhr Region Association, Robert Schmidt, worked on a new vision of the Ruhr Region. A big change came with the allocation of the IBA (International Exhibition Emscher Park). It not only represents a building for exhibitions, but also a new way of thinking in regards to the future of the region. Within a 10-year period, more than 100 projects were developed for the region. Among them, the landscape park that represents an ecological connection between cities (Severenes, 2015). This project allows us to see a method that can transform a former industrial polluted area into a new landscape, which would not be possible without the cooperation of all provincial and national authorities. Indeed, the 53 local authorities of the Metropolitan Region all worked together, with the common goal to create a new future for the Region.

The main aim of this project was to develop high quality standards for the redevelopment of buildings, while also regenerating the landscape, in order to improve the environmental, economic, and social quality of the region. The conceptual approach of the design was to re-interpret and reconnect fragments of the former industrial structures, and in doing so developing a brand new landscape.

Country: Germany
City: Duisburg-nord
Wastescape category: former wastescapes of contamination and obsolescence
Todays' condition: Post-industrial landscape park
Year: 1990 – 2002
Actors: Project team made up of Latz + Partner, Latz-Riehl, G. Lipkowsky. Realization by help of citizens' actions, associations, and employment schemes.
Keywords: landscape, post-industrial, obsolescence, contamination, park

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Image source:
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CONTAMINATION

Amsterdam OVERHOEKS

In 17th century North Amsterdam, the neighborhood of Overhoeks was the location where the gallows stood, and where criminals were hanged for their crimes. In those times, these kinds of events attracted quite a few spectators. The history of the site eventually evolved from this characterization, then in 1913, the first Shell buildings were created in this area. Then around 1940, the Tower Overhoeks was built. In spite of these developments, this area has always been considered a marginal site for the everyday life of citizens, especially for their lack of leisure activities. Nevertheless, as in many other former industrial areas, it is now located in a strategic zone. This is because the area is not far from the city centre, and it is well connected with the rest of Amsterdam through its efficient public transportation system. It is for these reasons that it became an area of great interest for investors and stakeholders, who consider it as a potential multifunctional neighbourhood for new developments.

In 2002, the first projects for the redevelopment of the area were initiated. Palmbout Urban Landscapes designed the Overhoeks Masterplan, a vision commissioned by Stadsdeel Noord and the City of Amsterdam. The proposal was structured in three phases, with the realisation of the project starting in 2005. In 2009, Shell moved all its area activities into a new building. During this process, the site was cleansed and prepared for the construction of new homes. The residential buildings were designed by famous Portuguese architect Alvaro Siza, the architect Tony Fretton, Dutch Coenen & Co Architects, Van der Hoeven Baneke Architects, Mecanoo (Francine Houben), and Geurst & Schulze. This year also saw the construction of the Eye Film Institute Netherlands, which was designed by Austrian architects Roman Delugan and Elke Delugan-Meissl. In the second and third phases of the project, additional residential areas and facilities such as commercial premises, shops, and other public functions will be implemented to the site, along with the regeneration of the Tower Overhoeks set to take part within these phases. This strip, as a whole, is being developed by Team Area Development of the Municipality of Amsterdam. Eventually, Overhoeks will be an area that is combination of functions that will act as a link between the Amsterdam city centre and the northern neighbourhoods of the city, therefore becoming an attraction for new investors and residents. Overhoeks is an excellent example of a public-private partnership in urban development. Seven very different partners have come together to make important decisions about the future of this area. These decision makers include ING Real Estate, the municipality of Amsterdam (via the North Project), Amsterdam-Noord, Ymere Vesteda, Shell, and the EYE Film Institute

Country: The Netherlands
City: Amsterdam
Wastescape category: former wastescapes of obsolescence, contamination, dereliction
Todays' condition: an attractive mixed functions area
Year: designed from 2002 to 2004, realization starting from 2005
Actors: public-private partnership
Keywords: former industrial area, soil regeneration, mixed functions, residential, working area

Netherlands. Today, Overhoeks represents the redevelopment of a former industrial area, providing new opportunities for the city of Amsterdam. Overhoeks is part of Buiksloterham area. In contrast with the gradual and organic transformation of Buiksloterham, Overhoeks is undergoing a traditional development. This is defined by the process that the private project developers are going through to build housing projects in this specific area acquired by the Municipality of Amsterdam.

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CONTAMINATION

Amsterdam NDSM

In 1894, the Dutch Shipbuilding Society NDSM was founded. The company was successful until the 1970s, during which the NDSM was facing a crisis. Later on, in 1984, it ceased to function. Before its crisis, the NDSM-wharf was one of the biggest shipyards in the world. In the 1990s, after several years of abandonment, some bottom-up initiatives collaborated with city authorities to give importance back to the area by providing a new creative identity to the former NDSM shipyard. As a reaction to this initiative, the large shipbuilding shed was transformed into a 'Kunststad' ('Art City'), which has become an architectural monument. Numerous other initiatives followed, such as festivals and other cultural events. The area is appealing for both creative experimentation and entrepreneurship. The industrial heritage character combined with new creative activity, thus creating an interesting and 24/7 energetic neighborhood. It is becoming a district for urban pioneers. More than 2,100 new residences are being built, including houses for young professionals and students. It is a mixed-use neighborhood where it is possible to live and work. This combination of functions also assures a rich mix of inhabitants with various ages and work styles. Student housing is also present there.

NDSM is just 15 minutes away from Amsterdam central station by ferry, bicycle or car. It is possible to find shops and restaurants within walking distance. The role of the water has been always crucial for the NDSM Wharf. Even though the shipyard is closed, the water now serves new functions, for example nautical activities.

Country: The Netherlands
City: Amsterdam
Wastescape category: Contamination
Todays' condition: mixed-use neigborhood
Year: since 1990
Actors: ship workers, artists, media makers, performers and young entrepreneurs
Keywords: former industrial area, creative neighbourhood, industrial heritage

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Image source:
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CONTAMINATION

BINCKHORST

From heavy industry to the creative city made up of an industrial character designated for living and working

Binckhorst is an industrial area of 130 hectares located on the eastern side of Den Haag, which is near the city centre, and has a long history of planning and renewal. A Masterplan was first developed by OMA in 2006, who planned to implement a top-down approach for the vision of this area. Due to a lack of financial resources, the Masterplan that was proposed by OMA has remained largely unrealised. The Masterplan was really ambitious as it proposed a city park and a new city entrance, which would act as a tunnel facilitating faster connections between Rotterdam and The Hague, as well as new residential and business space wihin the site area. All of these ambitions remained mostly unrealised, which as stated above, was due to the economic crisis of 2008. In fact, already one year after OMA's Masterplan, the different actors involved in the project were no longer able to face the financial risks that the plan would have caused. For this reason, the office of Urhahn Urban Design was contacted to face this problematic situation, from both an economic point of view and from a design perspective. The major criticisms regarding OMA's Masterplan both involved the lack consideration for the existing social reality, and for the numerous activities that already exist in the area. These criticisms were the main starting points for the proposal elaborated by Urhahn, who looked at the project area from a bottom-up perspective. The main motivation behind the new proposal that was developed for Binckhorst involved the creation of small projects that would show the possibility for new developments for the area by acting as a catalyst for new growth. The main examples of this involve the creative incubators developed in New Binckhorst, which exist in the former Caballero factory, and at Bink 36. It is here where innovative, creative, and cultural businesses coincide together in one place. Nowadays, Binckhorst can be seen as a flexible area that merges the old with the new. In this project to redevelop the Binckhorst area, the combination of participation between the inhabitants living in the area, and of private investors was involved in its development. There is also an inherently strong connection between these people, and their direct existence within the physical environment, making it a good space for renewal and experimenting. To conclude, we can say that the project is based on the regeneration of what exists already.

The project follows a bottom-up approach, giving attention and value to what already exists, especially the people that already live in the area, which resulted in the reconnecting of Binckhorst. This project/process can be considered a valid example of flexible regeneration of an inner-city industrial area.

Country: The Netherlands
City: The Hague
Wastescape category: obsolescence, contamination, dereliction
Todays' condition: industrial area with a mix of bottom-up initiatives
Year: OMA's masterplan, 2006
Actors: Municipality, design office, inhabitants, public and private investors, developers
Keywords: bottom-up activities, industrial area, flexible area, urban regeneration

References:

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former wastescape OBSOLESCENCE

TONI AREAL

By the late 1980s, a lot of urban areas in Switzerland, had been abandoned by the manufacturing industry, which moved to the periphery of the city or abroad. This particularly happened around the Zurich-Nord and Zurich-West areas, and by the early 1990s, this change left large areas of the inner-city as urban potential. Recent developments show an influx of more mixed-use structures that try to incorporate existing buildings, and expand on them where necessary. Generally, large-scale developments such as industrial buildings and structures were kept intact, because they seemed to be attractive to investors who were in favor for their redevelopment (EM2N,2015).

A former milk factory in Zuich called Toni Areal, has been transformed into a hybrid location for various cultural activities. Demolishing this former milk factory would not have made sense from many points of view that involve ecological, economic, and urban planning issues (Angelus Eisenger and Jorg Seifert, 2012). The purpose of converting it into a hybrid location for education, culture, and residences was to keep the inherent value of the existing landscape. In 2005, the architexts of EM2N won the competition that allowed them to convert and design the Toni Areal. The organization who opened it had collaborated early on with the Canton of Zurich, which was interested in finding a central location between two of its three cantonal universities. Together with various politicians, a decision was made to create a cultural building block for a new district called Zurich West. The Toni Areal is a culmination of a massive urban redevelopment plan of Zurich. The focus of this proposal was to breathe new life into Zürich West by rethinking the site as a knowledge hub. The project became the catalyst to ameliorate the urban development in this part of the city.

Both the Canton and the City of Zurich, in collaboration with universities and architects, were the developers who implemented the result of the aforementioned architectural competition. This entire process is an example of how a big waste of industrial processes can be re-interpreted and reintegrated into the city by becoming a multifunctional building that also creates a social mix for all.

Country: Switzerland
City: Zurich
Wastescape category: former wastescapes of obsolescence
Todays' condition: platform for education, culture, and living.
Year: study commission first done in 2005 (1st prize EM2N), then planning in 2005–2009, and finally construction in 2008–2014
Actors: architects, politicians, university
Keywords: cultural centre, hybrid location, education

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Image source:
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OBSOLESCENCE

VOLKSKRANT BUILDING

Circular reuse

Inside the inner core of dense cities, a large amount of ample buildings (and also whole districts) are becoming abandoned. This is due in part to either the obsolescence of their structures, or the end of a life-cycle that has become obsolete. Nowadays, some bottom-up and spontaneous initiatives are already occupying these buildings that have been left vacant. Many of them are self-organising projects that have been developing in shrinking areas such as these.

One example of this can be seen in the work done by the Foundation Urban Resort, which was founded in 2006. Their first project involved the regeneration of the former Volkskrant building in Amsterdam. Since then, Urban Resort has taken other buildings in the city under its wing. Furthermore, a municipal agency in Amsterdam, the Bureau Broedplaatsen, keeps an eye out for vacant buildings similar to the Volkskrant House, and subsidises their upkeep until they can be regenerated. Urban Resort provides inexpensive space for social, cultural, and creative sectors through the transformation of vacant properties into vibrant spaces, which exhibit both a public function and a cultural influence within them. By reusing these vacant buildings, Urban Resort wants to contribute to the liveliness of Amsterdam through the promotion of culture in the city.

The Volkskrant building underwent a regeneration process that transformed it from a disused office building, and into a truly creative incubator. Nowadays, Het Volkshotel occupies the former headquarters of the Dutch newspaper de Volkskrant, which is a very heavy 1960s concrete structure. After many years of abandonment, the white facade had turned grey, and the interiors were left to crumble, as the newspaper found a new main office. Recently, however, the building has found a new purpose as a public space. This is thanks, in part, to its re-invention and reestablishing of new functions, which even includes a hotel. The hotel is indeed a far more open and public approach to the conventionally private atmosphere of a hotel. The spaces within this new hotel are designed to cater and appeal to locals, workers, students, and of course, travelers.

Above the Volkshotel, there is Canvas, which is a top floor restaurant by day, and a nightclub by night. It includes a club/restaurant, a rooftop bar, and a café with a sauna and outdoor spa. It also contains a nod to its former life, which done through a collection of co-working spaces and meeting rooms. The conceptual design set forth by interior designer Bas van Tol is predominantly inspired by newspaper production, and the world of paper, ink, and photographs. This hotel is an example which shows that there could be an alternative to demolition through (temporary) reuse by giving a creative and cultural character to an unused building.

Country: The Netherlands
City: Amsterdam
Wastescape category: obsolescence
Todays' condition: creative incubators
Year: 2007
Actors: developers, start-ups
Keywords: former office buildings, creative regeneration, circular reuse

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OBSOLESCENCE

ROTTERDAM STADSHAVENS

Renew the city starting from its edges

The necessity to improve the economic situation of both the port and the city, led the Municipality of Rotterdam and the Rotterdam Port Authority, in cooperation with private companies (also through bottom-up activities and private investments), to work together towards developing special, innovative, living, and working areas.

The four sub-areas of the Stadshavens in which many recent developments are happening, are Rijn-Maashaven, Merwe-Vierhavens, Waal-Eemhaven, RDM-Heijplaat.

Different strategies have been developed to enhance the economic power of those areas. Between them: "sustainable mobility" and "crossing borders" aim to re-connect the city and the port, improving public transportation across water, and in between the other facilities. In the same areas listed above, it is possible to find a good example industrial heritage's re-cycling: re-qualification of the Fenixloodsen in Deliplein area. The building has been recycled through the creation of several activities, following a bottom-up approach, e.g. the Fenixloods Circuscentrum, the Rotterdam Theatre Walhalla and Fenix Food Factory. The Fenixloodsen Circuscentrum and the Rotterdam Theatre Walhalla are projects, recently realised by Van Schagen Architecten. They can be considered good examples of recycling industrial heritage through bottom-up activities. It can be seen as a major boost in dealing with vacant properties in times of crisis through private funding and in stimulating new economies in wastescapes areas.

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Country: The Netherlands
City: Rotterdam
Wastescape category: obsolescence, dereliction
Todays' condition: A connection between city and port, created by revitalising the harbour area
Year: since 2010
Actors: Municipality of Rotterdam, Rotterdam Port Authority, private companies
Keywords: low budget/high impact

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OVERLAPPING

AGNIESEBUURT, HOFBOGEN

New creative public spaces

Since 2006, after years of vacancy and decay, the housing association Havensteder e Vestia started a collaboration with Rotterdam Hofpleinlijn (the first electrical Dutch railway line) that was based on an interest in the renewal of the abandoned Hofplein viaduct. Firstly, the debate about the urban regeneration of this area was focused on the requalification of the former Hofplein station, which had sat abandoned for a long period of time. Thanks to its position in Rotterdam's urban structure, the former station represents a very interesting connection with the city centre. The railway overpass is composed of 189 arches that crosses several districts, constituting a physical separation between the buildings of the area. The main goal of the project is to renew all the railway arches in order to improve the quality of the public spaces around it, therefore improving the citizens' quality of life. However, the regenerated viaduct has the potential to not just represent a resource for local inhabitants, but also as an attraction for other visitors. The project works with structures that are potentially useful for modification, through various creative practices. The arches are perpetually being changed in a creative way. This is being achieved through the intervention of artisans and creative artists in general, who are revitalising the area and the surrounding neighbourhoods. The project aims to regenerate both the old infrastructure (the built parts), and its relative open spaces. The objective is to reinhabit the arches by creating spaces in which creative activities can happen. By creating new people flows, there will be an increase the quality of the public open spaces. The housing association Havensteder e Vestia, in collaboration with Rotterdam Hofpleinlijn, have operated this transformation through crowd-funding. The project is based on socio-economic, cultural, historical, and commercial studies.

The project will improve the quality of public spaces, particularly the northern parts of the city. Renewing the former railway infrastructures will recreate a connection with the surrounding urban areas.

Country: The Netherlands
City: Rotterdam
Wastescape category: overlapping (infrastructures), dereliction, segregation
Todays' condition: a meeting place for exceptional entrepreneurs in the field of food, fitness, and design
Year: since 2006
Actors: Housing associations Havensteder e Vestia, in collaboration with Rotterdam Hofpleinlijn
Keywords: urban regeneration, abandoned viaduct, reconnection of urban areas, creative spaces

References:
- Hofbogen, http://www.hofbogen.nl/, last access 19 March 2019.
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Image source:
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OVERLAPPING

GÜRTEL AXIS viaduct

In the city of Wien, Austria, the project for the re-development of the Gürtel axis came into existence through the re-adaptation of an infrastructural axis: a viaduct. The area that is crossed by the beltway was historically degraded and underused. In the 1990s, it was the location for Vienna's red-light district, and it was considered as a "Public space (that) was truly a space of fear" by Silja Tillner (Eisenger A., Seifert J., 2012: 187). This axis created a barrier between two parts of the city. The combination of these factors made it necessary for a renovation, which take the form of a transformation that could obtain better quality public spaces with new attractions, and in doing so helping to develop a new image for the beltway. The project designed by Tillner&Willinger Architects (in cooperation with the Federal Heritage Office) focused on the renewal of the image of Otto Wagner's rail arches, and the possibilities to create public spaces. Thanks to the strategies implemented by the project, bars, galleries, and different activities have developed under the viaduct. Today, the beltway is becoming a transition place between the centre of the city and the suburbs (Eisenger A., Seifert J., 2012).

The architects Tillner&Willinger, in collaboration with the Municipality, the Federal Heritage Office, and the University in Wien, all helped to develop a project that restores the continuity between the inside and the outside of the city. This was accomplished by eliminating the barrier and using glass enclosures, whose additional aim was to improve the general security of the area.

It is considered as an interesting design example for other cities who want to redevelop an infrastructural and unused axis. Something that can be initially perceived as a barrier (and/or a segregating element), can be transformed into a public space that has a sense of being, allowing for various peoples to interact with each other.

Country: Austria
City: Wien
Wastescape category: Overlapping (buffer zones of the infrastructures)
Todays' condition: vital public space
Year: 2000
Actors: architects, municipality, Federal Heritage Office, unversity
Keywords: infrastructures, buffer zones, viaduct, leisure, restaurants

References:
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Image source:
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OVERLAPPING

POMPENBURG PARK, LUCHTSINGEL
From waste to resource: new life to a forgotten area

Hofplein is an area located in the Northern side of Rotterdam. Over time, it has lost its central role for the city, and is now dominated by empty spaces and main traffic arteries. The project for its renewal includes two main aspects. The first aspect involves the re-functioning of the Schieblock building, with the second being focussed on the realisation of the Pompemburg Park, which is to be constructed on a neglected plot in the North-east corner of Hofplain. This location also has a temporary wooden pedestrian bridge that has been realized through a crowd-funding effort.
Until 2009, Schieblock represented 8.000 m2 of vacant office space in the centre of Rotterdam. Thanks to the project by ZUS (ZUS – Zones Urbaines Sensibles), the area developed in the period from 2009 to 2013, which today is a place where several activities and experiments happen. It also represents a location for creative activities where lectures and exhibitions take place. The roof of Schieblock is utilised as a green and productive garden where vegetables are cultivated. The building is connected to different urban areas through the pedestrian temporary wooden bridge previously mentioned above. The bridge, called Skybridge, is 390 metres long, and it creates a connection between the centre of Rotterdam and the Northern area.
Pompeburg Park has been developed to establish a connection between three districts of the city, and it has become a catalyst element for further developments. At the time of realization, the economic crisis made it necessary to look for new ways to get funding to create urban projects, which is why a crowd-funding strategy was implemented. The construction of this project was a participatory effort that combined the citizens of Rotterdam with private and public partners, who heled in building and buying the wooden structural elements of the pedestrian bridge.
This project explores new strategies to directly involve citizens in various urban regeneration processes. This method of involving citizens as active parts of the process is quickly changing, thanks in part to innovative planning instruments based on new digital technologies. The involvement of citizens can facilitate the creation of a new identity for our places, and in turn improve the sense of belonging to them.

Country: The Netherlands
City: Rotterdam
Wastescape category: overlapping (infrastructures), dereliction, obsolescence
Todays' condition: public space and pedestrian bridge
Year: 2009-2013
Actors: creatives, citizens, private and public partners, designers
Keywords: urban regeneration, crowdfunding, pedestrian bridge, buffer zones, infrastructures

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former wastescape
WAITING condition

BLUE CITY Rotterdam

Due to the many years of vacancy (since 2010), the building has deteriorated considerably. At the end of 2015, two entrepreneurs suggested the plan to reopen the Tropicana as a subtropical swimming pool. This made it possible to get a huge amount of likes on social media, but not the necessary 14 million euros for the estimated restructuring costs.
Since 2015, Tropicana has been in the hands of BlueCity and the building has been addressed by Coup-Group (Urban Producers) and Superuse Studios (the design and architecture agency that shapes the transformation).
Blue City project is an emblematic example that goes towards the direction of circular regeneration of wastescapes combined with the reuse of material waste. Here, waste becomes a resource and loops are closed in different ways. The recovery of the Tropicana building is the core of this project. It used to be a swimming pool built in the 1980s, and later an abandoned one in 2010. After a few years of dereliction, the company BlueCity bought the vacant building and decided to turn it into a creative incubator for entrepreneurs who wanted to experiment circular economy principles. These companies work on waste by turning them into input for new processes. For example, one of the companies reuses coffee leftovers to cultivate mushrooms, another company reuses CO2 that produces spiruline, and finally fruit waste is reused to produce a material similar to leather. All of these initiatives contribute to innovation and to creation of new jobs. Moreover, they reduce the amount of waste and produce new economies not at the expense of the environment. The project allowed reconquest of the waterfront by the city and re-establishing a relationship between people and water.

Country: The Netherlands
City: Rotterdam
Wastescape category: waiting condition, obsolescence
Todays' condition: creative incubator
Year: 2013 the first entrepreneur started to occupy the building
Actors: private investors, entrepreneurs,
Keywords: bottom-up initiatives, former swimming pool, circular economy, blue economy

Reference:
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Image source:
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About the author

Libera Amenta is a post-doc researcher in the Department of Urbanism, which is within the Chair of Environmental Technology and Design at Delft University of Technology (TUD), and is located in the Netherlands. She also works at the Department of Architecture at the University of Naples Federico II (DiARC UNINA), which is located in Italy.

She currently holds a PhD in Urban Design and Planning, and also a Master Degree (cum laude) in Architecture, and both were gained at DiARC. She gained her PhD in May 2015, which resulted with a research project entitled *REVERSE LAND Wasted Landscapes as a resource to re-cycle contemporary cities*.

Since 2016, she has been carrying out research on topics regarding the "circular regeneration of wastescapes" as member of the funded "Horizon 2020" (H2020) project titled "REPAiR-Resource Management In Peri-urban Areas: Going Beyond Urban Metabolism", which is lead by TUD prof. Arjan van Timmeren. She is the leader of the REPAiR Peri-urban Living Lab (PULL) in Naples, which is one of the two pilot cases of the research project, and the other pilot case being in Amsterdam.

She is member of the Advisory Board for the H2020 project tiled "UrbanWINS," which involves waste prevention and management in 24 cities, and works towards finding solutions that provide resilience and resource efficiency.

She has also received approval and funds for a fellowship within the project "OPPORTUNITÀ," which involves topics regarding how the "Circular Economy" can be applied to both urban and landscape regeneration at the University of Venice (IUAV), which is also located in Italy.

Since 2018, she has also been tutoring design studio courses at TUD, which are focused on topics regarding sustainable neighbourhoods and potential spatial strategies for the global metropolis, and at the Amsterdam Institute for Advanced Metropolitan Solutions in Amsterdam (AMS Institute) in collaboration with Wageningen University about Metropolitan Solutions.

She most recently published, together with prof. Arjan van Timmeren, a scientific paper entitled *Beyond Wastescapes: Towards Circular Landscapes*. This paper was published in the international journal called Sustainability, and it addresses the "Spatial Dimension of Circularity through the Regeneration of Wastescapes."

Resource consumption mostly overcomes the embedded capacity of global ecosystems, which are self-regenerating until they reach the point of the planet's limits. Moreover, the consumption of virgin resources and raw materials is strictly related to a consequent production of waste, which is negatively affecting both human health and other various spatial conditions. In addition to this, the temperature of the globe is predicted to rise even more in the next century, which might lead to food shortages, water scarcity, and even conflicts. Studies show that if this model of growth goes on, there will be the need of almost an additional planet Earth (in terms of resources) for us to be able to continue to survive. This condition of scarcity also regards land itself, which is understood as a non-renewable resource. Issues regarding linear metabolism, unsustainable resource consumption, abandonment, vacancies, and also the depletion of fertile soil, are caused by various rapid urbanization processes that can generate wastescapes. These can be generated in the form of unused, abandoned, polluted, or (socially) problematic areas.

The unsustainability of this linear model of growth is self-evident, because it represents a significant threat for environmental sustainability, human health, and happiness. Many initiatives around the world are currently in the process of moving towards circularity. However, the recycling of wastescapes is still an important knowledge gap in the current definition of a circular economy, with the latter mostly only focusing on the recycling of material resources in contemporary cities.

What can be done to integrate the regeneration of wastescapes with the principles of a circular economy? Can we envision a spatial dimension of circularity by going beyond just recycling of material waste to improve citizens' quality of life and wellbeing? Could this be achieved through the preservation of both the availability of natural resources and the ability of eco-systems to regenerate themselves, without exceeding the global ecological overshoot?

ISBN 978-94-6366-156-0

TU Delft