Eco-Innovative Solutions for Wasted Landscapes

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Abstract

The paper focuses on the impact generated by the un-efficient management of waste flows, on both natural environment, and urbanization process, and on the opportunity to invert it by regenerating Wasted Landscapes, i.e. underused, polluted and abandoned sites, especially located in peri-urban areas. This is one of the aims of the REPAiR project, funded in 2016 by the European Commission within the Horizon 2020 framework, developed by University of Naples with TU Delft as Lead Partner. The implementation of multi-scaling/multi-disciplinary approach, for testing out collaborative decision-making, has seen so far the research of a scientific based definition of peri-urban area in the context of the Metropolitan Area of Naples. The selection of the peri-urban areas has also been tested through Living Labs, aimed at designing eco-innovative solutions towards circularity.

Keywords

Wasted Landscapes, Circular Economy, Urban Metabolism, Peri-Urban, Eco-innovation, Living Labs

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Introduction

This paper[1] explores the paradigm of circularity as an innovative approach for planning, stressing out the complexity of urban systems and working on the interactions between in-bound and out-bound flows (Swyngedouw, 2006; EC, 2011, 2014; Allen, Broto and Rapoport, 2012; Golubiewski, 2012; Ibañez and Katsikis, 2014). Such approach is based on the critical review of planning paradigms, not anymore referred to the linear urban growth (Latouche, 2009), but focused rather on both the paradigm of urban resilience (Davoudi, 2012) and resource preservation. This approach is here referring to the capacity of enhancing, recovering and re-using urban and peri-urban areas in terms of reducing soil loss and managing waste cycles.

Therefore, circularity refers to multi-scaling design approaches and to innovative models of designing products, processes, and projects. In particular, the concept of eco-innovation seems to be appropriate to explain the design potentials, when extended to the environment according to the EU definition: «Eco-innovation refers to all forms of innovation – technological and non-technological – that create business opportunities and benefit for the environment by preventing or reducing their impact, or by optimizing the use of resources» (EC, 2012).

The EU Commission boosts the role of eco-innovation as a central action for the transition towards a sustainable growth. To do so, a set of policies and measures such as the *Europe 2020 strategy for a smart, sustainable and inclusive growth* (EC 2010b), the seven flagship initiatives (EC 2010b), the *Eco-innovation Action Plan* (EcoAP, 2011) and the program Horizon 2020[2] have been developed so far. Within this framework, the call *WASTE-6b-2015: Eco-innovative strategies* aims at promoting the development of Eco-innovative solutions for waste prevention and management in urban and peri-urban areas. The call adopts an integrated urban metabolism approach and actively engages local authorities, citizens and all kind of relevant stakeholders, in a way that is consistent with the objectives of the European *Resource Efficiency Roadmap* (COM 2011) and the *Directive 2008/98/EC on waste* (EC, 2008).

The Horizon research project REPAiR (REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism – GA 688920)[3] runs under the above-mentioned call, and it aims at providing eco-innovative solutions for fostering the quantitative reduction of waste flows in peri-urban areas. Furthermore, REPAiR aims at integrating Life Cycle Thinking and Geo-Design approaches to operationalize Urban Metabolism especially in terms of reduction of Wasted Landscapes[4] in peri-urban areas. Wasted Landscapes are discarded urban are-

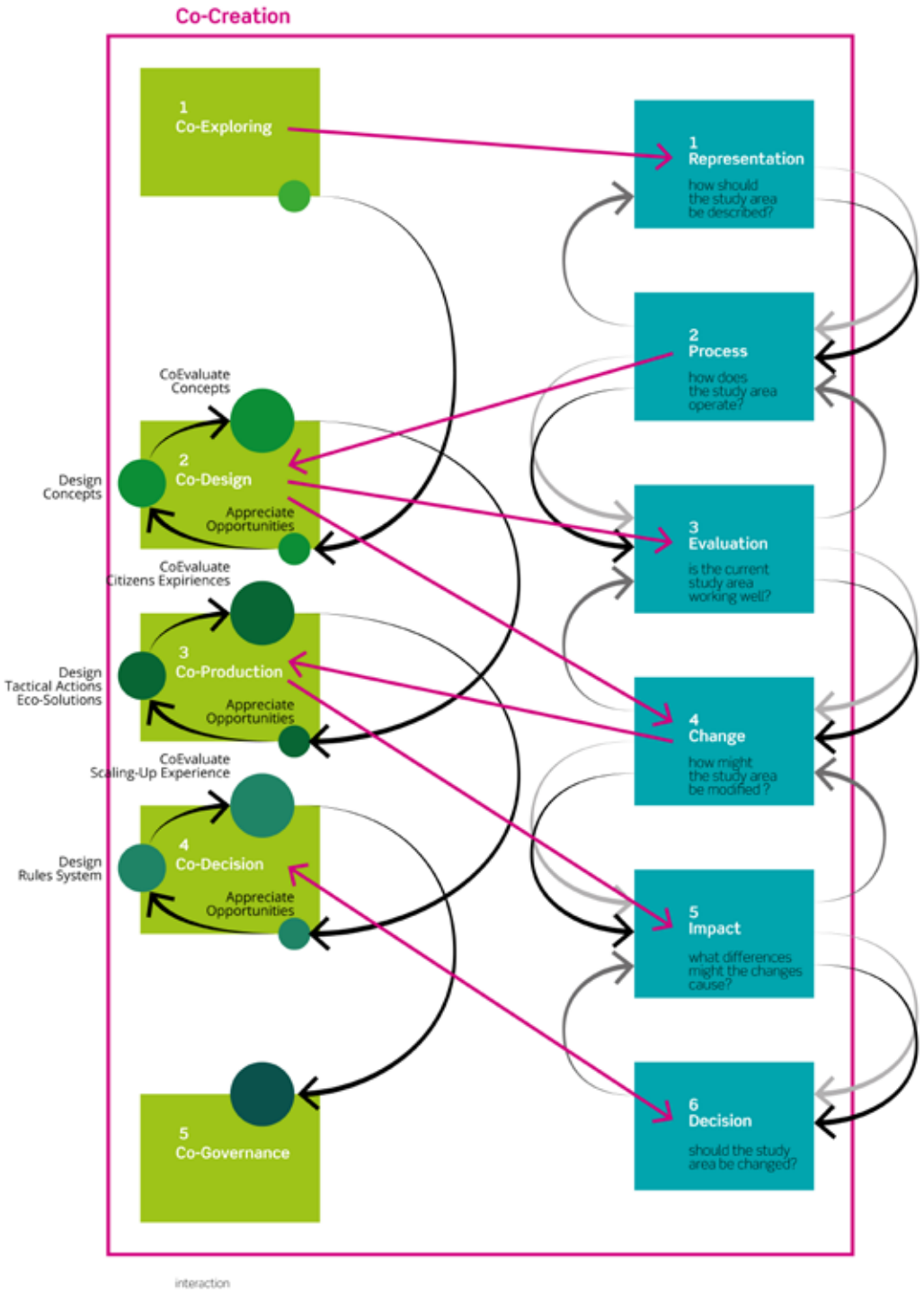
Co-Creation
1
Co-Exploring
2
Co-Design
CoEvaluate
Concepts
Design
Concepts
Appreciate
Opportunities
3
Co-Production
CoEvaluate
Citizens Expiriences
Design
Tactical Actions
Eco-Solutions
Appreciate
Opportunities
4
Co-Decision
CoEvaluate
Scaling-Up Experience
Design
Rules System
Appreciate
Opportunities
5
Co-Governance
1
Representation
how should
the study area
be described?
2
Process
how does
the study area
operate?
3
Evaluation
is the current
study area
working well?
4
Change
how might
the study area
be modified ?
5
Impact
what differences
might the changes
cause?
6
Decision
should the study
area be changed?
interaction

Fig. 1 – REPAiR Peri-Urban Living Labs across Europe (Image credit: REPAiR proposal. Graphic: Libera Amenta).

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Fig. 2 – Relation between Living Labs process and Geo-Design (Graphic: Maria Cerreta, Pasquale Inglese).

as, mainly characterized by a bad quality of life and environmental problems, the leftovers of exhausted lifecycles of territories (Amenta, 2015; Palestino, 2015).

REPAiR does not focus on 'end-of-pipe' solutions, on the contrary, it aims at tracking waste flows back to resource consumption patterns in order to reduce them and estimate the best routes for changes.

This approach makes it possible to achieve iterative visions of both production course and consumption processes within the territorial specificities of each (different) countries involved into the project. Criticalities and opportunities of the whole life cycle are pointed out; boosting the concept of waste from discarded matters to potential resources, (the REPAiR approach is briefly reported in fig. 2).

REPAiR specifically focuses on:

- Selected categories of waste flows (Construction&Demolition Waste, Biowaste, *Post consumer plastic waste*, *Waste electrical and electronic equipment*, *Municipal solid waste*), including Wasted Landscapes as innovative object of study;
- Providing more sustainable waste management systems, based on Life Cycle Thinking;
- Testing out new practices for collaborative problem solving, through the implementation of six Peri-Urban Living Labs (PULLs) aimed at involving local communities in the problem solving activities (Mitchell, 2003; Bilgram, Brem and Voigt, 2008; Steen and Bueren, 2017);
- Supporting decision-makers, through innovative tools, such as Geo-Design Decision Support Environment (GDSE) (Steinitz, 2012; Campagna, 2014);
- Providing new planning approaches, and design solutions for regenerating and recovering Wasted Landscapes in peri-urban areas.

Within the REPAiR partnership (fig. 2), the Italian Research unit (Department of Architecture of Naples of the University of Naples Federico II) has mainly focused on the territorial dimension of waste management and specifically on Wasted Landscapes as scrap products of the urban metabolism. The research interest is given to the peri-urban areas, where waste flows management follows a sectorial, un-efficient approach, running without a comprehensive, territorial strategy by administrators and without any of inhabitants' awareness. Further, peri-urban areas (Donadieu, 1998; Viganò, 2001) are those more affected by the presence of Wasted Landscapes (EC, 2011). They are located in between the urban-rural territories, and they are featured by a kind of chaotic, not-planned land use, where urban uses melt with the (former) rural areas, thus generating new geographies of waste: REPAiR 'wastescapes' (Amenta and Attademo, 2016).

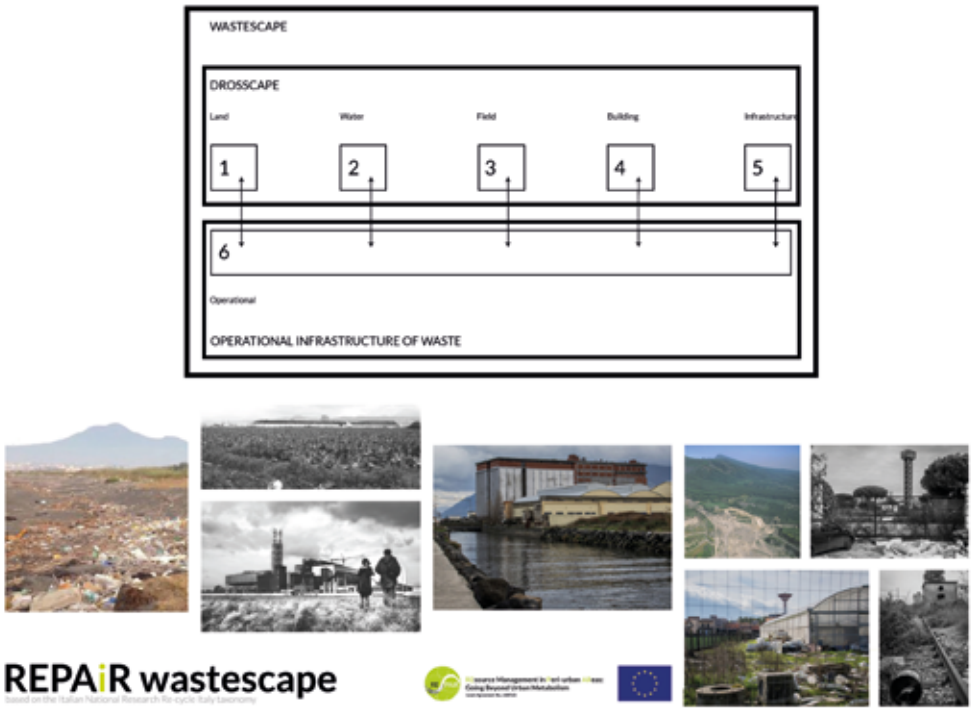

Fig. 3 – REPAiR Wastescapes identification (Graphic by UNINA Research Team).

This paper illustrates the first advances of the Neapolitan research team, in applying a crosscutting analysis of the study area by the aim of providing a scientific based description of peri-urban areas. The analysis is oriented to collect quantitative and qualitative data, as well as data for the spatial analysis, for representing, understanding and improving the relationship between the detection of peri-urban area borders and the current urban metabolism of waste flows.

Case study area

As part of the REPAiR proposal, two pilot cases are carried out in order to develop and test eco-innovative solutions in peri-urban areas: Naples, in Italy and Amsterdam, in The Netherlands. The other partners (Pecs, Hungary; Ghent, Belgium; Hamburg, Germany; and Lodz, Poland) will test the capacity of transferring knowledge within the consortium. Specifically, in Naples the research focus is mainly oriented on the Wasted Landscapes, deepening territorial and landscape issues (fig. 3). Whereas, in Amsterdam, the research deepens the knowledge on the potentialities of circular economy, stressing both the waste/resource flows optimization and business development.

The Italian case study area is located within the Metropolitan Area of Naples, where waste flows and Wasted Landscapes characterize the peri-urban territory. Sadly known as '*Terra dei Fuochi*' ('Land of Fires' in English – authors' translation), the Metropolitan Area of Naples is increasingly losing its former values as relevant area for agriculture. The dramatic exploitation of the original agricultural habitats leads to the deep degradation of the environmental and cultural assets (Legambiente, 2015); although, criminal organizations have significant influence in this area, especially in terms of illegal waste management and of built-up areas

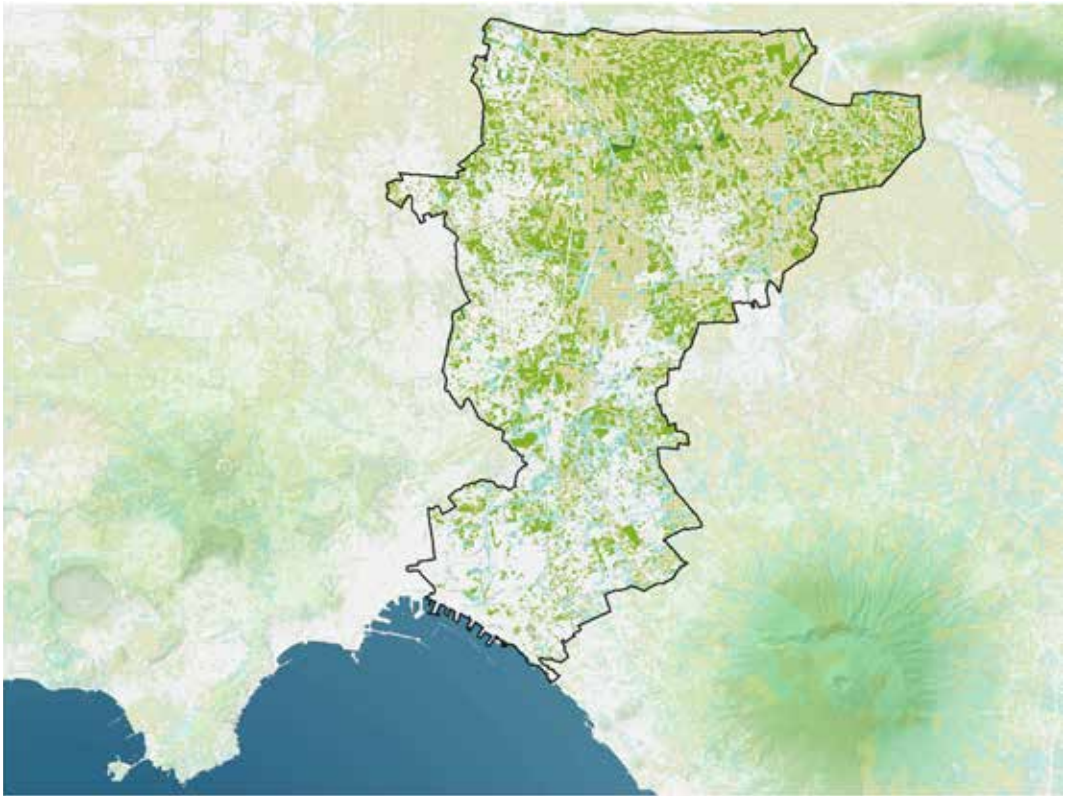

Fig. 4 – REPAiR Focus Area within the Metropolitan Area of Naples (Graphic: Pasquale Inglese).

development. In addition, the whole Campania Region has potentially 2551 contaminated sites, mostly of which are landfills or other areas of uncontrolled waste dumping. The Campania Region presents six Sites of National Interest (SIN), areas featured by relevant pollution; hence, the 15.8% of the entire region is polluted, ranging 2,157 km^2 (ARPAC 2008). These alarming data make urgent for planners, professionals and decision makers to move forward this situation, finding strategies to improve the quality of living conditions. According to this, the REPAiR team is focusing on a wide, sprawling urban area, hereinafter called Focus Area. It is located at the edges of the compact cities, and featured by the lack of planning and by illegal building activities. Here the historical centers, mostly originated from the former rural areas, have merged into a continuous urban environment, where hybridization exists between urban and rural landscapes. Lack of facilities, public infrastructures and public spaces characterize the Focus Area too. There is not an acclaimed tradition of spatial planning, nor did regional and / or municipal levels of planning, thus such territorial 'fragmentation' (with low quality urban patterns) generate a sort of 'no man's land'.

Materials and Methods: Peri-urban areas analysis

Starting from such description, the first aim of the research team is to provide a scientific based definition of peri-urban area within the Focus Area and in the context of the Metropolitan Area of Naples. The first assumption regards the definition of how the Focus Area should be described (Geldermans et al., 2017):

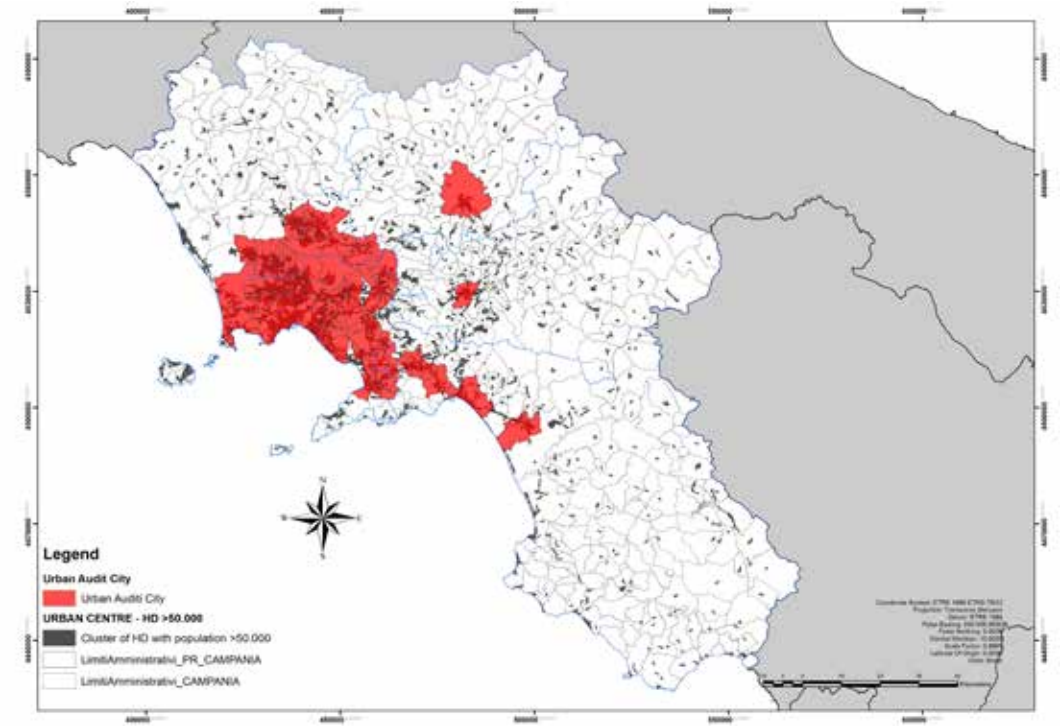

Fig. 5 – City identification.

- A representative sample of the Regional context, containing:
  - Mix of urban, rural and peri-urban areas, with a dominant share of peri-urban ones;
  - Wastescapes;
  - Huge infrastructure networks;
  - Productive areas and logistic platforms.
- A 'paradigmatic' area, having the value of 'model' for investigating problems and challenges and for testing potential eco-innovative solutions.
- A defined area based on administrative borders, socio-demographic and land cover data as well as on qualitative assessments.

So far, the Focus Area has also defined, including its spatial requirements according to REPAiR's definition (Geldermans et al. 2017), and it is specified by:

- High density population, urban dispersion and peri-urban features;
- Lack of public spaces and facilities.

The research Focus Area is therefore represented in fig 4. It is the array of local municipalities located in North-Est Naples featured as above. Moreover, the Focus Area border is consistent with the ATO Napoli 1 border, where ATO means *Ambito Territoriale Ottimale* (Optimal Territorial Area), and it represents the basic territorial unit for the urban solid waste management as planned by the Regional Waste Management Plan made by the Campania Region in 2016.

Regarding the peri-urban areas depicting, generally those areas have not the same features of urban compact cities, nor the ones of suburban villages. They are somehow dispersed urban development, widespread cities (*città diffusa* in Italian) (Soja, 2000; Forman, 1995 and 2008; Indovina, 2009). The research assumes the following definition of peri-urban areas as «areas where new functions, uses and lifestyles arise as a result of the on-going

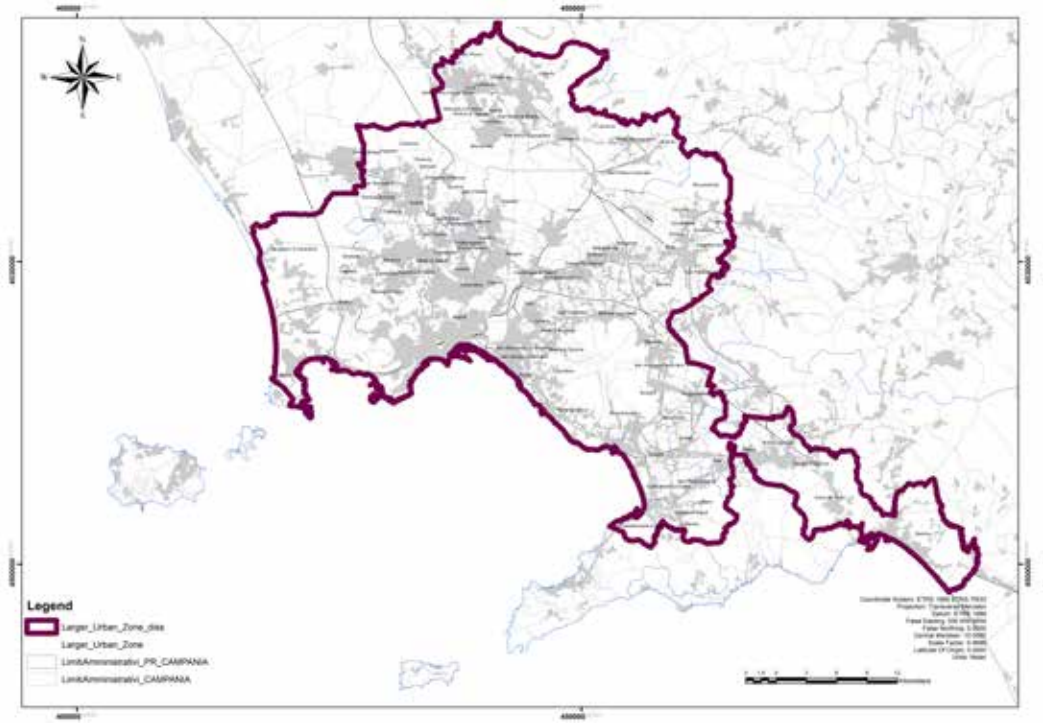

Fig. 6 – Commuting-zone identification - 145.000 ha.

interaction of urban and rural elements» (Wandl *et al.*, 2014).

To understand the peri-urban characteristics of the Metropolitan Area of Naples, the research compares some specific territorial features, carried out by distinguishing (and mapping) the follow urban patterns: A) the City, B) the Commuting Zone and C) Territories in transformation.

Furthermore, the research distinguishes the following steps in methods:

- Step 1: Definition and individuation of 'City'
- Step 2: Individuation of 'Commuting Zone'
- Step 3: Individuation of the 'Territories-in-between'
- Step 4: Individuation of the 'Territories-in-between' in the Focus Area

In Step 1, the research unit mapped the 'City' according to the New OECD-EC Definition (2012) using the following data: CORINE Land Cover 2012, XV ISTAT Census Data and the administrative boundary (fig. 5). Step 1 was done in four sub-steps:

- All grid cells with a density of more than 1.500 inhabitants per sq. km are selected;
- Then contiguous high-density cells are clustered, gaps are filled and only the clusters with a minimum population of 50.000 inhabitants are kept as an 'urban centre';
- All the municipalities (local administrative unit's level 2 or LAU2) with at least half their population inside the urban center are selected as candidates to become part of the city.
- The city is defined ensuring that:
  - there is a link to the political level;
  - that at least 50% of city the population lives in an urban centre; and
  - that at least 75% of the population of the urban centre lives in a city.

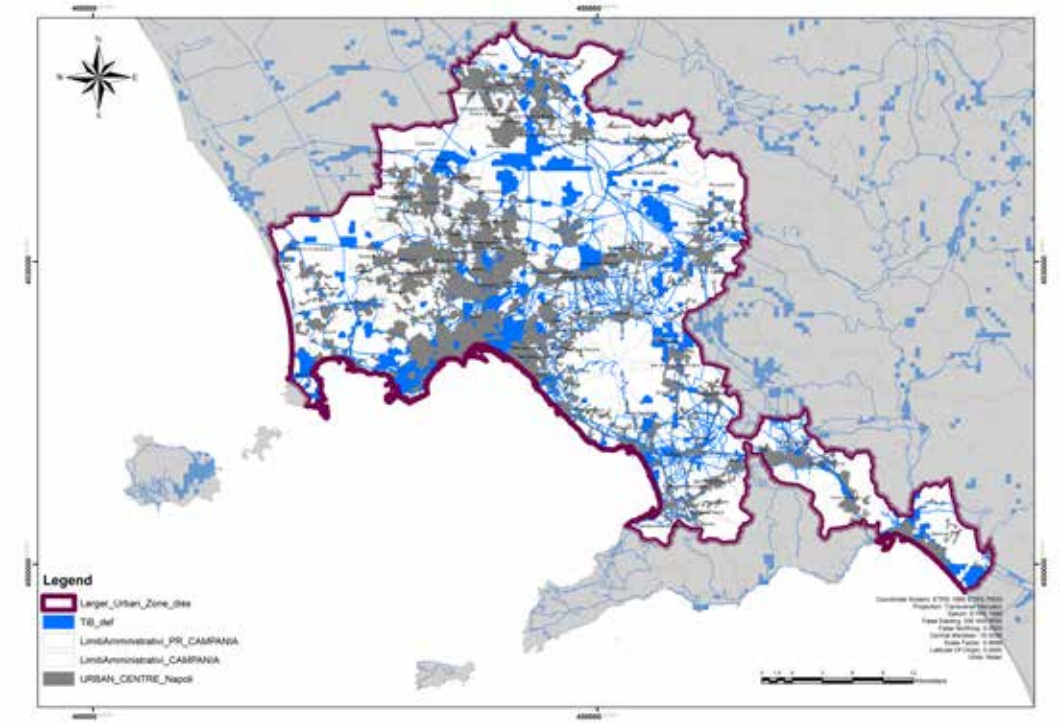

Fig. 7 – Territories in-between identification - 145.000 ha.

In Step 2, the research unit mapped the 'Commuting zone' (Fig.6) according to the New OECD-EC Definition (2012) using the Commuting Flows Data that are in the XV ISTAT Census Data. As for the previous step, the second step requires three sub-steps:

- Less than 15% of employed persons living in one city work in another city, these cities are treated as a single city.
- All municipalities with at least 15% of their employed residents working in a city are identified.
- Municipalities surrounded by a single functional area are included and non-contiguous municipalities are dropped.

The step 3 was achieved with the following GIS operations:

- Dividing the area into 500x500m (0.25 km²) grid cells and selecting those grid cells with a maximum population density that is characteristic for territories-in-between (150-5000 In/km2). This density corresponds in a grid cell a number of inhabitants of 38-1250 In/Cell
- Adding those grid cells, with a maximum rural population that spatially overlap with typical infrastructures and services;
- Subtracting those grid cells with territories-in-between corresponding maximum population that are not characterized by the intermingling of built and open landscape pattern. To this were subtracted the areas that are classified as class 111 in CLC 2012.

At the end the Territories In-Between define the commuting zone with a precise range of population density according with Wandl (2014), and they are not continuous urban areas (fig. 7).

The Step 4 corresponds to the cutting of the x map with a shape of municipalities within the selected focus area.

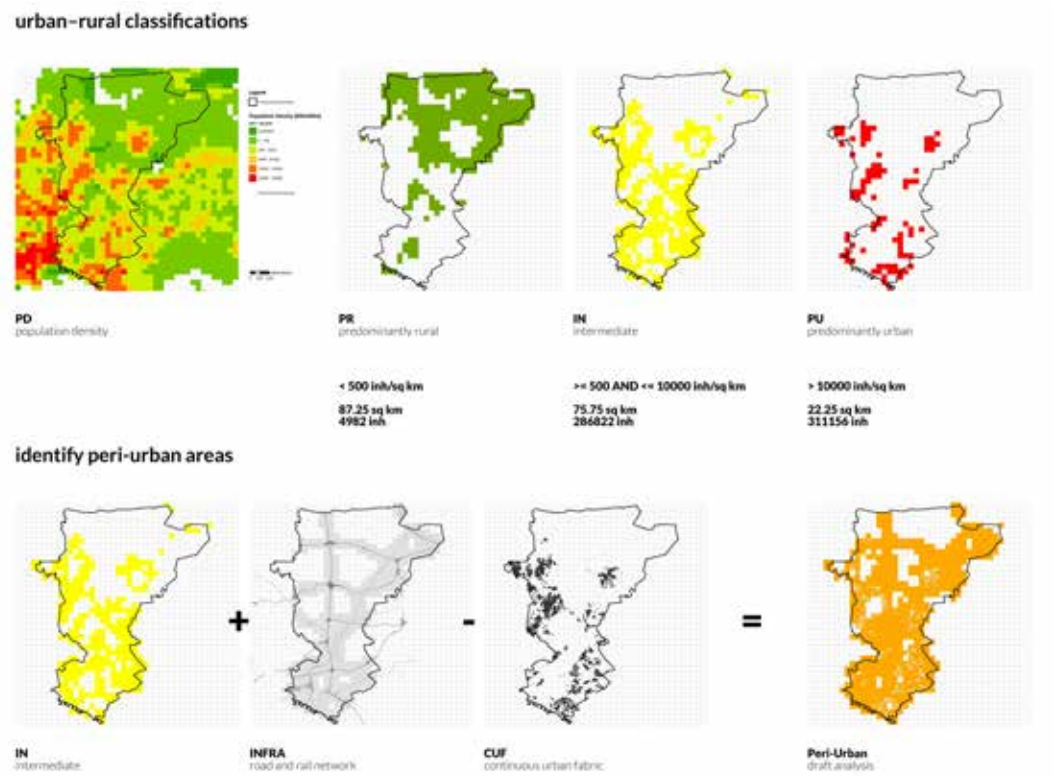

Fig. 8-9 – Urban-rural classification and peri-urban areas identification (Graphic: Pasquale Inglese).

Results and Discussion

The 'territories-in-between' of the Metropolitan Area of Naples are identified from the interconnection of commuting areas and infrastructure networks, excluding the urban continuity.

On a total Focus Area surface of 163.72 km², the area is equal to 4153 ha, so that the 'Territories-in-between' therefore represent the 25% of the whole Focus Area. This percentage (25%) is significantly lower than that determined by Wandl (2014) for Southern Netherlands (54%), but higher that the percentage of the Tyrol Region (estimated as 1%), also calculated in Wandl 2014. Furthermore, the 'Territories-in-between' value (25%) is consistent with the observation of the Metropolitan Area of Naples, and it strengthens the idea that an approach based on the land cover category 'urban-discontinuous' as a starting point would be misleading. The result is that the 'Territories-in-between' not correspond to the whole Focus Area. Conversely, they define specific areas within the selected area where it is more likely to find wastescapes and territories in transition of uses. Therefore, the 'Territories-in-between' were selected within the commuting zone, and featured by a precise range of population density. Furthermore, the originality of the research approach is to not consider these areas through the assumption of the spatial proximities with the city.

It is possible to recognize numerous spaces 'in transition' and in a 'waiting condition', such as the Eastern part of Naples, the fringe areas of Casoria, Acerra and Afragola (fig. 8), the vast plain around Caivano (fig. 9), and many others. These 'stand-by-spac-

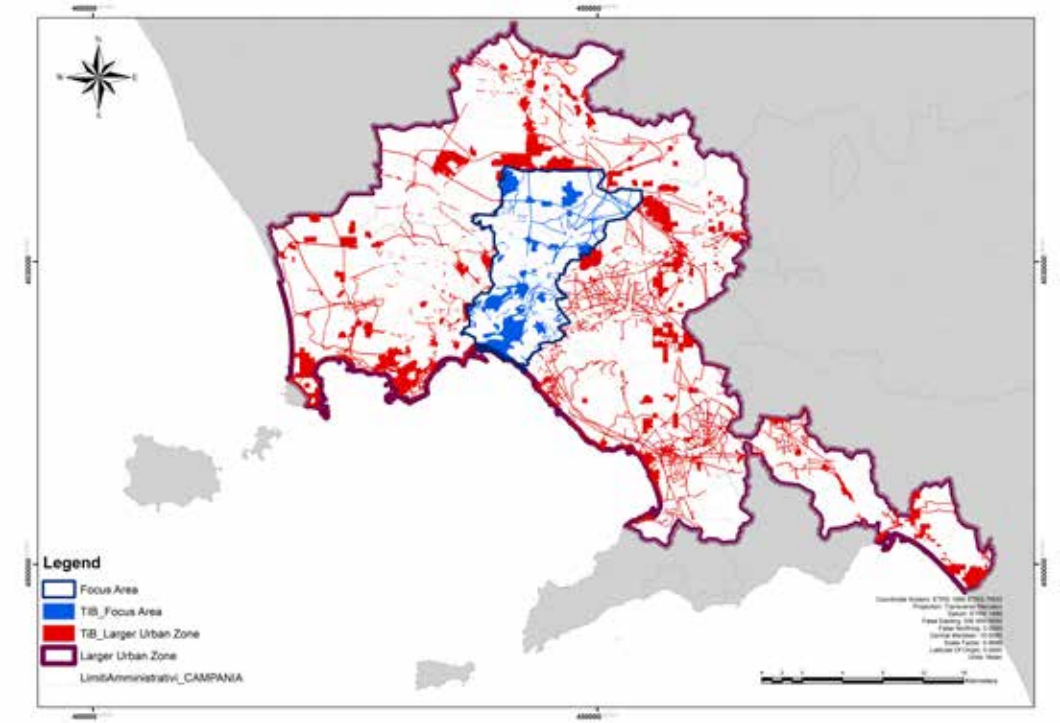

Fig. 10 – Territories in-between identification – additional approach.

es' are declining or have ended their lifecycle; today they represent spaces with a strong potentiality. Indeed, they can represent strategic parts for the regeneration of the whole Focus Area, especially if included in the new topological and functional framework that can result by the on-field work with residents and stakeholders.

Conclusions

In conclusion, we assume the Wandl approach is not considering peri-urban as a gradient, resulting from the distance of the urban center to the edge fan, while the definition of peri-urban as areas with both urbanization features and infrastructure availability. These results are consistent with the description of the urban typologies recorded in the Focus Area by the aim of fostering a change in sustainable resource management, and thereby preventing waste generation. Through the recognition of the territories-in-between, REPAiR aims at providing dedicated design and planning approach by which reducing wastescapes and expressing the site potentials in terms of planning, providing new uses for the wasted lands consistent with the local needs (i.e. new public spaces, as green infrastructures with high eco-systemic values). Planning and architecture are also considered key challenges to reconfigure peri-urban areas, asserting new collective identities, overcoming the social and ecological vulnerability of those territorial systems (Russo, 2012).

In the current phase, the process of selection of the Focus Area through spatial analysis has shared within the Living Lab carried out in the Afragola Municipality, where a wide range of stakeholders is involved in (Ståhlbröst and Holst, 2012). Moreover, the territories-in-between defined through the spatial analysis could be used by local authorities, to better recognize and manage urban issues in terms of

Fig. 11 – Fringe areas between Casoria and Afragola (Photo: Anna Attademo).

waste reduction and management, by the aim of applying circularity models, including those of Circular Economy. Such ambitious goal explain the reason of identifying such analytical methods for enhancing the spatial relations between waste cycles and urban metabolism, focusing on the specific characteristic of the territories. The methodology could be applied for the entire Metropolitan Area of Naples.

The methodology for the selection of the case study area is scalable and transferable to other European case studies of REPAiR, considering the local differences. Moreover, the selection of the territories-in-between can be tested through the participatory process, together with the stakeholders involved in the Living Labs (fig. 10), generating new ideas, creative innovations and strategies for the implementation of circularity in planning and in local economies.

Endnotes

[1] All the paragraphs have been written and approved by all the authors M. Rigillo, L. Amenta, A. Attademo, L. Boccia, E. Formato and M. Russo.

[2] See more at the link https://ec.europa.eu/programmes/horizon2020/.

[3] REPAiR has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 688920.

[4] In REPAiR research proposal is used the term 'Wasted Landscapes', referring to open spaces as well as built entities, like buildings and infrastructure. In the development of the project, the research team widened its meaning, introducing the term 'Wastescapes', referring to the material and immaterial condition of these landscapes.

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Fig. 13 – REPAiR Waste Geography and 'circular features' in Peri-Urban Areas (Image credit: REPAiR proposal. Graphic: Libera Amenta).
Fig. 14 – REPAiR's stakeholders landscape (Image credit: REPAiR proposal. Graphic: Libera Amenta).

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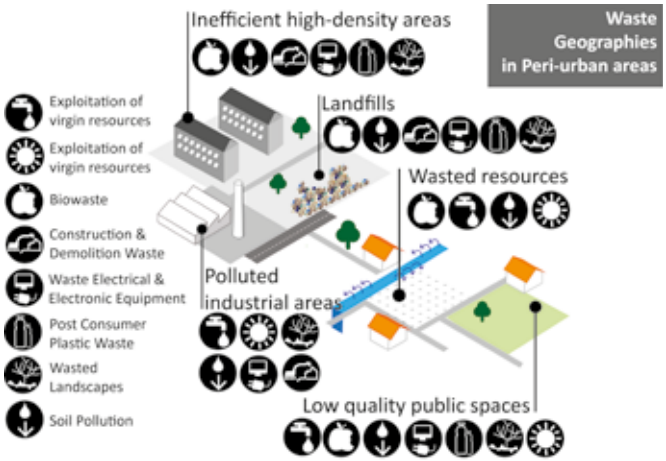
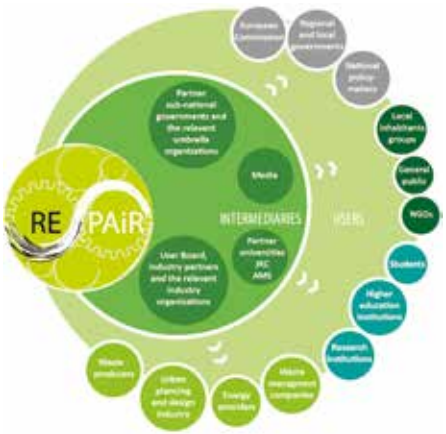
Fig. 12 – Wastescapes in the Metropolitan area of Naples (Photo: Libera Amenta).





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