

IMPLEMENTATION OF ECOLOGICAL NETWORKS IN LOCAL PLANNING:  
OPERATIONAL MEASURES

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**SOMMARIO**

This paper proposes a reflection on the possible role of landscape and ecological networks within the local urban planning practices. We are faced with a constant population growth in cities and peri-urban and marginal areas are increasingly subject to environmental degradation. Therefore, it is necessary to identify and recognize the ecological values of the environment to define plans and natural resources. This contribution, starting from some pilots conducted in Piedmont Region, reflects about the urban planning operational paradigms, the importance of green infrastructures and ecological quality for sustainable and resilient city is sustained by a proposal of local planning regulations. The paper aims to tackle two general issues: first, the quest for new forms of implementation based on the channelling and coordination of the public administration and on the operative responsibility of private parties; and second, the integration of the approaches to planning the urban and ecological problems with the aim of ensuring complete compatibility between urban transformation and the demands for environmental quality. The ecological regulations described in this paper propose an evolution of the meaning of the planning standards, especially those applicable to green space: the regulations in fact consider the collective use of green spaces a crucial requisite, while according priority nonetheless to the role of private areas as an invaluable factor in the environmental regeneration of urban tissue. Therefore, this contribution focuses on an innovative model of planning and management at the local scale, the role of ecosystem services, the relationship between biodiversity of the ecological network structural areas and periurban and agricultural residual ecological areas to be strengthened to improve connectivity between ecosystems.

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## **1. Introduction: ecological networks, protected areas and new urbanizations**

Many researches in recent years focusing on how ecological networks and ecosystem services can contribute to healthy and resilience cities. Worldwide, more than half of us live in cities, and the number is increasing, making urban sprawl a specific fact of our common future: there can be little doubt that cities are where “our struggle for global sustainability will be won or lost” (United Nations [UN], 2012).

Meanwhile, in cities, peri-urban landscapes and beyond, concerns have grown regarding loss of biodiversity and degradation of natural resources, giving rise to recognition of the central role that ecological networks have to play in these territories. The European Commission [EC] in 2013 published a document to promote green infrastructure planning, and mainstream it in Europe (European Commission, 2013). This strategic document underlines the green infrastructures may contribute to sustainable development, enhancing social cohesion, supporting the economy, and adapting to climate change, and highlights the importance of ecological networks and nature-based solutions in cities, where more than 60% of the EU population lives.

In view of these data, in recent years we have seen an exponential growth of urban land use towards more natural spaces: external urban areas (uncultivated land, cultivated land abandoned, the burnt areas, degraded forests) are often been confined to a “inessential” position and sometimes simply considered as “waiting for a new urbanization”. Too often, this is due to poor operability of local plans to lead an urban development coherent with the preservation of natural areas and ecological connectivity. We can identify the consequences of these processes in 6 significant phenomena (Benedict and McMahon, 2002; Voghera and La Riccia, 2018):

- the substantial loss of natural areas: urban development has led in recent years, a reduction of natural areas (in the world, in the years 2000-2010, the rate of decline amounted to about 16 million hectares lost each year);
- the fragmentation of natural areas: a process that determines a breakdown of structural areas of ecological networks into smaller patches, and consequently more isolated from the point of view of connectivity;
- the degradation of wetlands, which have always been an important ecological function for the control of water flows, for the ability to block the sediments, for the support of plant and animal species (stepping stones function) and for the ability to provide nutrients for the ecosystems;
- the inability to ecosystems to respond to change and find a new ecological balance: that is to say a significantly reduced resilience;
- the loss of ecosystem services: natural systems have important “services”, such as the control of water, the filter functions for pollutants, the preservation of the climatic risks;
- the increased costs for public services, due to the response to natural disasters as a result of the ecological footprint by man.

Nature conservation in the city is one of the biggest challenges for sustainable urban development, as a result of a social and ecological coevolution. The value of nature in the city, however, goes far beyond its influence on the inhabitants’ quality of life or rather an intrinsic value: urban areas are surprisingly rich in biodiversity. The conservation and management of nature and biodiversity in urban areas is often vary complex (Antrop, 2001, 2004): there are more people, stronger development pressures, less space, a multiplicity of actors involved, etc. Often, the analyses reveal that the urban natural reserves are few but large and have a high density.

Large natural reserves can be especially important in urban landscapes, as the difference between the urban and natural environment can be high (Powell, Selman and Wragg, 2002). It should be noted, however, that the strategies of urban planning and those of nature are in Italy generally separated. One possible reason is that the protection of nature has favoured a purely “conservative” vision towards nature outside the city and has made trivial and distorted the vision of urban nature conservation.

However, the identification of urban nature is also part of a broader change in perspective within the conservation policies and remains as a necessary point of reference for a sustainable urban development. In many cities, this change of perspective was manifested through the institution of urban areas for nature conservation, supported by a general concept of “urban landscape”. In the urban context, the establishment of these areas has been started during the twentieth century as a reaction to the rapid degradation of the urban environment due to industrialization and the consequent urban growth. It was therefore seen as a necessary step to keep nature and landscape away from private exploitations. Today, instead, the public interest is more oriented to the preservation of social values, biodiversity of nature and landscape. In the recent decades, in effect, the nature conservation and landscape policies have changed: today, a possible alliance between nature and landscape (Gambino and Peano, 2015; La Riccia, 2015) is assumed to be an essential condition for sustainable development and lays itself at different scales (United Nations Environment Programme [UNEP], 1992; European Council of Town Planners [ETCP], 2003; Hooper et al., 2005; Potschin and Haines-Young, 2006; Selman, 2006; International Union for Conservation of Nature [IUCN], 2012).

Until the 1970s, in Italian urban planning, we could not speak about a real ecological paradigm, but of “urban greening”, the distribution of which was generally expected in new districts as well as in historical centres. The creation of urban parks also became one of the focal points of the urban plans. Keeping them indicated a fundamental aspect of environmental continuity in urban space. The consideration of nature and landscape in the Italian urban planning tradition has privileged the aesthetic approach, oriented to the historical and cultural heritage of excellence. During those years, when in Italy the debate was focused on the general “crisis of planning” (Gabrielli, 1995), at the international level an important shift on focus could be observed towards the “landscape planning at the local level” (La Riccia, 2017), a new way of understanding the landscape in the plan, closer to the urgency of reducing ecological problems and supported by an emerging environmentalist currency in the cultural and political scenes. On the one hand, there was a growing need to put an end to environmental disasters; on the other hand, the issue of landscape merged forcefully in different disciplinary contexts.

Urban planning, rewritten through a new ecological paradigm, does not appear to be capable of solving the identification, convenient, of landscape with the natural environment, still promoting an approach, especially design, which remains “promotional”. Sustainable development requires more than designed landscapes that are created using sustainable technologies. Design is a cultural act, a product of culture made with the materials of nature, and embedded within and inflected by a particular social formation; it often employs principles of ecology, but it does more than that, enabling social routines and spatial practices, from daily promenades to commuting to work.

In the Italian experience, indeed, green areas acted as a common element for re-joining city and countryside, that is to say, for the redevelopment of the modern districts in order to reduce the pressures on both historic centres and new districts. The ecological paradigm is therefore a different vision and has guided the practice of urbanism towards a new direction. The environmental provisions now seem to articulate the new practices, coordinating behaviors and reconfiguring the spaces of the city: this means defining new and more ecological functionalist provisions.

To harness the full potential of local ecological networks, however, a carefully conceive, experience-based approach is required. This paper aims to support such an approach by providing information on how to plan for and develop local ecological networks. We can define local ecological network planning as a strategic planning approach that aims to develop and detail the networks of ecological structural areas, designed and managed to deliver a wide range of ecosystem services and other benefits at the local scale. Local ecological network planning can help also to tackle key urban and peri-urban challenges that cities face:

1. Protecting biodiversity
2. Adapting to climate change
3. Promoting green economy
4. Increasing social inclusion

Considering these challenges, local ecological network planning must be based on the integration and coordination of green infrastructures with the urban uses; creating and restoring connections to support and protect processes, functions and benefits that marginalised ecological structural areas cannot provide alone; delivering and enhancing multiple functions and ecosystem services; and finally, including collaborative and participatory planning.

While these challenges provide a fundamental basis for local ecological network planning, certain supporting approaches could be also taken into account:

- *Multi-scale approach*, linking all spatial planning levels, ranging from regional to local scale;
- *Multi-object approach*, including all types of green and blue spaces, public and private, considered as part of a green infrastructure network;
- *Transdisciplinary approach*, linking disciplines, policies, and practices from different fields (landscape ecology, regional and urban planning, landscape architecture, etc.).

## **2. Local ecological network planning and new urban challenges**

Since the Seventies, urban planning practices demonstrated the potential of ecological network to contribute to challenges such as health, species protection, biodiversity protection, climate change adaptation. When understood as part of local ecological network, these and other emerging challenges and trends must be considered not just as obstacles to overcome, but as important drivers for investing the future urban planning choices.

### *1. 1. Protecting biodiversity*

Despite the Protected Areas and Natura 2000 sites are now considered the “backbone” of the European policy for biodiversity, at the local level they are included with a clear difficulty within the urban policies and plans. The policies for the improvement of ecological networks are in fact necessary to overcome the fragmentation of the habitats and natural areas, which is the main cause of biodiversity loss in Europe. From this point of view, in fact, the Natura 2000 network, now implemented in 28 Member States and considered, at Community level, such as the exclusive policy for the conservation of biodiversity values, covering a total of 18.36% of the surface of the member states and It includes a set of sites of Community interest for about 60 million hectares. Then, there is a considerable overlap of these with the surface of Protected Areas that instead corresponds to approximately 22% of the surface of the Member States (European Environment Agency [EEA], 2017).

Loss of biodiversity is a major threat worldwide, requiring attention from policy-makers at the local, regional, national and global levels. Support for halting biodiversity loss has gained increasing attention since the release of the United Nations’s Convention on Biological Diversity in 1992. Major recent initiatives include the UN Strategic Plan for Biodiversity 2011-2020 (United Nations, 2011) and its Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Service [IPBES]<sup>2</sup>, as well as the EU Biodiversity Strategy to 2020 (European Commission, 2011), in addition to many plans at the regional and local levels.

Biodiversity includes diversity within and between species, the variety of original, semi-natural and man-made biotopes (such as forests, dry meadows, or private green spaces) and, at the large scale, the diversity of ecosystems themselves. Although urban growth often negatively impacts upon biodiversity, urban areas can also harbour significant number of species and habitat types, thus offering opportunities both for biodiversity protection and for people to experience nature. Through strategic, integrated coordination and management, local ecological network planning seeks to enhance these opportunities.

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<sup>2</sup> IPBES website at: <http://www.ipbes.net/>

## *2.2. Adapting to climate change*

As a matter of fact, whatever the warming scenarios and however successful mitigation efforts could be, the impact of climate change will increase in the coming decades because of the delayed impacts of past and current greenhouse gas emissions. Cities are increasingly facing the risk and consequences of climate change. Among them, flooding from heavy rainfall, heat extremes, drought, effects on health, higher energy demand for heating and cooling, and reduced availability of water and food (Wilby, 2007). This condition requires an urgent imperative to both mitigate the effects of climate change and adapt to them.

Therefore, adaptation planning is needed to deal with the unavoidable climate impacts and their economic, environmental and social costs. Due to the specific and wide-ranging nature of climate change impacts, adaptation measures need to be taken at all levels, from regional to local, aiming at minimising the risks connected to climate change, protecting public health by improving the adaptation capability of natural ecosystems and the social and economic systems. Climate change adaptation involves making changes to existing systems (natural and urban): this means anticipating adverse effects and taking appropriate action to prevent or minimise the corresponding damage, as well as seizing opportunities that may arise.

Adaptation differs from mitigation, and they should not be considered alternative or conflicting approaches. Rather, they both represent complementary aspects of a comprehensive and more successful policy to tackle all the impacts of climate change. While mitigation operates on a longer time scale and requires a world-wide coordinated approach to reduce gradually greenhouse gases emissions, adaptation acts mainly at the local level and can be modulated according to the different local situations (e.g. local impacts, vulnerabilities and resilience capacities, see Intergovernmental Panel on Climate Change [IPCC], 2014). Both mitigation and adaptation strategies are needed to address the impacts of climate change, however, it is important to be aware that they do not always work in harmony with one another.

Local urban settings show different features than rural and natural areas resulting in different vulnerability profiles concerning the sensitivity of local systems to climate changes (e.g. local dependency on ecosystem services and products, concentration of cultural values, economic activities, etc.), in relation to the adaptive capacity (availability of easily accessible infrastructures or public services). For instance, increasing ecological networks may reduce overall urban density and thus create less-energy-efficient cities, whereas urban densification may reduce the adaptive capacity of cities. For this reason, local ecological network planning can play a key role in strategies for climate change adaptation and, to a lesser degree, mitigation, by delivering ecosystem services (multifunctionality). Important, planned adaptation is more cost effective than emergency measures and retrofitting.

## *2.3. Promoting green economy*

The recent global economic crisis and ongoing environmental challenges, such as climate change, have sparked a renewed interest in alternative economies and forms of growth. Among these, green growth and the transition towards green economy are the most widely discussed (United Nations Environment Programme [UNEP], 2012). A holistic approach to sustainability underpins the green economy concept, which aims for simultaneous environmental, social and economic benefits. Alongside the conventional goals of avoiding costs and fostering economic efficiency, competitiveness and business opportunities, a green economy seeks to improve the quality of urban environments, reduce resource consumption by creating synergies between functions, and provide opportunities for people to engage with each other and with their environment. It is an emerging concept yet to be fully embraced by ecological network planning, although many cities already have planning objectives tied to related concepts like sustainable planning, green jobs, a low carbon economy, or attractive public spaces.

Local ecological network planning can benefit cities' economies in a range of ways, both directly and indirectly. Attractive ecological structural areas can not only improve the city's competitiveness as a destination for new residents, businesses and tourists, but also help to generate income (e.g. food and service industries, through leisure activities and special events, see Rolls and Sunderland, 2014). For local business owners, "greenery" has been linked to positive shopper perceptions, lower stress levels and increased

walkability (La Riccia *et al.*, 2019): encouraging sales, while also increasing staff motivation. It could also support local food production and sale at farmers' markets. A green economy would see all such economic benefits weighted up against their corresponding social and environmental impacts in evaluating their net effect.

In addition to generating income, local ecological network planning can also help to avoid costs, e.g. by creating healthier communities or avoiding the damage caused by extreme natural hazards. About this, a study estimated the average avoided costs from flood damage to housing in a 100-mile-long green infrastructure along the Meramec river in USA to be \$7.7 million per year (Kousky and Walls, 2014).

## 2.4. Increasing social inclusion

Social inclusion can be understood as the capacity of a society to ensure the welfare of all its members, minimising disparities and avoiding inequality. It in general refers to the involvement of a wide range of social groups (including vulnerable ones that are often excluded) in all spheres of life. Making local ecological network planning socially inclusive demands attention to the needs of these different groups. Of particular concern are those with the most difficulties accessing information and articulating their interests.

Social inclusion is related to social cohesion, yet these are not the same. The latter concerns the outcome of local ecological network planning with regard to its social effects, while social inclusive ecological network planning is instead a process of including all social and cultural groups people in decision-making processes. Social inclusion is often talked about in association with the term *governance*, a concept entailing a widening of focus from state-centric government, to further include the role of non-state actors. The concept of governance has emerged in a context where the distinction between “top-down” and “bottom-up” is becoming increasingly harder to see. Instead, both approaches are often in play at the same time: e.g. when a local government authority moves to define a grassroots initiative.

Even though governance is emerging across Europe, recognition of the concept does not automatically lead to the involvement of all population groups and equal consideration of their interests, nor does it mean that social considerations are always given high priority. Recent projects on peri-urban green infrastructure development<sup>3</sup> found that economic growth motives continue to dominate urban planning decisions, and, while ecological protection is of growing policy interest, social justice concerns receive very little attention. Local authorities have a crucial role to play in mainstreaming social inclusion in local ecological network planning together with members of civil society who are empowered not only to participate, but also to take action.

Many levels of participation in planning are possible and these have often been represented along a spectrum, starting at one end with simply informing citizens, all the way to complete citizen control in decision-making at the other end. In European cities, information and consultation processes are usually dictated by laws or regulations. Despite their formality, these processes can help to reveal citizens' point of view. However, ensuring that they sufficiently reflect all residents' interests requires different efforts to engage people. Consultation tends to be less formal in cities where citizens' landscape demand is part of the public policy culture and strengthened by bottom-up initiatives. To promote collaborative decision-making, some cities, such as Aarhus, have agreed on guidelines for people involvement from the outset of all municipal plans, strategies and projects<sup>4</sup>. Another way to think about participation is in terms of co-governance, where power is distributed between authorities and citizens. Citizens can be rewarded with increased influence over decision-making processes and outcomes, while governments may benefit from building trust with citizens and accessing non-traditional forms of local knowledge.

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<sup>3</sup> On this regard, see the EU-funded project of the Alpine Space Programme 2014-2020 “LOS\_DAMA! Landscape and Open Space Development in Alpine Metropolitan Areas” at [https://www.alpine-space.eu/projects/los\\_dama/en/home](https://www.alpine-space.eu/projects/los_dama/en/home)

<sup>4</sup> See more at City of Aarhus website: [https://www.aarhus.dk/sitecore/content/Subsites/CityOfAarhus/Home/The-City-Council/The-Aarhus-model.aspx?sc\\_lang=da](https://www.aarhus.dk/sitecore/content/Subsites/CityOfAarhus/Home/The-City-Council/The-Aarhus-model.aspx?sc_lang=da)

Allowing for and considering social participation in local ecological network planning is a step towards a co-governance framework: there are many ways to increase the willingness of citizens to express their preferences and participate in different stages of the planning process.

### 3. The construction of the ecological network at the local level

Attributing ecological significance and therefore an ecosystem role, not necessarily secondary, to territory means reflecting on a general renovation of the urban planning paradigms, considering the importance of productive, business and policy interests. Therefore, a clear need to define the objectives, which avoid simple “territorial schemes” of new ecological corridors, maybe excellent in aesthetic terms, but lacking of all meanings from the point of view of biodiversity. For this reason, it is important not to stop to analyse only the state of naturalness and diversity at different scales, but it is necessary go further to give priority to the pursuit of ecological coherence of the whole territory: that is to say to link the network with the impacts deriving from human activities and, more generally, to define a framework for urban planning operability.

In this context, several interesting experiences about this issue have been launched in the Piedmont region (Italy) with the aim to improve the overall ecological quality of the natural and landscape areas and specifically indicate the operational procedures to avoid the ecological fragmentation. Between 2014 and 2016 the research “Guidelines for the Green System of PTC2” (convention between Metropolitan City of Turin, ENEA and Polytechnic of Turin) and the “Operational proposals for the ecological network of Chieri” (Polytechnic of Turin and Comune di Chieri, Turin) were conducted with the objective of defining a proposal for the implementation of the ecological network at the local level in two municipalities of Turin (Ivrea and Chieri).

In these experiences, the approach proposed by ENEA was reconsidered to guide governments with specific measures to limit anthropogenic land use and, where possible, orient and qualify the conservation of ecosystem services. Habitats, natural areas and landscape have not been interpreted only by exclusively ecological point of view (a mosaic of ecosystems) but also considering a broader perspective that embraces cultural, social and economic aspects of the Ivrea area. The proposed methodology identifies the ecological character of the territory and defines the criteria for the evaluation of different types of land use: in the Chieri area 97 types of use, according to Corine Land Cover database, were identified. Subsequently, we applied five key indicators for assessing the ecological status (see Figure 1):

- *Naturalness*: the types of land use are classified into 5 levels of naturalness, considering the closeness to the formations that would be present in the absence of disturbance (climax). So, the natural levels ranging from the 1st which includes all natural formations up to a maximum the 4th considering the types of land use at total anthropic determinism but not artificial (like almost all cropland) and the 5th level which includes the types of land use corresponding to artificial areas.
- *Relevance for conservation*: the types of land use are classified on four levels of relevance based on the relevance/suitability of land use for biodiversity conservation at the same time considering the importance for habitats and species. It introduces the concept of interest habitats for species of the Natura 2000 network including not only the habitats of Community interest but also the complex habitats whose conservation is necessary for the protection of species of the Natura 2000 Network.
- *Fragility*: the types of land use are classified in terms of intrinsic fragility due pressures such as pollution, ingression of exotic and invasive species, human disturbance in general. The 1st level includes types of land use that define both natural environments with very low resilience as rock fields or glaciers is semi-natural areas and significant anthropic determinism but easily fragile for both types of land use and poor resilience such as artificial water reservoirs or areas with sparse vegetation.
- *Extroversion*: the types of land use are classified on the basis of the potential “capacity” to put pressure compared to the neighbouring patches. We have considered the pressures in an integrated way that goes from pollution of productions to the spread of invasive alien species. It ranges from



level 1st, which includes types of land use that coincide with the areas with the highest human settlement and able to exert pressure, to the 5th level, containing natural types of land use types of use of the natural ground.

- *Irreversibility*: the types of land use are classified on the basis of the potential possibilities of change in the intended use. The 1st level includes all artificial types of land use totally characterized by the irreversible intended use (for example: urban, commercial industrial zones).

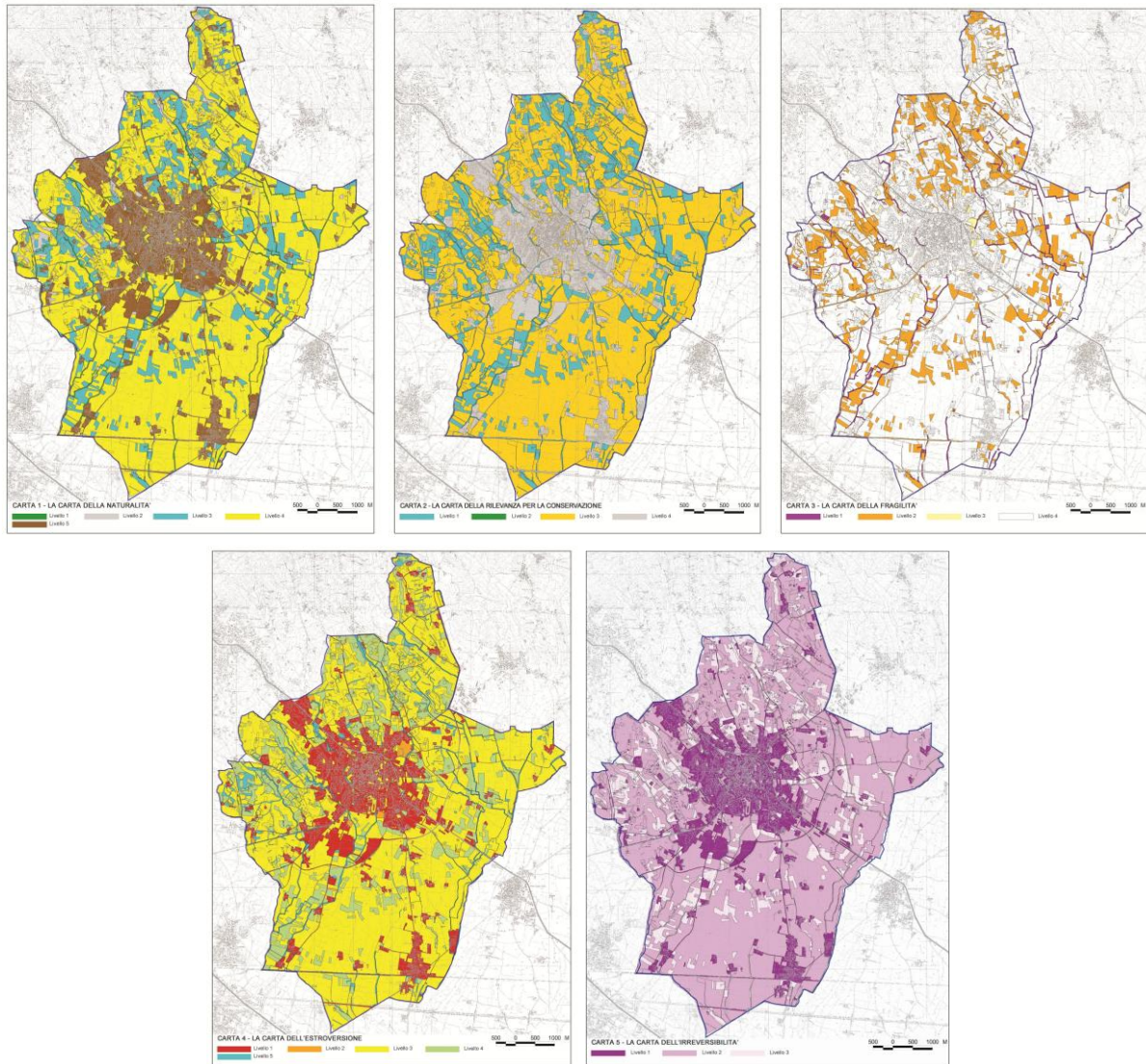


Figure 1. Maps of Chieri territory according to the considered five indicators (in the order of appearance): Naturalness, Relevance for the conservation, Fragility, Extroversion, Irreversibility. Processing Politecnico di Torino, 2016.

From the integration of the results of different indicators the so-called “Structural map of the ecological network” has been obtained (see Figure 2). This map shows the elements of the Local Ecological Network system, chosen on the basis of the levels of naturalness, ecological functionality, geographical continuity, and consists of three main elements:

- *Structural elements of the network* (primary ecological network), namely the areas of high and moderate ecological functions, as well as areas that hosting the specific conservationist emergencies, i.e. of natural and significant importance for the conservation of biodiversity.



- *Priority Network Expansion areas*, namely the at residual ecological function areas where priority action to increase the functionality of the primary ecological network and for which the implementation of protection measures for the maintenance of primary ecological network. These areas are further divided into: Connection areas and Contiguous portions to the structural elements.
- *Possible expansion of the network areas*, i.e. areas at residual ecological functionality, but on which it is possible implement new interventions aimed at increasing naturalness useful to protect the habitat and species of interest for the conservation of biodiversity.

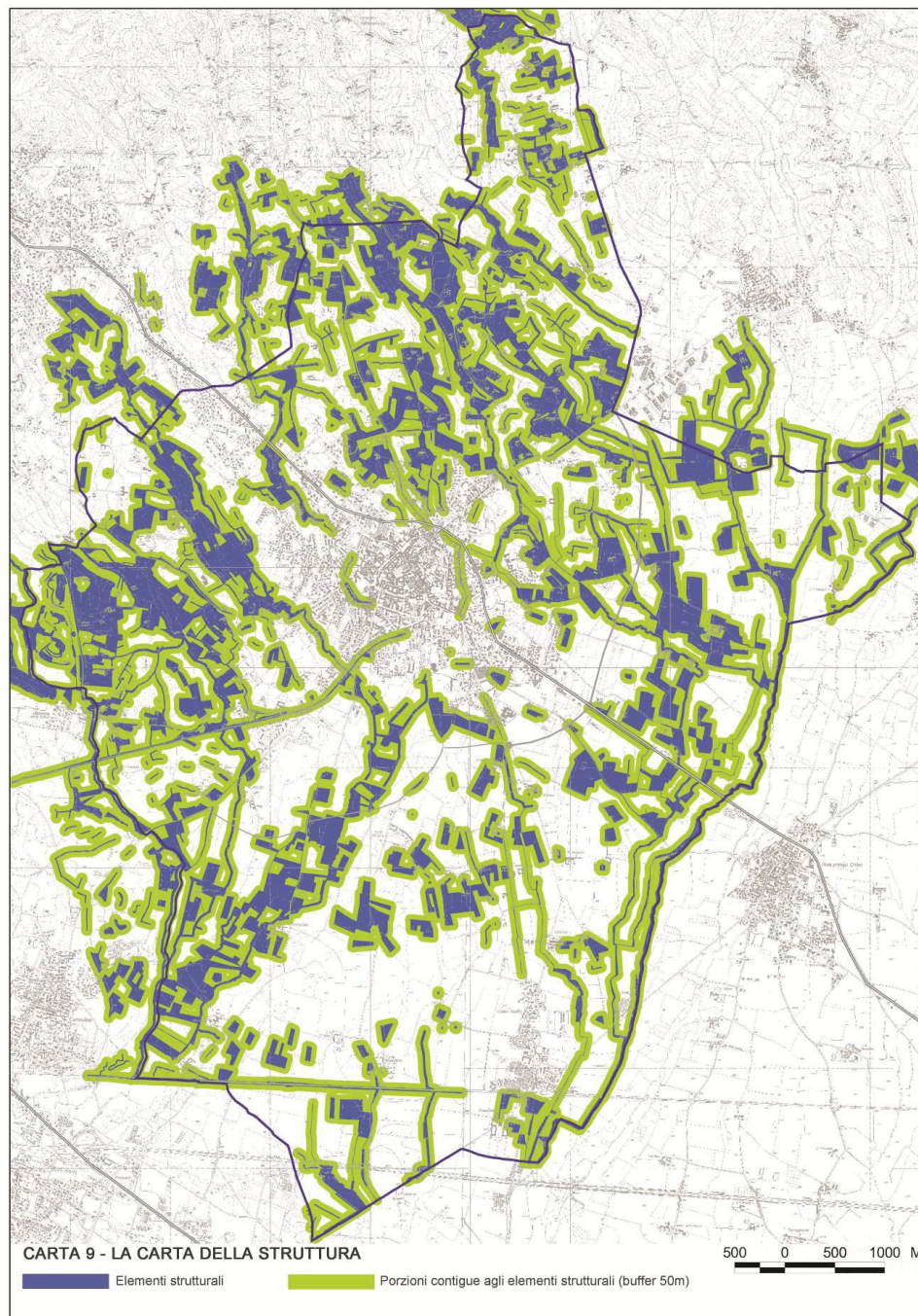


Figure 2. Map of the ecological structuration of Chieri territory. The picture shows the two components of ecological structuration (Structural elements and the Contiguous portions to the structural elements). Processing: Politecnico di Torino, 2016.

#### 4. Rules for implementation of local ecological network in urban planning

In the considered case studies, from an analytical process (framing of the territorial ecological system and public consultation through negotiating tables) it has come to drafting of rules, directly integrated with the urban plans, which include provisions for the implementation tools, such as spatial equalization measures, compensation and mitigation of impacts and provisions for the urban green management.

These implementation mechanisms are designed to intervene where projects and actions included in the urban plan could lead to changes of the level of the local ecological functionality. The procedure for the definition of the compensatory measures for impacts not mitigated includes an analytical phase, an assessment phase, a phase of planning/design, an implementation phase and a phase of management and monitoring:

1. recognition and evaluation of the ecological relevance of the compensatory areas, through the evaluation of urban-environmental state;
2. definition of possible measures for improvement and protection of the ecological and landscape value, for each area identified for compensation;
3. setting priorities for action, to increase biodiversity and the sustainable use of the territory;
4. choice of the compensatory measures;
5. design of compensatory measures, based on the characteristics of each lot chosen;
6. updating the natural value of the areas subject to compensation.

For the implementation of the ecological network into urban planning the selected measures have to be concrete, feasible, included into the landscape framework and coherent with the sectoral strategies defined at higher levels. In order to enable institutions to act towards a well-implemented local ecological network the following factors need to be considered:

- provisions of incentives, funding and authorisation to enable local action;
- strategic direction through regional level strategies and action plans;
- regional coherence of local urban plans and measures through coordinating activities.

Some rules are introduced for the urban green: the idea is that urban green spaces can contribute, with the green development of the rural environment, to the landscape quality of the territory. The defined parameters for the green management integrated (i.e. in the case of the City of Ivrea) the list of plant species adapted to the general urban conditions (climate and soil), as well as the conditions imposed by the urban environment, such as the resistance to pollution and pests. In the selection of plant species, it is indicated to have to consider: at least 50% of native species or particularly suitable to the urban environment and less than 25% of non-native species or naturalized (hence excluding the weeds or plant with relevant on-going diseases).

The urban nature conservation requires also new conditions: ecosystems, such as landscape, transcend the scales, beyond just the urban area. We need to understand, within the rules and projects, that green is no longer just a mere architecture of context but contributes, primarily, to create a complex system, unitary consistent with historical heritage and environmental dynamics. We can identify five key passages through which to build this system (Voghera and La Riccia, 2016):

7. Transposing the ecological network elements at regional level and verifying the implementation and the possible expansion at local level (the network project must become an integral part of the territorial vision).
8. Defining the appropriate modalities for intervention favouring the natural use for the areas included in the network.
9. Making the local ecological network also through the institution of urban and territorial equalization models giving priority to the protection of rivers areas and public lands.
10. Ensuring the correct inclusion of allowed building work and the prohibition of definitive elimination of trees and shrub formations, including rows, hedgerows, etc.

11. Defining compensations and mitigation measures of impacts deriving from urban transformations, consistent with the goals of enhancing the local ecological network and the landscape quality.

An important section of the legislation on a local scale for the construction and implementation of the ecological network at local scale is represented by the penalty system, according to two main aspects. For the purposes of protecting the ecological-environmental system that constitutes an asset of landscape interest, the author of a damage in the matter of the protection of landscape assets must, alternatively, either restore the state of the places at his own expense or pay a sum equivalent to the cost to restore the damage caused by the administration. For the purposes of protecting the ecological-environmental system that constitutes an asset of landscape interest, the author of a damage in the matter of the protection of the landscape assets has two alternative measures: the sentence to the remittance in restoration at his own expense of the state of the places or of the failure realization of a project concerning the environmental system. In the first case, it will have to pay a sum equivalent to the greater amount between the damage caused and the profit achieved through the transgression, entrusting to the administrative authority in charge of safeguarding the constraint the choice, deemed most appropriate, between one or the other sanctioning measure. In the second case, it will be sanctioned with a fine equal to the payment of the expense to be sustained for the realization of the project increased by 20%.

## 5. Conclusions

The case studies have been shown to be an effective means of testing new approaches. They can encourage similar methodologies and convince decision-makers that an idea is worth pursuing. Learning from these examples can also help to adjust and refine a local planning strategy.

Before developing a planning strategy based on local ecological network implementation, local priorities need to be defined. Such priorities are often driven by widely-recognised challenges may present windows of opportunities for urban development and decision-making overall. The underlying principles of ecological network planning here need to be understood as part of a holistic approach based on landscape and need to be adapted to the local planning system, social, economic and environmental conditions, as well as the available stakeholders.

Local ecological network planning requires a complex whole of interventions useful for the optimal provision of services and the quality of living conditions, aimed at production and production public and private wealth distribution, characterized by an eco-systemic approach, with which the city is negotiable as a dynamic organism. Water, energy, waste are the cycles on which to intervene. Bring natural components into harmony different urban forms allow to recover relations between spaces open and built spaces, buildings, soils, morphologies. Production urban agriculture, new solutions for public lighting linked to sustainable mobility and energy production, the reconfiguration of urban fabrics to improve conditions microclimatic and for perceptive wellbeing, aesthetic quality and the functionality of the pedestrian and cycle paths, the connection among parks, city gardens, cultural assets are components a positive environmental balance, which, at the same time, favour inclusion, propensity to care and sociality, restore degraded values, recover residual and abandoned spaces, produce common goods.

Therefore, urban planning it is not a field confined into the technical sector; it can be to become a collective field, assigning to social and environmental values an economic relevance, putting to centre of attention, habitability, defining new types of spaces public, overcoming the season of volumetric rewarding, for an effective and concrete solution to the inequalities: between centrality and marginality, between city and modern campaign, places, redeveloped parts and parts that will have to looking forward to the conditions to be reborn. With this change of approach, it is possible to change behaviours and lifestyles, financial costs and environmental factors associated with current urban conditions; new economies can be activated, together with job opportunities. It is time, therefore, to move from the technical standards designed for

growth of the city to the facilities for the quality of the various urban forms, from destinations of use to activities, from predetermination to compatibility and environmental suitability.

Ecological networks are the key to planning the city of tomorrow, to strive to the settlement balance, to reduce risks, to promote policies integrated, adhere to the contexts and support the improvement of conditions of populations and productive capacities. The networks the operational fields of structural planning are no longer confined to municipal administrative limits, so as to provide territorial standards for citizens moving in the areas metropolitan and vast, interdependent ones. Finally, they involve the necessary integration of management into projects, to measure ecological quality and the supply of ecosystem services, abandoning an administrative approach based only on protection of territorial assets.

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