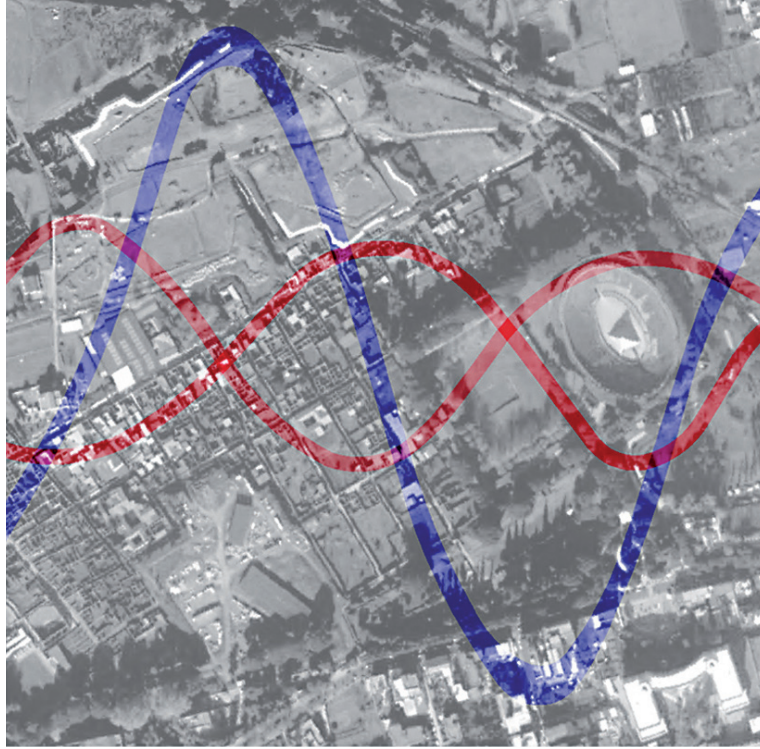


ARCHITECTURE HERITAGE and DESIGN

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XVII INTERNATIONAL FORUM

Le Vie dei
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Le Vie dei Mercanti
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Conference report 300 abstracts and 650 authors from 39 countries:

Albania, Australia, Benin, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, India, Italy, Japan, Jordan, Kosovo, Lalaysia, Malta, Massachusetts, Michigan, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russia, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

Preface

The XVII Forum “World Heritage and Legacy” addresses the issue of the handed down in the sense of transmission over time of generation, at the state of knowledge, the material and immaterial heritage that comes from the past. A generational commitment to operate, in the cyclical temporal process, in order to preserve and protect the cultural heritage; a duty of the present generations to deliver to the future generations the legacy of the past at least in the same conditions in which it is received.

A commitment that takes on an even more meaningful significance in a historical moment that is crossed by destructive and iconoclastic wars and by great migration phenomena involving abandonment of territories undermining the identities of places, traditions, material and immaterial culture, which characterize the Cultural Landscapes. A re-appropriation by humanity of the value of a biological continuity that is traceable in its genetic complexity as a custodian and bearer of the memory of the past and, at the same time, belonging to those who live in the future by living the present. Moreover, “to the state of knowledge” should not be interpreted as a limitation but as an exhortation not to live on the position income and above all to remind men that they were not “made to live like brutes but to follow virtues and knowledge”.

Knowledge therefore contains an evolutionary value in the history of progress. Where knowledge is substituted by acts or policies conducted by brutal and unreasonable actions against Humanity and its Patrimony, a fracture on historical continuity is created, which produces a negative value due to the great expenditure of economic resources and loss of human values. Therefore, in the awareness that the value produced by the past generations, which have given us and above all entrusted as heritage to be transmitted to the future is not commensurable to the value of time to re-establish and restore continuity to the regenerative space of the common good, it is impossible to activate more and more moments of reflection and I would say to monitor the behavior of supranational cultural policies.

This in the spirit of inducing to avoid the disastrous temporal intervals that involve serious losses of the human heritage, which break the glue that binds the generations. Architecture, Cities, Infrastructures and Landscape not only represent the form of time but all the disciplines that have contributed to and contribute to their characterization. The form of time is the body of a cultural program of society and the modification project makes use of the knowledge at the date. Economics, mathematics, physics, in one the sciences are always traceable in the construction of man’s works, from the simple artifact to monumental architectures, to cities, to large infrastructures. In fact, with

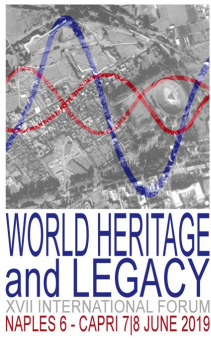
the previous sixteen editions of the International Forum “Le Vie dei Mercanti” an interdisciplinary community has been created of about 6000 scholars and researchers, coming from over 50 Countries of the World. These have presented realized projects, theoretical research, good practices, technological innovations, which are recognized in the principles and actions to be carried out so that the Planet with its species can always adapt itself to the needs of humanity in a sustainable reciprocal relationship for the salvation of the same Planet. And if Beauty will save the world, the principles and actions shared in these sixteen previous years will find with the seventeenth Forum a moment of evaluation of the state of art so that they can increasingly reach, interest and belong to as many people as possible such as Governments, Institutions, Universities, and Enterprises.

This is to create and disseminate a new Humanism that acts as a generational glue through a review of the inheritance concept, or of an ongoing heritage formed by resources intended as lot, which, declined as an income statement, create solidarity, peace, trust, work with art and quality of life.

For these reasons and for the history of the Forum, I am sure that the scientific community will establish a debate in Naples and Capri on 6th, 7th and 8th of June which will bring further richness to the discussion among researchers who have faced the protection and safeguard of heritage handed down to us and the researchers who through their works will be the bearers of the future legacy.

Carmine Gambardella

President and Founder of the Forum



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Ecological Network from regional to municipal scale. The case-study of San Tammaro (Ce)

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Abstract

Ecological Network involves the whole territory, the elements that make it up are recognizable:

- at *regional scale* in: national and regional parks, **Site of Community Importance** on the conservation of natural habitats and of wild fauna and flora (Habitats Directive 92/43/EEC), **Special Area of Conservation** of wild birds (Birds Directive 2009/147/EC), agricultural and forest areas and ecological corridors;

- at *provincial scale* in: areas of high naturalistic value, natural areas of naturalistic completion, urban and peri-urban areas for widespread ecological reconstruction, gates and contaminated areas;

- at *municipal scale* in: primary and secondary nodes, buffer zones of these nodes, areas of environmental protection, ecological connections, linear and punctual elements of local ecological network such as the gates of this network, the eco-fruitive connections between area with diffused naturalness or in anthropized areas, the fruition routes and the support areas.

EN represents the fundamental sub-network of the **Green Infrastructure** that is an equipped macro-network able to perform multiple functions and consists of a system of interconnected networks with green spaces that preserve the natural values and functions of the ecosystems and provide multiple benefits to the human population. Planning, design, implement and manage an efficient EN helps to stem climate change, rising temperatures, decreasing rainfall, increasing extreme weather events and the urban heat island effect. The recognition, protection, environmental regeneration and new realization, at various scales, of an EN is a real possibility both to mitigate the effects in the short term and to affect the causes in the long term too.

The paper explores the implementation of an EN at the municipal scale as a fundamental element to design the town land use plan starting from a case-study to identify elements of generality distinguished from the territorial specificities.

Keywords: Eco-Planning, Urban Ecosystem, Green Infrastructures, Ecological Networks

1. Anthropized territory and fragmentation

Pseudo-urban contexts, characterized by fragmentation of functions, are also places of environmental fragmentation, i.e. in the context of anthropization of the territory the natural areas are divided into more or less separate parts. The double fragmentation that we see in man-made territories represents not only one of the major causes of urban imbalances, but also one of the main threats to the conservation of biodiversity, making it necessary to study the connectivity of the territory/landscape [1]. It represents the degree to which the environment facilitates the movement of flora and fauna and, in the context of the ecological restoration of the territory, is now an important shared objective. A distinctive feature of contemporary anthropized territory is precisely the fragmentation, Cusinato [2] in 2004 writes that, *we would therefore be witnessing a process of socio-spatial fragmentation, in the sense that different segments of society would tend to separate permanently even from the spatial point of view, cluttering in specific portions of the urban territory, under the action of both*

agglomerating forces within the individual segments, and mechanisms of segregation put in place by the dominant ones, so that the urban fragmentation would result from the joint operation of social fragmentation and spatial fragmentation. Vidal [3] already stated that urban fragmentation, as a phenomenon directly linked to the explosion of traditional urban morphology (referring to different historical periods) can be generated both for the construction of the urban complex through different parts (generating a *continuous discontinuity*) and for the deconstruction of the urban, social or economic whole in various sectors (generating a *discontinuous continuity*) [4].

Without getting into the debate on urban fragmentation, but focusing only on ecological fragmentation, also starting from the Index of fragmentation of the urban landscape (included in the Urban Index [5] - Indicators for Urban Policies), it is clear that fragmentation refers, by contrast, to the concept of network that represents the system of connections to which one should strive through the implementation and/or restoration of ecological continuity. In the strategies of conservation and reconstitution of biodiversity, it is therefore not enough to protect individual isolated natural areas, but it is essential to connect or network them through landscape-environmental restoration, ecological restoration and the creation of new natural areas.

The increasing anthropization (often with functional and morphological urban fragmentation with reduction of biodiversity, consumption of resources) of urban and territorial contexts, the awareness of the impossibility of regenerate all resources as well as their conservation for future generations mean that ecology (urban [6] and landscape [7]) and Land Planning [8] are looking for a synthesis both to provide an interpretative contribution to the analysis of environmental/territorial issues and to identify intervention techniques aimed at their mitigation or restoration of habitats. In this perspective, it is necessary to plan land transformation interventions aimed at achieving greater efficiency in the management of available resources, such as the control of land consumption, biodiversity, the production and maintenance of eco-system services, and the reduction of climate-changing gas emissions. The ecological objectives that increase and improve the eco-systemic quality of the habitats and the degree of biodiversity of the territory thus become part of the priorities of the urban planning, the traditional physical planning, recognizing in them the superior public interest, evolves towards the *Eco-Planning*. The planning, design, implementation and management of an EN, at various scales, is identified as a priority element of a GI, a macro-network instrumental in reducing environmental/territorial problems. In this cultural and technical context, *Eco-Planning* is experimenting with new techniques to mitigate the effects of strong anthropization for a better quality of life of the communities settled. The EN can represent a valid tool of the urban planning in the reconstruction/construction of the continuity of the natural or para-natural eco-systems. Urban planning opens up new design perspectives oriented towards mitigation and adaptation, using design techniques that become a fundamental part of urban planning (ecological system/network) and that direct the use of land towards ecological criteria and optimization of resources in a perspective aimed at achieving a new urban condition of closure of cycles and greater environmental sustainability.

2. Green Infrastructure and Ecological Network

The definitions of GI include both those that consider green spaces and their interconnections and those that refer primarily to connections between green spaces, in either case there is a tendency towards interconnectivity, which in turn refers to the interpretative paradigm (and design technique) of the network [9] and, specifically, of EN, of accessibility and public use, of historical goods and of the agricultural fabric.

These definitions are many and, to name but a few, it is possible to list those developed by the United Kingdom in 2007 (2015) with the *Green Infrastructure Planning Guide* [10], by the United States in 2009 with the *Environment Protection Agency - EPA*, by the European Commission in 2009 [11]-2010-2013 [12], by the *Observatory of Sustainable Cities of the Polytechnic and University of Turin* [13] in 2010 and by the Italian Ministry of the Environment [14] in 2013 (Fig. 1).

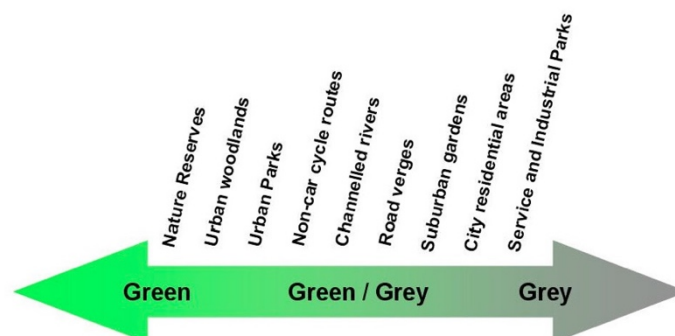


Figure 1: The Gray-Green continuum (Source: Davies et al. *Green infrastructure. Planning guide*, 2015, p. 3)

From a comparative reading it emerges that they agree in defining the GI as an equipped macro-network, able to include multiple functions, consisting of a system of interconnected sub-networks [15] to green spaces, both new and existing, both rural and urban, that promotes and supports natural and ecological processes with the main aim of preserving natural values and ecosystem functions, all aimed at improving the health, well-being and quality of life of the human settled communities. The GI includes together natural and semi-natural areas, agricultural landscapes (open and intact) and fragmented peri-urban fringes or those with a high degree of incorporation in the urban landscape.

GI includes the EN while the GI is multifunctional because it associates to the landscape and ecosystem aspects those related to agricultural forest production, recreational activities, and mobility, the EN is monofunctional because it concerns in a more limited way the eco-systemic characteristics. The EN can be regarded as a planning technique aimed at the protection/enhancement of biological diversity and landscape with the aim of connecting areas of significant environmental and landscape interest in a continuous network. It is an advancement and integration of the model of protection focused on protected areas isolated like islands immersed in an anthropized territorial matrix.

Various definitions occur in scientific literature for the EN too [16] such as the one proposed by ISPRA [17], which considers the EN as *a system of natural habitats physically and functionally interconnected, through the populations of species and ecosystems whose biodiversity must be safeguarded, thus taking care to potentially endangered animal and plant species*, and the other developed by the OSC, which defines it as *a monofunctional system aimed at increasing the degree of biodiversity of the territory and a system of natural landscapes that improve the natural heritage and environmental quality of the network of cities*.

From a comparative reading of these definitions it is possible to extrapolate the elements that constitute an EN:

- *Core areas* that can be sub-articulated in *primary* and *secondary*: high nature areas that are large (the former) or made up of a number of smaller areas (the latter) but well connected to each other. These are parks or reserves, EU SCI and SAC, wooded areas of significant size and wetlands that are already, or may be, subject to environmental protection;
- *Ecological corridors*: regional, provincial and local (ecological passages) connecting areas, widespread and of particular naturalistic/landscape interest. They constitute connective areas of core areas, morphologically they are linear and continuous bands that connect the areas of high naturalness, they represent the key element of EN because they allow the mobility of species and the genetic exchange, a phenomenon essential to the maintenance of biodiversity. They can be sub-articulate in *robust connection areas*, consisting of wide river corridors or wide wooded areas and *weak connection areas*, consisting of corridors of smaller rivers with related wooded areas or networks of rows of trees and hedges or eco-ducts;
- *Buffer zones* or ecological buffer or complementary habitats also divided into *primary* and *secondary*: crown areas around the core areas, primary and secondary, highly natural areas designed to ensure the necessary gradualness of the habitats and to protect them from the negative influences of the context. These are buffer zones or transition areas subject to protection rules that limit the interventions of transformation of land uses for nature protection purposes;
- *Stepping zones*: small areas which, due to their strategic position or composition, represent important elements of the landscape to support species in transit on a territory or to host particular microenvironments in situations of critical habitats (e.g. small ponds in agricultural areas);
- *Nature restoration areas*: intended to increase and/or reinforce existing core primary or secondary areas. These are: areas destined to the enlargement of the previous nodal areas; nodal areas to be reconstituted ex-novo through forestation and/or reclamation interventions of sites destined to extractive activities or to landfill or to illegal vegetable gardens and settlements;
- *Areas of ecological defragmentation*: green areas highly fragmented and insulated in the disintegrated settlement tissues of peri-urban fringes;
- *Protection areas*: agricultural areas whose management follows criteria of ecological protection of water resources, fauna and flora.

EN can be defined as a sub-network of the most articulated and complex multifunctional macro-network of the GI and has the fundamental objective of preserving, strengthening, enhancing and reconstructing the connections between the natural and semi-natural environments of the territory. The large area eco-connections identified and/or planned in the **Regional Ecological Network** and **Provincial Ecological Network** projects are of ecological interest as they support environmental continuity, increase biological diversity and the self-generating capacity of the ecosystem itself without hindrance and the weight of anthropogenic actions (Fig. 2-3).



Fig. 2: Spatial configuration of an Ecological Network, on the left

Fig. 3: Eco-bridge, on the right

3. Campania REN and Caserta PEN

The provision of an EN, as essential component of a GI, is a mandatory choice for urban planning that aims to integrate the natural environment in the process of transformation of the territory (*Eco-Planning*), in order to counteract the reduction of biodiversity and promote relations between the human territory and natural and rural elements of the territory. The current experiences, although differentiated in conceptual and operational strategies, show to recognize that the GI and the EN should be considered as fundamental components of the territorial and urban infrastructure of man-made territories so as to require the identification and planning of them in territorial and urban planning, from the large area to the municipal and sub-municipal, with specific functions and content to vary the scale of intervention [18].

Campania **R**egional **T**erritorial **P**lan [19] foresees among its strategies the realization of the REN [20] and its configuration on the territory through the structural/operational planning of the PEN [21] and the structural/operational planning of the **M**unicipal **E**cological **N**etwork. The REN is recognized as a priority infrastructure by the RTP and is a strategic tool for provincial and municipal planning. The main corridor of Campania REN consists of natural parks that winds along the carbonate reliefs placed on the regional longitudinal axis from north-west to south-east. This corridor is a segment of the Apennine mountains corridor that extends to Calabria region and the Nebrodi and the Madonie Mountains in Sicily. A second corridor, of great strategic importance, is part of the Tyrrhenian coastal corridor, used by the migratory birds. Unlike the first, which presents few crisis points in the crossing of some intensely populated valleys that separate some carbonate massifs, it winds along the coastal strip and is characterized by numerous crisis points due to excessive settlement pressure along the Campania coast; it is therefore a connecting corridor to be strengthened. All the transverse and longitudinal corridors that connect the coastal strip with the inland areas in the direction of Puglia, Basilicata regions and the Adriatic Sea, as well as those that go up the clayey sandy Apennines in the direction of Molise region (Fig. 4), must also be strengthened. Moving from the strategic form of planning at regional level to the structural/operational one at provincial level, the priority objective of the PEN will be to contribute to the construction of the connective tissue of the network, through more minute and targeted interventions, both within the agricultural areas and within the urbanized areas. With reference to the territory of Caserta province, the REN consists of the ecological corridor of the main Apennines mountains and the transversal regional ecological corridor connecting Caserta, Benevento and Foggia provinces. The province is affected by areas of maximum eco-system fragmentation mainly due to the phenomenon of very intense urbanization of large infrastructure and the heritage of second homes, often illegal, due to polluting discharges, water withdrawals and ecological barriers that have made the coastal strip a *territory of high environmental criticality* to be urgently remedied (Caserta **P**rovincial **T**erritorial **P**lan, Report p. 18). The mountain systems of Caserta Province cover about 75.000 ha, equal to 31% of the provincial territory, they contain the main portion (more than 80%) of the natural and semi-natural habitats present in the provincial territory and constitute the backbone of the PEN. Many of the agricultural and grassland areas of the mountain ranges fall within the EU definition of *agricultural areas of high naturalistic value* and represent key elements of the PEN (complementary habitats or buffer zones).

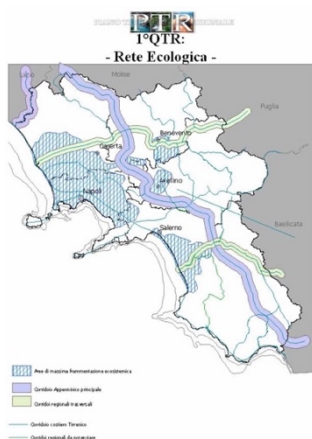


Fig. 4: RTP of Campania - Forecasts: **Regional Ecological Network**, on the left

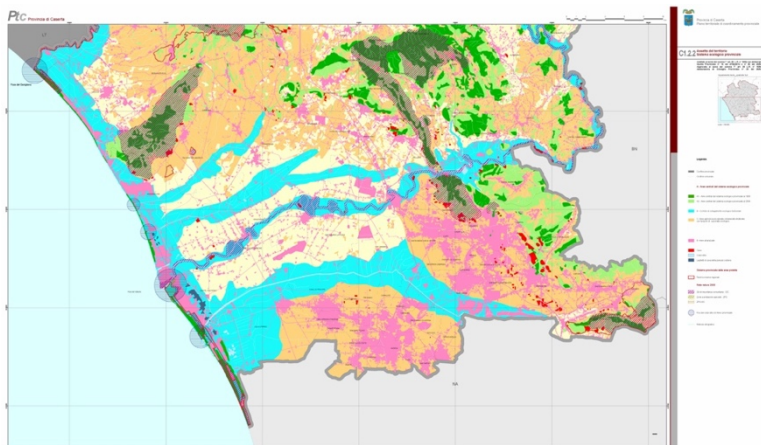


Fig. 5: PTP of Caserta - Forecasts: **Provincial Ecological Network**, on the right

The hilly areas are characterized by a mosaic of prevailing agricultural matrix, with the presence of discontinuous forest areas, which play the key role of point areas, ecological corridors, and sometimes central areas of the PEN. The Roccamonfina volcano forest areas constitute an important central area of the PEN, while the agricultural areas play the key role of complementary habitats and buffer zones with respect to the more natural areas; of functional connection zones between the slopes of the volcano and the plains adjacent to them; of multifunctional agro-forestry areas in the urban and peri-urban context. In the lowland systems there are areas of river relevance of the major rivers (Volturno, Garigliano) and their tributaries, whose protection, sustainable management and environmental recovery is of strategic importance for the maintenance, within the PEN, of ecological corridors associated with watercourses, and buffer zones to protect the quality of surface waters. The coastal strip constitutes a unitary ecological, territorial and landscape system, with the value of a common good of which it is necessary to safeguard the environmental balances, the multifunctionality and the possibilities of access and public use. It includes semi-natural habitats of high naturalistic, aesthetic-perceptive and recreational value that play, within the PEN, the key role of intermediate areas in the processes of diffusion, dispersion, migration (*stepping stones*). The rural and open territory of the coastal ecosystem is one of the most compromised parts of the provincial territory. In 5.000 ha it understands what remains of the dune and back dune areas, once occupied by temporary pools of water and marshes, now reclaimed. The coastal plain environments are an important element of the provincial physiographic and landscape diversity and are areas of higher environmental sensitivity. They constitute hydrological delivery areas characterized by a low degree of protection of the surface water table. Due to their high natural potential, they are a key element of the PEN project (Fig. 5). The rural and open territory of ecological protection and soil protection includes the areas of relevance of the watercourses of provincial importance. It covers almost 32.000 ha, characterized by high environmental value and play the important role of ecological buffer for watercourses. They are also characterized by high potential for the reconstitution of lowland and riparian habitats and constitute an important element of the PEN, as priority areas for the construction and strengthening of functional connecting corridors.

4. The Municipal Ecological Network. The case study of San Tamaro (Ce)

The EN performs functions related to both the conservation of biological diversity and the improvement of the human environment to this end, it must connect the entire territory wedging even in urbanized and anthropized areas. The forecast of a MEN aims to combat ecological fragmentation, caused by the growth of strong anthropized areas, infrastructure and technological networks, through the protection, enhancement, redevelopment/re-naturalization, implementation of natural environments and functional links between them.

A MEN recognises the characteristics and potential of the territory and indicates the strategic, structural and operational forecasts to consolidate and increase the environmental endowments, aiming at an increase in ecological efficiency. In order to structure the project of a MEN and to attribute to it the role it must play, it is fundamental that it constitutes an integrated element on the wider territorial, provincial and regional scale, only in this way can it be effective on a local scale and,

conversely, local choices can produce positive effects also on the wider area. The MEN is configured as: *priority area* to implement compensation and renaturalization interventions, foreseen in case of significant territorial transformations; *reference* to organize and configure the territory and to define the rules and protections of agricultural areas of landscape, environmental and ecological value; *instrument* for the evaluation of the sustainability (especially environmental) of the transformations. The project of a MEN represents the synthesis between: *implementation* of the REN strategic forecasts; *territorialization* of the PEN structural/operational forecasts [22]; *identification* of the MEN elements and their integration in the structural contents of the municipal land use plan; *verification/improvement/strengthening* of the interactions between the MEN, PEN and REN elements and the choices of the local land use plan, to plan suitable mitigation and/or compensation measures; *identification* of the forecasts to be implemented at local level, in order to strengthen the ecological connection and solve the most critical situations; *inclusion* of the elements of natural and eco-systemic value present in the territory, in the operational land use plan and in the technical regulations implementing the municipal land use plan.

The MEN project connects the urban and anthropized habitats between them and these in turn with the peripheral areas, allowing the movement of species on the territory that would otherwise be blocked by territorial fragmentation. In the MEN it is therefore possible to identify interactions between the two main functions: the *ecological* one, which aims at the conservation of nature, the strengthening of environmental functions and the transformations for the improvement and development of habitats, and the *social* one, which aims at the conservation and enhancement of the landscape and fruition aspects. Among the various elements that make up the MEN, the green corridors play a fundamental role, they will have to connect the urbanized/anthropized with the peri-urban and are typically associated with the presence of rivers, streams, canals, avenues, hedges and rows of trees. Particular attention should be paid to conflict points, where the MEN intersects infrastructural and technological networks; in these points it will be necessary to design defragmentation systems through the creation of structures to overcome the critical points.

The implementation of the REC integrates the different objectives of the municipal land use plan such as the *improvement* of the landscape (rural, peri-urban, urban), the *usability* and *accessibility* of rural and natural areas (routes and footpaths connected to ecological networks), the *enhancement* of places and elements of the landscape of open spaces. The objectives of a REC project can be summarized as follows: *protection, enhancement and strengthening* of the existing natural system through measures to safeguard it; *construction/reconstruction* of the REC through actions of restoration, overcoming barriers, rehabilitation, redevelopment, renaturalization of degraded portions of land or in contrast with network projects.

The PEN foreseen by the PTP [23] of Caserta, in the specific case of the municipal territory of San Tammaro, foresees (Fig. 6-7): *central areas of the PEN*: Agricultural areas of higher structural complexity with the function of ecological buffer; Agricultural areas (rural and open territory) of prominent agronomic-productive value; Agricultural areas (rural and open territory) complementary to the city; Denied areas (denied territory) with environmental potential; Urbanized areas; Ancient agricultural partition; Founding elements of the Bourbon landscape; *ecological corridors to be formed and/or strengthened*: functional ecological connection corridor of the Regi Lagni; hydrographic network; *infrastructure network*: provincial road network; historical provincial road network; road network of the route of the ancient agricultural partition; road network of new connections; Caserta conurbation underground; high speed railway line.

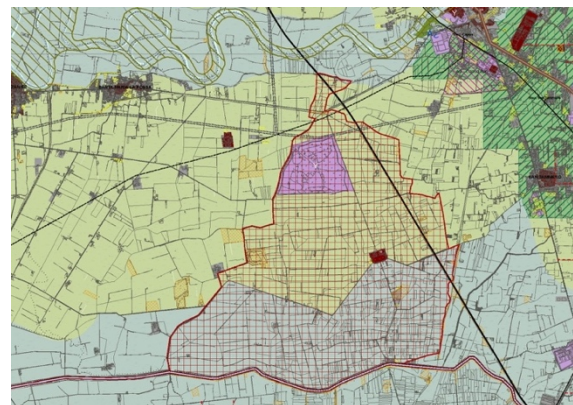
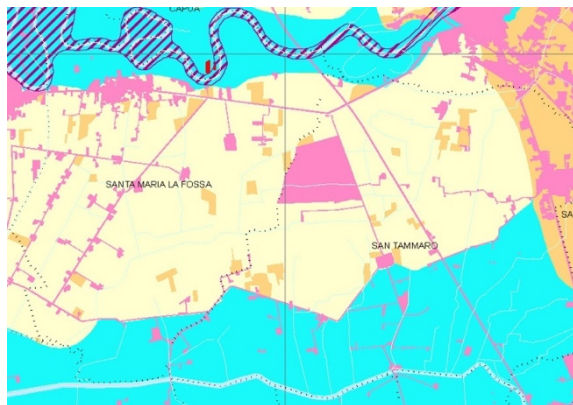


Fig. 6: PTP Caserta forecasts - excerpt. The municipality of San Tammaro (Ce): Structure of the territory Provincial Ecological Network on the left

Fig. 7: PTP Caserta forecasts - excerpt. The municipality of San Tammaro (Ce): Spatial planning. Networks and central systems, on the right

In order to fully frame the territory of San Tammaro from an ecological, landscape, naturalistic, historical-cultural, geological, hydrogeological, floral and faunistic point of view, the analysis took into consideration the individual elements of potential interest present in the territory, such as the central areas of the ecological system, the protected areas, the landscape/historical-environmental assets, the agricultural fabric, the hydrographic network, the wooded and riparian strips, the paths, the tree-lined rows, the gardens and the other urban green spaces with different functions. Main objectives are: the configuration of the MEN; the highlighting of the most important and strategic connections; the protection of the hinges to be preserved, conserved and strengthened; the resolution of critical issues to be resolved through appropriate transformations. The open spaces of the lowland, semi-natural and above all agricultural, were considered to have high ecological potential and identified as the ecological connective of a large lowland. Territorial areas of particular naturalistic interest, such as the network nodes (core areas) of the historically important Bourbon landscape, are in fact elements of excellence in the MEN project and play a pivotal role in structuring the main ecological corridors, since they are concentrated in the most significant natural habitats, effective reservoirs of biodiversity with a high natural value to be preserved. Once the main extra-urban elements had been identified, it was considered important to delimit all the green areas in the urban and peri-urban context and the watercourses, as these are functional elements of the MEN project. The MEN project in the San Tammaro municipal land use plan identifies the following elements (Fig. 8): *network nodes*, primary and secondary nodes, core area Bourbon landscape with historical importance; buffer zone or ecological bearing; meadows, crops and gardens; agricultural crops; orchards, vineyards and olive groves; protected crops; ornamental matrix ecosystems; private green; equipped and urban green; *diffuse ecological connections*; wooded ecosystems; uncultivated; woods; *corridors and ecological connections*; ecological corridor; protected area in force of art. 136-142 of Legislative Decree n. 42/2004 [24]; protected area in force of art. 10-45 of Legislative Decree n. 42/2004 [24]; *elements of landscape importance*; tracing of the Roman landscape; paths; *punctual and linear elements of the EN*, rows and system of trees; *ecological river corridors*; minor water network; regi laggi; *urban system*; *railway line*: underground provincial metro; high speed raised line; *critical elements of the EN*; main infrastructure barriers; state road 7 bis; provincial roads 229/230; high speed rail; power lines. main settlement barriers; urbanized areas; contaminated sites; landfills. The choices to be pursued, through the conservation and/or transformation planned by the municipal structural land use plan of San Tammaro to aim at the configuration of an efficient MEN can be summarized as follows: *promotion of continuity* between MEN, PEN and REN; *safeguarding and increasing* biological diversity; ensuring the survival of ecosystems; *limiting the fragmentation* of ecosystems; *protecting and strengthening* ecological connections and widespread connectivity; *safeguarding* ecological corridors; *enhancing and strengthening* wooded areas; prediction of environmental mitigation of existing and new settlements; *implementation* of the requalification of contaminated areas, in particular those affected by the storage of solid urban waste; *support* of the use of natural resources and open territory through the maintenance and enhancement of the network of paths; *reduction* of land consumption of agricultural land in the territory and safeguard the articulation of open spaces; *protection* of the quality of environmental and historical-cultural landscape of the territory; *conservation* of natural and historical environments, ensuring their ecological function.

The implementation is included in the operational land use plan of San Tammaro through the identification of the specific objectives for all the elements of the MEN and the modalities of the same are assigned by the Technical Regulations of Implementation. As an example, the specific objectives of the *network nodes and ecological corridors* are given below. For the *primary and secondary network nodes*, on which to support the spatial relation systems within the design of the MEN of San Tammaro, the specific objectives include: the *conservation and reconstruction* of the natural elements, the *territorial continuity* of the elements, the *conservation and protection* of residual ecosystems caused by fragmentation, the *creation* of new ecosystems and ecological corridors functional to network efficiency, the *achievement* of a balanced relationship between the areas built and affected by human activities and the open territory, the *environmental restoration* of areas of degradation and contaminated by pollutants. For *ecological corridors*, the *implementation* of an urban agricultural park is particularly important, the specific objectives include the *conservation* of natural characteristics and *protection* of the ecological system, *maintenance and improvement* of the vegetation and habitats to strengthen the role of elements of continuity and connection, so as to promote the environmental and microclimatic diversity of the ecosystem, the *intensification* of the connection with the green system, the *conservation and renaturalization* of riparian vegetation, a link between the aquatic and terrestrial environments, capable of contributing decisively to the natural balance of the territory, through the enrichment of native species and the *conservation and reconstitution* of plant formations in the areas of pertinence of watercourses.

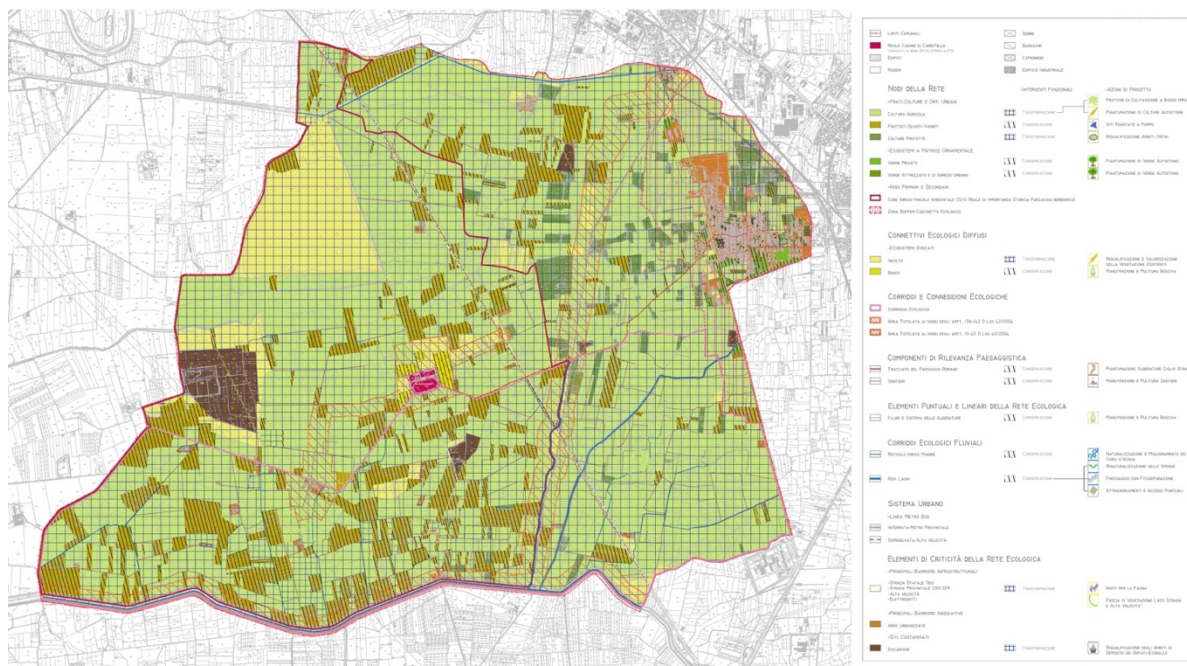


Fig. 8: Plan forecasts. Municipal Ecological Network in the Structural Land Use Plan of San Tamaro (Ce)

5. Some conclusive considerations

The recognition, forecasting and implementation of the MEN, in a system logic with the PEN and the REN, in urban planning is a technique of *Eco-Planning* to plan new balances between natural and man-made territory. The construction criteria of the municipal structural land use plan allow to plan and configure, through the MEN, the ecological-environmental system that directs all the choices of the plan project and reverses the traditional practice in which the municipal land use plan is almost exclusively the plan of the built areas while the remaining part of the municipal territory represents the complement to them. The benefits range from the overall improvement of the quality of life of the citizen, to the mitigation of the urban microclimate, the reduction of environmental pollution, the increase of habitats for flora and fauna in urban environment with positive effects on the conservation and improvement of biodiversity. *Urban Eco-Planning* considers nature, not only as an object of consumption and/or only for aesthetic use but recovers and focuses on its role as a supplier of vital resources and mitigator of imbalances induced by uncontrolled anthropization. The inclusion of the *MEN paradigm* in the local land use plan allows to forecast, in an integrated way, the territory without neglecting, starting from the areas of interference between anthropic and natural flows. In this way, the MEN represents the place of protection/requalification/regeneration of the natural space in anthropized contexts, contrasting soil consumption and environmental fragmentation. Non-eco-oriented local planning risks transposing the PEN to a local scale without configuring its spaces and without integrating it in a structural way in the local choices of overall territorial planning, thwarting a concrete greater sustainability of development.

Only in this way will it be possible to improve the sustainability of territorial transformations, since environmental, social and economic advantages will be obtained in urban and suburban areas where green spaces are restricted and environmental degradation is more widespread. The planning/prediction of *nature* in the plans has effects on the *environment*, such as the mitigation of flood risk and the phenomenon of the urban heat island, energy saving, conservation/reconstruction of habitats for wildlife and flora that find an environment conducive to their settlement; on the *social* for the spread of places for outdoor relaxation with consequent improvement of health and welfare and on the *economy* through the increase of employment resulting from the promotion of sustainable development and smart growth. In a sustainable city scenario, the EN and the consequent GI are to be considered of strategic importance for growth/development/transformation, as are the grey infrastructures. [25]

The EN, the historical-cultural and socio-economic network constitute the GI, a multifunctional macro-network able to ensure a high environmental quality. The strategic/structural role of urban planning allows the coordination between environmental elements through the planning, design, construction and management of the GI, which branches out in the territory to increase the continuity between natural and semi-natural areas, to improve their functionality, to reduce barriers and waste so that it

can provide a wide range of eco-systemic services. The concept of urban green area evolves into the more complex notion of GI [26]; an interconnected system of non-urbanized areas that constitute a continuous and permeable green plot that develops within the urban environment. It is the evolution of the green space that integrates with the urban structure and directs its formal design, as well as the structure of open spaces, urbanized and to be urbanized, anthropized and to be anthropized. In the perspective of the construction of strategies for adaptation to climate change these areas are considered useful for the provision of a large number of eco-systemic services that contribute to the ecological integrity of the city environment, to improve the livability of the urban environment and its inhabitants (Fig. 9). From the comparison with the current municipal land use plan of San Tammamo, drawn up without the provision of the MEN, it emerges clearly the weight that this choice determines in the planning of future municipal land use, both the perimeter of the areas identified and that the uses of the territory provided for are very different from those prescribed by the land use plan in force.

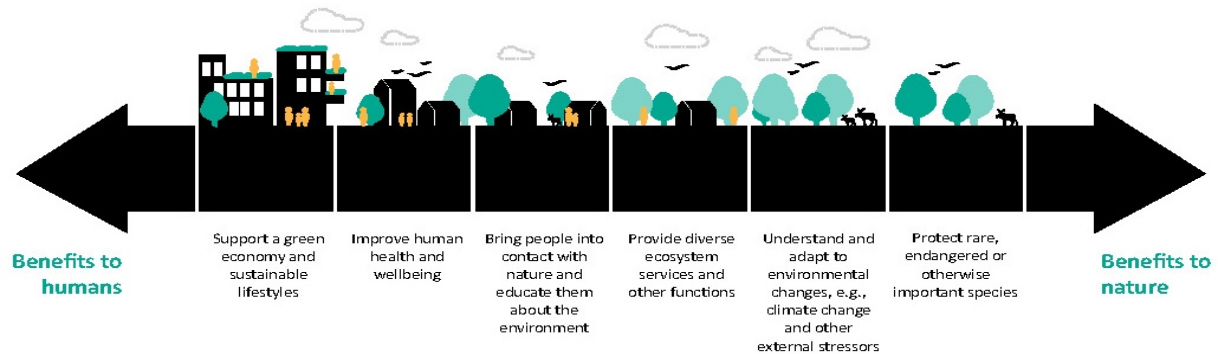


Fig. 9: HANSEN Rieke, RALL Emily L., CHAPMAN Eleanor., ROLF Werner, PAULEIT Stephan. *Urban Green Infrastructure Planning: A Guide for Practitioners*, 2017, p.12. GREEN SURGE. <http://greensurge.eu/working-packages/wp5/>

If from the scientific-technical point of view is this the way to ferry the municipal land use plan from the urban-centric approach and expansion towards the eco-centric and regeneration one much remains to be done from the regulatory point of view to give the choices of the eco-environmental municipal land use plan the prescriptive character appropriate to the overriding public interest that characterizes them.

Attributions:

Within the present contribution, which is the result of the authors' common drawing up, personal contributions can be identified as specified as below: *Anthropized territory and fragmentation and Campania REN and Caserta PEN* (Claudia de Biase), *Green Infrastructure and Ecological Network and The Municipal Ecological Network. The case study of San Tammamo (Ce)* (Salvatore Losco), *Abstract and Some conclusive considerations* joint drawing up.

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[2] CUSINATO Augusto. *Una ipotesi interpretativa della frammentazione urbana* in: XXV Conferenza Italiana di Scienze Regionali, 2004. https://aisre.it/images/old_papers/023-Cusinato.PDF.

[3] VIDAL Rodrigo. *Metrópolis en recomposición: elementos para una teoría de la fragmentación urbana*. Observatorio Geográfico de América Latina, 1997.

[4] VOLPE Carmine. *Frammentazione Urbana*, 2018. <https://carminevolpe.wordpress.com/2018/02/22/frammentazione-urbana/>

[5] <https://www.urbanindex.it/>. In December 2015, the Italian Department for Planning and Coordination of Economic Policy started a collaboration with the Politecnico of Milan - Department of Architecture and Urban Studies - with the aim to develop useful tools for the definition and evaluation of public policies in urban areas and in the belief that these tools can also be useful in defining the

contents of a National Urban Agenda. There are 98 basic indicators one of these is the **Edge Density** calculated as the ratio of the total sum of the polygon perimeters of the built areas to their surface area. Correlated with Housing Dispersion Index, Index of concentration of building use typologies, Index of compactness of urban areas, Index of building expansion in population centres and nuclei, Urban green (non-agricultural) per capita, Index of housing underuse.

[6] Interpretation of the humanized environment and the city through the models of traditional ecology, it is therefore an ecosystem in which a biotic community (man and the other species that inhabit it) and the surrounding physical environment interact; this relationship is based on energy flows in and out, and on the cyclization of materials (ecosystem). Unlike other ecosystems, the city is completely artificial both in the regulation of its development and in the supply of energy outside the system. Urban ecology is based on the collection of quantitative and qualitative data on the distribution of energy, water and material flows, with particular regard to the polluting effects and the probable lack of vital inputs, with the aim of elaborating predictive models useful for directing human behaviour towards the preservation of the vitality of the system.

[7] The definition of Landscape Ecology was formulated in 1939 by the German biogeographer Carol Troll, in these terms: *it is the science that studies the aggregations of ecosystems that make up the landscape as a complex system of ecosystems and holistic entity that assumes characteristics different from the sum of the characteristics of the ecosystems that compose it. Landscape is considered as the result of all the processes (both anthropic and natural) that take place in a complex mosaic of ecosystems in which the events of nature and the actions of human culture are integrated.* Troll was the first to understand some of the properties of ecosystems and their evolution towards higher bio-entities that he called landscapes. The discipline breaks down landscapes into constituent elementary ecosystems and analyses them on the basis of their structural aspects studied by means of basic models called patterns. On the basis of their structural characteristics, the various ecosystems systematized in the landscape are grouped into systems with a simple structure (patches, eco-topes, corridors, matrices) or complex (apparatuses, eco-mosaics, landscape fabrics), <http://ecologiae.com/ecologia-del-paesaggio/25838/>

[8] In 1936 Childe G. (1892-1957) Australian archaeologist, father of modern palethnology: the science that studies the culture of prehistoric and protohistoric human civilizations through the analysis of material finds, introduced the concept of urban revolution to highlight the processes of transformation generated by population growth, spatial extension and the degree of environmental impact of cities, which determined the transition from agricultural centers to large urban centers. While in the 1960s cities were perceived as biological deserts and urban expansion as the result of rapid unplanned urbanization associated with increasing population and economic activity, from the 1970s onwards cities developed through suburbanization processes with high demand for land.

[9] CASCIANA Aldo, CLEMENTI Alberto, DEMATTEIS Giuseppe, PALERMO Pier Carlo, PALAZZO Anna L. (edited by). *Reti e territori al futuro. Materiali per una visione: Italia e Europa*, Ministero delle infrastrutture - DICOTER, Roma, 2007.

DEMATTEIS Giuseppe. *Lo spazio geo-economico: territorio, regioni, reti* in: DEMATTEIS Giuseppe, LANZA Carla, NANO Ferruccio, VANOLO Alberto. *Geografia dell'economia mondiale*, Utet, Novara, 2010, p. 1-26. ISBN 9788860083005.

[10] DAVIES Clives, MACFARLANE R., MCGLOIN C., ROE Maggie. *Green infrastructure. Planning guide*, Newcastle University, Northumbria, University, 2015, p. 2.

[11] The concept of GI was introduced in the European Commission's White Paper on Adapting to Climate Change (2009), which stated that green infrastructure *is essential to mitigate fragmentation and unsustainable land use both within and outside Natura 2000 areas and to address the need for multiple benefits for the maintenance and restoration of the ecosystem.*

[12] EUROPEAN COMMISSION. DG Environment Unit B.2 Bio-diversity. *Green Infrastructure - Enhancing Europe's Natural Capital*, Strasbourg, 2013.

[13] SOCCO Carlo, CAVALIERE Andrea, GUARINI Stefania M., *L'infrastruttura verde come sistema di reti*, Working Paper, Osservatorio Città Sostenibili Dipartimento Interateneo Territorio Politecnico e Università di Torino, 2008.

[14] Conferenza Nazionale, *La Natura dell'Italia: Biodiversità ed Aree protette: la Green Economy per il rilancio del Paese*, December 11-12, 2013, Roma.

[15] The OSC defines GI as an equipped network that performs the dual function of EN and network of accessibility and public use. These two networks are integrated with two other networks: the network of historical assets and the network of the agricultural fabric, made up of the system of farms. The four networks perform different functions, potentially conflicting with each other, but which, under certain conditions, can find dynamic balances characterized by relations of synergy and environmental compatibility. Together, these networks determine the multifunctionality of the GI and its quality, which will be all the higher the higher the value of each of them. The GI is an ecological, historical-cultural and socio-economic network, whose presence is essential to ensure a high level of environmental quality for the network of cities. A city without a good GI is a city of poor quality, less livable, less competitive. In a sustainable city scenario, GI must be considered of strategic importance for development, in the same way as transport or energy supply infrastructure (i.e. grey infrastructure). The multifunctional network of the GI must also establish an environmental compatibility relationship with the network of infrastructure and urban settlements as a system consisting of buildings and equipment connected by linear infrastructure of various types (grey infrastructure).

[16] Giacomini (1965), *nature conservation conceived in a unitary sense must not be limited to acting in the reserves or with the instrument of reserves. It must also extend beyond, without schematic limits, with an uninterrupted spatial continuity. It must reach everywhere, right into the heart of the cities, of the intensely cultivated countryside, of the tourist resorts.*

Art. 2 - Habitats Directive 92/43/EEC. The purpose of this Directive is to contribute to safeguarding biodiversity by conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies.

Art. 10 - Habitats Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies. Where they consider it necessary, in the context of national spatial planning and development policies, and in particular to make the Natura 2000 network more ecologically coherent, Member States shall endeavour to promote the management of landscape features of primary importance to wild fauna and flora. These are those elements which, due to their linear and continuous structure (such as watercourses and their banks, or traditional field delimitation systems) or their connecting role (such as ponds or groves), are essential for the migration, geographical distribution and genetic exchange of wild species. Art. 2 of the Directive defines the object of conservation, i.e. biodiversity, while Art. 10 below stresses that conservation requires going beyond protected areas through a system that is currently defined as an ecological network. The concept of EN has been understood in different ways, depending on the functions that were intended to privilege, which in turn can be translated into different operational consequences (Malcevschi, 2001): EN as an interconnected system of habitats, whose biodiversity must be safeguarded; EN as a system of parks and reserves, included in a coordinated system of infrastructure and services; EN as a system of landscape units, to support perceptual and recreational use as a priority; EN as a multi-purpose ecosystem scenario, to support sustainable development. Guccione defines the EN from a strictly ecological-landscape point of view. They are a recent conceptual proposal for integrated management of the physical territorial space that, by protecting the interconnections between habitats, make possible the flow of genetic heritage of living beings from one area to another. GUCCIONE Matteo e SCHILLECI Filippo (edited by). *Le reti ecologiche nella pianificazione territoriale ordinaria. Primo censimento nazionale degli strumenti a scala locale. Rapporti 116/2010, ISPRA, Roma, 2010. ISBN 978-88-448-0450-3. AA.VV. Gestione delle aree di collegamento ecologico funzionale. Indirizzi e modalità operative per l'adeguamento degli strumenti di pianificazione del territorio in funzione della costruzione di reti ecologiche a scala locale, Manuali e linee guida 26/2003, APAT-INU, Roma, 2003. ISBN 88-448-0111-6. Ingegnoli states that EN are closely dependent on the theory and applications of landscape ecology. INGEGNOLI Vittorio. *Fondamenti di ecologia del paesaggio*, Città Studi, Torino, 1993. ISBN 8825100329. INGEGNOLI Vittorio, PIGNATTI Sandro (edited by). *L'ecologia del paesaggio in Italia*, Città Studi, Milano, 1996. ISBN 9788825101102.*

[17] Higher Italian Institute for Environmental Protection <http://www.isprambiente.gov.it/it/progetti/biodiversita-1/reti-ecologiche-e-pianificazione-territoriale/reti-ecologiche-a-scala-locale-apat-2003/cose-una-rete-ecologica>. Indeed, the EN, once defined as its priority objective the conservation of biodiversity, lends itself to establishing a landscape system capable of supporting functions of a recreational and perceptive nature. The improvement of the landscape becomes an opportunity for the creation, for example, of low environmental impact routes (paths and cycle paths) that allow people to cross the territory and to enjoy the landscape resources (forests, hedges, rows, etc..) and possibly the territorial ones (places of memory, places of refreshment, etc.).

[18] DAVIES Clives, MACFARLANE R., MCGLOIN C., ROE Maggie, op. cit, p.12.

[19] Campania Regional Law n. 13/2008. The RTP is articulated in five Territorial Reference Frameworks, briefly described, useful to activate a vast area planning in agreement with the Provinces and the Superintendences, able to define at the same time also the addresses of landscape planning: networks, settlement environments, territorial systems of development, complex territorial fields and institutional cooperation. Within the territorial framework of reference between the networks, the regional EN is identified with the aim of implementing actions aimed at identifying, strengthening and creating biological corridors between areas with more or less high levels of naturalness and a dense network of linear and precise areal elements that, together, aim to strengthen the bio-permeability of the areas concerned. Depending on the matrix of the area, it will be necessary to envisage actions ranging from the prevailing conservation and maintenance, to the enhancement of bio-permeability and connectivity, up to the reintroduction of elements of naturalness, also using rural development strategies.

[20] The REN includes: National and Regional Parks, State and Regional Reserves, EU Natura 2000 Network: Sites of Community Importance and Special Areas of Conservation, Agricultural and Forestry Areas, Integrated Water Cycle, Green Infrastructures.

[21] The PEN includes areas of high naturalistic value, natural areas of naturalistic completion, ecological corridors, urban and peri-urban areas for widespread ecological reconstruction, passages, contaminated areas.

[22] GUCCIONE Matteo e SCHILLECI Filippo (edited by). *Op. cit.*

[23] PTP Caserta: Table C1.2.2. - *Spatial planning. Provincial Ecological Network*. Table C1.2.8 - *Spatial planning. Protection and transformation*. Table C1.3.1 - *Spatial planning. Networks and central systems*.

[24] Legislative Decree n. 42/2004:

- art. 10 - *Cultural heritage*. Cultural assets are immovable and movable property belonging to the State, to the regions, to other public territorial bodies, as well as to any other public body and institute and to private non-profit-making legal persons, including civilly recognized ecclesiastical bodies, which are of artistic, historical, archaeological or ethno-anthropological interest.

- art. 45 - *Indirect protection requirements*. 1. The Ministry has the right to prescribe distances, measures and other rules aimed at preventing the integrity of immovable cultural property from being endangered, its perspective or light from being damaged or its environmental and decorative conditions from being altered. 2. The requirements referred to in paragraph 1, adopted and notified pursuant to art. 46 and 47, shall be immediately applicable. The local and regional authorities concerned shall transpose the requirements into building regulations and urban planning instruments.

- art. 136 - *Buildings and areas of high public interest*. 1. They are subject to the provisions of this Title for their considerable public interest: a) immovable property that has conspicuous characteristics of natural beauty, geological uniqueness or historical memory, including monumental trees; b) villas, gardens and parks, not protected by the provisions of Part Two of this code, which are distinguished by their uncommon beauty; c) complexes of immovable property that make up a characteristic aspect with aesthetic and traditional value, including the centers and historical centers; d) scenic beauty and so also those points of view or viewpoint, accessible to the public, from which you can enjoy the spectacle of those beauties.

- art. 142 - *Areas protected by law*. 1. The following are, however, of landscape interest and are subject to the provisions of this Title: a) coastal territories included in a strip 300 m deep from the shoreline, even for land high above the sea; b) territories bordering lakes included in a strip 300 m deep from the shoreline, even for territories high above the lakes; c) rivers, streams and watercourses included in the lists provided for by the consolidated text of the provisions of the law on water and electrical systems, approved by Royal Decree 11 December 1933, n. 1775, and the relative banks or feet of the embankments for a band of 150 m each; d) the mountains for the part exceeding 1.600 m above sea level for the Alpine chain and 1.200 m above sea level for the Apennine chain and for the islands; e) glaciers and glacial cirques; f) national or regional parks and reserves, as well as the external protection areas of the parks; g) areas covered by forests and woods, even if they have been covered or damaged by fire, and those subject to reforestation restrictions, as defined in art. 2, paragraphs 2 and 6, of legislative decree n. 227/2001; h) areas assigned to agricultural universities and areas burdened by civic use; i) wetlands included in the list provided for by Presidential Decree n. 448 of 13 March 1976; l) volcanoes; m) areas of archaeological interest. 2. The provision referred to in paragraph 1, letters a), b), c), d), e), g), h), l), m), does not apply to areas that on 6 September 1985: a) were delimited in the urban planning instruments, pursuant to Interministerial Decree n. 1444/1968, as homogeneous territorial zones A and B; b) were defined in the urban planning instruments within the meaning of Interministerial Decree n. 1444/1968 as homogeneous territorial areas other than

zones A and B, limited to those parts of those areas covered by multiannual implementation plans, provided that the relevant forecasts were actually implemented; c) in the municipalities without such tools, fell in the perimeter built centers in accordance with art. 18 of Law 22 October 1971, n. 865. 3. The provision of paragraph 1 does not apply, likewise, to the goods referred to in letter c) that the region has considered wholly or in part, irrelevant for the purposes of landscape including them in a special list made public and communicated to the Ministry. The Ministry, with a reasoned measure, can confirm the landscape relevance of the mentioned goods above. The confirmation measure shall be subject to the forms of publicity provided for in art. 140 paragraph 4. 4. In any case, the regulations deriving from the acts and measures indicated in art. 157 shall remain unaffected.

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