Chapter 4
Ecosystem Services and Territorial Resilience: The Role of Green and Blue Infrastructure

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Abstract Responding to the new environmental, ecological, and social emergencies requires a shift in strategies and urban design models. In the contexts of sustainability and resilience, green and blue infrastructure (GBI) is a wide-ranging concept that can help overcome the usual dichotomies of urban growth versus green or the built environment versus nature. This provides different benefits, both environmental and ecological and social and economic. In urban contexts, green spaces play a strategic role due to the number of typologies and functions that vary from neighborhood spaces to green, play, and sports facilities to protected areas of territorial scale. In this way, the planning and design of GBI take on the triple objective of regenerating fragile and degraded ecosystems from an environmental, social, and economic point of view. Focusing on this assumption, we describe how the GBI that develops along the axe of the Stura di Lanzo river in a multiscalar mosaic of soils at both local and territorial levels can determine options for the ecosystem quality of the metropolitan area of northern Turin. We suppose that mapping ecosystem services (based on a correct land use/land cover design) can support designing new urban and regional plans to improve resilience.

Keywords Ecosystem services · Green and blue infrastructures · Spatial planning

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G. Brunetta et al. (eds.), *Post Un-Lock*, The Urban Book Series,
https://doi.org/10.1007/978-3-031-33894-6_4

4.1 Introduction

4.1.1 The Territorial Interpretation for Resilience and Well-Being

Since vulnerability to pandemics, environmental and economic crises, social disaggregation, and climate change-related impacts are increasing, above all in EU urban areas that are home to over two-thirds of the population,[1] biodiversity, green and blue infrastructure (GBI), and ecosystem services (ES) are gaining importance for resilience and sustainability. Moreover, in line with sustainable development goals (UN 2015), these concepts are crucial to avoid landscape and environmental trivialization, degradation of nature and social inequality, and enhance well-being.

In this changing context, we focus on ES, GBI, and biodiversity through the adoption of a specific analysis methodology (see Sect. 1.2) within a particular case study, the Stura di Lanzo river and the "Basse di Stura," an urban park in the northern part of the city of Turin. This case study is an excellent example of where different landscape features coexist and where different scenarios can be imagined. Indeed, this case helps us understand how to contrast ecosystem degradation in cities, providing a wide range of ES (TEEB 2010) and developing the vital functions for social direct or indirect benefits in relation to the post COVID-19 situation.

Our application is reinforced by plenty of global and European strategies and policies (such as the EU Biodiversity Strategy 2030 and the Post-2020 Global Biodiversity framework) and scientific debates that stress the attention on the necessary transition toward sustainability and resilience. Indeed, these policies support enhancing biodiversity (giving a central role to protected areas—Pas—and other green areas), ecological reticularity and ecosystem functionality, regulating climate, ensuring health and well-being, purifying water and air, maintaining soil fertility, and ensuring species reproduction. The interconnection of PAs and green areas allows for building a multiscalar and multifunctional GBI, intended as an open system of relationships between these different green spaces. For its characteristics, this system is the most appropriate approach toward sustainability and resilience (Voghera and Giudice 2019) in planning and design, integrating different levels, scales, and types of policies and plans from the territorial context to local and sectorial plans and projects. Moreover, due to their multifunctionality, green spaces within GBI play an important social role, bringing people closer to nature. Additionally, in this system, ES, PAs, and biodiversity are the building blocks of GBI, where rivers and green spaces represent the corridors for guaranteeing connectivity, encouraging the provision of ES and associated benefits to humans, and integrating biodiversity in planning and ecological design at different scales.

Piedmont, the region of our case study, has a multifaceted system of PAs and green spaces (national parks, natural parks, provincial protected areas, natural reserves,

[1] Considering global data, today, more than 4.3 billion people live in urban areas: this means over half of the world (55% in 2017) live in urban settings (Ritchie and Roser 2018).

natural safeguard areas, and special reserves, sites of Natura 2000 network, Unesco WHS, and Biosphere Reserves). Furthermore, the topic of interconnection between different green areas is one of the central objectives of the policies and strategies promoted by the Metropolitan City of Turin (CMTO), in line with the indications defined at the national scale by the National Strategy for Biodiversity (MATTM 2010) and in the perspective of supporting policies to control land take. In particular, the CMTO developed in 2014, in collaboration with ENEA and the Politecnico di Torino (DIST), the Guidelines for the Green System (LGSV), which includes the Guidelines for the Ecological Network (LGRE), which identify the Provincial Ecological Network and provide municipalities with general regulatory guidance to control land take, increase, qualify, and conserve ES, with a focus on biodiversity and the promotion of rational use of natural resources.[2] Furthermore, GBI, ecological networks, and PAs have become central in planning tools promoted by the CMTO: the Metropolitan Strategic Plan (in particular, the Axis no. 2 "Green Revolution and Ecological Transition") and the preliminary technical proposal of the Metropolitan General Territorial Plan on GBI, ES, and PAs that incorporates and implements the Regional Ecological Network.

4.1.2 Methods and Data

Geospatial data can play a key role in supporting more resilient urban planning. Accurate and timely geospatial data, along with the tools needed to convert them into meaningful information for decision-making, can be strategic for better knowing and planning GBI with greater awareness of the value of ES.

Interoperable, high-quality, and timely geospatial information and analysis are fundamental prerequisites for good policymaking. This is particularly evident when there is a need to integrate both quantitative and qualitative information from different sources and, often, different methodologies. Instead, the lack of sufficient, reliable, high-quality, and timely geospatial information leads to inconsistent and incorrect decisions or even non-decision-making.

In particular, if we focus on ES, there are now many projects and initiatives that, both at territorial and local scales, reason with them and their ability to support land-government decision-making processes, aimed above all at the good use and proper management of the soil resource (Nedkov et al. 2018; Burkhard et al. 2018) through the design of green frames. In Italy, the most relevant recent experiments are often accompanied by urban planning processes (EU Life projects SAM4CP 2014–2018, SOS4Life 2016–19) and territorial planning (see Province of Turin 2014).

In the PostUnlock project, we chose to deepen the assessment of the habitat quality (HQ) ES, considered one of the most significant and structural ES to describe ecosystem functionality (Assennato et al. 2018) and, therefore, also the resilience of

[2] Many interesting local experimentations applied this methodology in some pilot municipalities of Piedmont (Bruino, Ivrea-Bollengo, Chieri, Mappano). See Voghera et al. (2017).

territories. Recognizing the level of quality of habitats at the urban scale is relevant because the interactions between living organisms and the physical environment give rise to functional relationships that characterize different ecosystems, ensuring their resilience, their maintenance in a good state of conservation, and the provision of ES (ISPRA-CATAP 2012). For this reason, the issue is becoming increasingly relevant within large European cities, as the ability to adapt to climate change is strongly linked to the state of ecosystems and the biological diversity they contain; the greater the degree of biological diversity, the greater the ability of species to adapt to the new living conditions produced by climate change (MATTM 2010) and to positively affect the well-being of urban communities. In addition, the 2016 OECD report highlighted the correlation between cardiovascular and respiratory diseases with the increased presence of fine particulate matter in urban settings, with a consequent increase in the economic cost of health expenditures, putting the focus on those supporting and regulating ES that are characterized by indirect human demand (improving air quality, CO2 absorption, etc.) but of broader collective interest and to the base of human life.

The proposed reflection is transcalar and transdisciplinary. In the experimentation conducted on the territorial context of Basse di Stura, the ecosystem analysis is the outcome of the application of two methodologies: (i) the InVEST software[3] assessment model that uses geospatial data that best describes the relationship between mapping ES and essential human life needs (Costanza et al. 1997; MEA 2005), (ii) the ENEA's bioecological model (Provincia di Torino 2014) that offers an in-depth and fertile reading of land uses to assess the bioecological value and structure of ecosystems. Since both models have some limitations, depending on the diversity of approaches and computational algorithms as well as the availability and usability of input data (including implications due to the 2021 update of the Piedmont Land Cover data), the paper presents a broader reflection regarding the effectiveness and reliability of the assessment conducted.

4.2 Morphological Conditions and Land Uses in Basse di Stura

As already mentioned, the case study we selected is the area of Basse di Stura,[4] located on the northern edge of Turin, in District 5 (Fig. 4.1). The local land use plan (*Piano Regolatore Generale*—PRG) of 1995 identifies it as Urban and River Park (P.17).

[3] Software developed within "The Natural Capital" project by Stanford University, University of Minnesota, The Nature Conservancy, and the World Wildlife Fund.

[4] The site has been the subject of different studies in the context of joint activities between the DIST Department of Excellence (Call 2017) "*Ecowelfare e governance intercomunale. Il suolo come infrastruttura per la rigenerazione dei territori*" (under the direction of prof. C. Giaimo) and Valium (directed by M. Bottero). See Giaimo (2020a, b, c), Giaimo et al. (2021a, b).

Fig. 4.1 Localization of Basse di Stura within the municipal territory. Elaborated by Pantaloni G. G

With an area of about 150 ha extending for almost 3 km along the right bank of the Stura di Lanzo river, Basse di Stura lies at the edge of the urbanized area, just south of Turin's northern freeway. Here, the Stura river once flowed in a typically agricultural landscape, traces of which can still be found thanks to the presence of some farmsteads (notably "La Ressia," "Il Canonico," or "Boscaglia," and "La Carpegna") and some agricultural land interlocked in a context strongly affected by the harmful effects of the functions and activities settled within the area and in its proximity. Indeed, Basse di Stura is surrounded by a set of viable (including the freeway) and technological infrastructure networks such as the AMIAT landfill (historically among the largest in Italy), also designated as a fluvial urban park on the opposite bank of the river. Currently, thanks to a series of remediation works, the Marmorina Park has been created in place of the old landfill.

Within Basse di Stura, included for many years in the Ministry of the Environment's list of Italian most polluted industrial sites (which has financed part of its safety), a set of impactful activities were located, such as heavy industries (Teskid), incinerators (Stureco), quarries now abandoned, industrial dumps (a former solfatara), and gravel extraction activities. Basse di Stura was successively downgraded as a site of regional interest by a Decree of the Ministry of the Environment. Moreover, its implementation is delayed by the need to provide for essential remediation works[5] as well as the permanence of some still active activities located on the site.

[5] The PRG subordinates any interventions to the preparation of an Environmental Recovery Executive Plan for the entire area—to be submitted for evaluation and authorization by the competent bodies—that takes into account, first of all, the following conditions: (i) the works must be located in areas which are not exposed to the risk of flooding, (ii) termination of polluting activities, and (iii) reclamation of polluted areas.

Its implementation (not yet activated by current planning activities) makes Basse di Stura a fundamental "piece" to be connected to the larger system of urban and river parks (already implemented and planned). It assumes roles and values that intercept a wide sphere of functionality, disciplinary contributions, and multiple spatial scales from the local to the vast area. This strategic relevance is also evident since the area is partially included in the system of PAs of the Po river belt—Turin section—"Basse di Stura Stralcio Area." Indeed, the site, which is also part of the "Torino Città d'Acque" project, is located within an environmental and landscape system connecting high-value green areas such as La Mandria Park, Mesino Reserve (Po-Stura Confluence), the hill of Turin and Superga Park, the Lanca di Santa Marta and Stupinigi Park (Fig. 4.2).

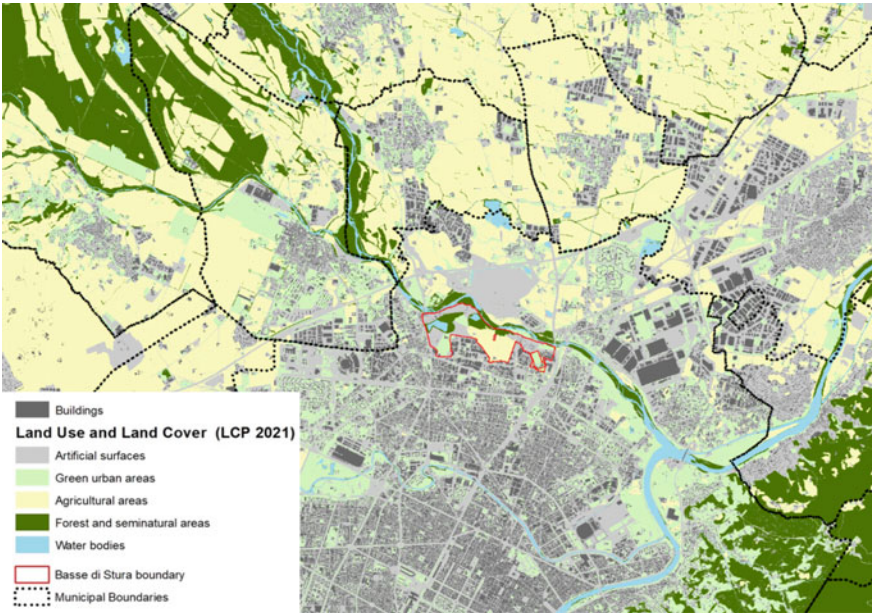

Fig. 4.2 Land use and land cover map (LCP 2021) with the location of Basse di Stura in relation to the ecological-environmental connectivities of Stura di Lanzo river. Elaborated by Pantaloni G. G

4.3 Mapping Ecosystem Service for Territorial Resilience

4.3.1 The Land Cover Piemonte Database and the Habitat Quality Model

The Land Cover Piemonte (LCP) database of 2021 is the most up-to-date and detailed open-access Land Use Land Cover (LULC[6]) database referring to the regional territory of Piedmont. The research group used it to support (i) an initial reading and interpretation of the morphological and settlement structure of the area and (ii) as the input data necessary for the proper functioning of the assessment model based both on ENEA indicators and to calculate the HQ service through InVEST (and in the SimulSoil application[7]).

In this research, one of the main advantages related to this increased geometric precision is the possibility of recognizing those urban green porosities that, although less extensive, play a fundamental role in assessing urban ecosystems.

Concerning the state-of-the-art scenario of the soils within Basse di Stura, a mosaic of uses and covers characterized by a strong unevenness emerges (Fig. 4.3): residential, manufacturing, and commercial human activities (16%), coexist with a large portion of land where there are sand and gravel mining activities (23%), arable agricultural soils, meadows, and pastures (26%) linked to the presence of the historic Martini and Ressia farmsteads, urban green areas (13%) of which it is sometimes not easy to distinguish the artificiality or the presence in the subsoil of an impermeable capping positioned to secure the aquifers. In addition to these anthropogenic activities, natural soils are composed of both spontaneous and riparian vegetation (17%) extended along the northern boundary of the area, where the Stura river flows. Finally, the two quarry lakes (5%), although artificial and polluted, constitute bodies of water with spontaneous vegetation undergoing renaturalization along the banks.

Using a LULC basis within dynamic ecosystem analysis models simulates alternative land use scenarios and allows us to observe how changing urbanized soils corresponds to a consequent change in the ecosystem performance delivered by the soil itself. In addition, such models help understand how the same quantitative soil design assumptions can generate greater or lesser impacts on ecosystem performance in the case of different physical-spatial correlations between different soils.

InVEST's HQ model combines information on land uses and land cover (derived from LULC map bases) with elements recognized as threats to biodiversity, generating habitat quality maps as outputs. Five degrees of naturalness[8] were associated

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[6] LULC provides a classification of the terrestrial land that identifies (i) the type of land cover and (ii) the type of anthropogenic land use, which can be used to trace the relationships between changes in land uses and land cover and the ecosystems' capacity to deliver goods and services.

[7] Realised by the EU Life SAM4CP Project, since 2016 it has been widely used in local planning activities of the Turin and regional area.

[8] As part of the LIFE + SAM4CP Project, the values of naturalness at the national level were derived through an expert-based approach. At the local scale, the reference was the Guidelines for the Ecological Network (LGRE) which assigned a score from 1 to 5 (where higher values correspond

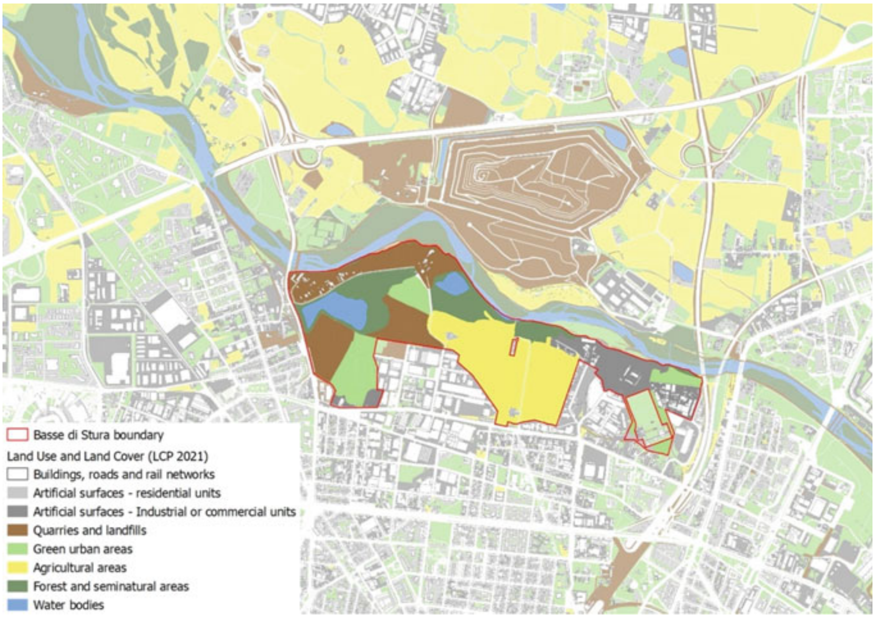

Fig. 4.3 Spatialization of LULC in Basse di Stura, Land Cover Piemonte 2021. Elaborated by Pantaloni G. G

Table 4.1 Naturalness levels derived from Provincia di Torino (2014)

1st level	*Land use typologies coinciding with climate and paraclimax stages*
2nd level	*Land use typologies coinciding with preclimatic stages*
3rd level	*Seminatural land use typologies, even if with relevant anthropogenic determinism*
4th level	*Seminatural land use typologies, even if with relevant anthropogenic determinism but not artificial*
5th level	*Land use typologies coinciding with artificial areas*

with each subcategory of land uses and land covers based on the presence/absence of anthropogenic disturbance and proximity to the climax[9] (Table 4.1) and then systematized with the spatial distribution of elements that may compromise ecosystem naturalness.

to more natural habitats), integrated with permeability values in the anthropogenic land use and land cover classes.

[9] Equilibrium situation of an ecosystem (Provincia di Torino, 2014).

The model, which takes into account 12 habitat types and considers as elements of residual or no naturalness the urbanized system, agricultural areas, and infrastructural network, allows the integration and revision of specific parameters by users, although it is necessary to keep the structure of the calculation algorithm unchanged.

Relating features placed in close proximity to each other and at a certain distance from each other introduces the concept of model dynamism, inasmuch the variables that contribute to defining the habitat quality level do not refer exclusively to the intrinsic characteristics of the single "pixel" of the soil itself (i.e., the one indicated as part of the ecosystem whose habitat quality level is to be measured), but also to parameters affecting soils placed nearby as possible sources of threat.

To assess the degree of impact of each threat, the model uses parameters such as (i) the distance (MAX DIST) between the threat source and the habitat (i.e., the maximum distance of influence that the threat exerts on habitat quality, measured in km), (ii) the decay, in space, of the threat (DECAY) of linear or exponential type, (iii) the weight (WEIGHT) of the threat and finally, referring to land uses within habitats, (iv) the sensitivity to threats.

The definition of the latter factor is done through a previously mentioned ecological sensitivity matrix, which reports the interactions between classes of land uses (to which an initial naturalness value is assigned) and threats.

The outcome of the algorithm, which relates all the variables listed above, consists of a map in which each soil pixel (with 5×5 m resolution) is assigned a habitat quality value, which, simplifying, is defined through a weighing of an initial naturalness value, related to the specific external threats that the model recognizes as detractors.

4.3.2 Design Scenarios for Basse di Stura

The application of the ecosystem assessment model described above allows for the identification of four design scenarios on the area considered ("*Parco dei Parchi,*" "*Trees,*" "*Res non Aedificatoria,*" and "*Coesistenze di Stura*") and highlights the sensitivity of ecosystem performance to changes in the mosaic of land uses (Giaimo et al. 2021b). The spatialization of biophysical values of HQ stresses that the soils with a more pronounced suitability to play the role of natural habitat are those belonging to the Stura di Lanzo river. Indeed, the river, running transversely through the urban fabric of the City of Turin, plays a role in environmental connectivity between the hilly part of the city, the La Mandria Nature Park, and beyond (Fig. 4.4).

Compared to the state-of-the-art described above, the four identified scenarios propose urban regeneration interventions that, although with different specific aims and objectives, intend to achieve a greater degree of permeability of the urban fabric and recover part of the natural riparian vegetation along the Stura di Lanzo river (Table 4.2), through soil desealing and reclamation actions. Commenting on the arrangements envisaged by the four proposals regarding the increase of permeable land covers, of particular interest are the cases of *Coesistenze di Stura* and *Res Non Aedificatoria.* While the first envisions a large presence of soils intended for an urban

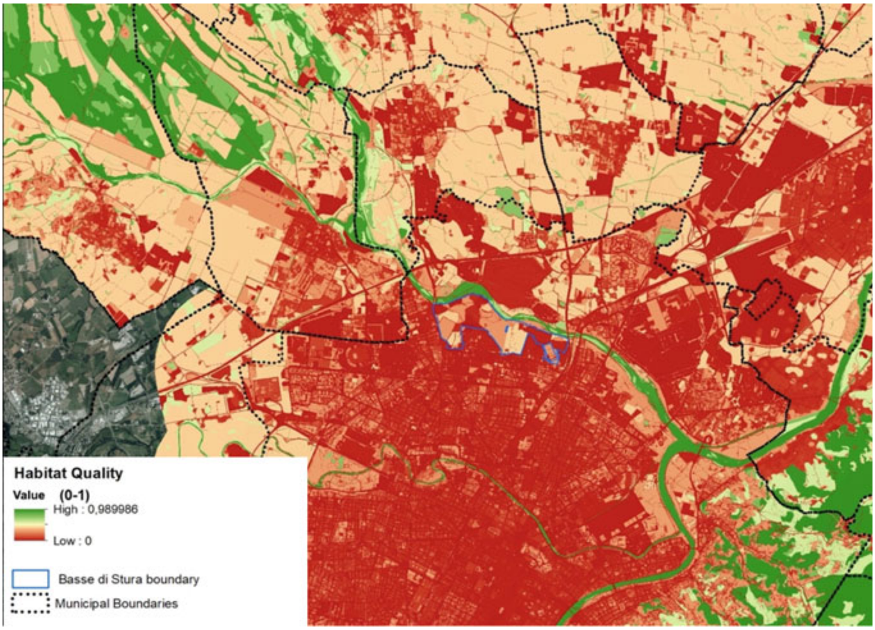

Fig. 4.4 Spatialization of HQ biophysical values in the northern Turin edge with Basse di Stura and along the Stura di Lanzo river (HQ model, InVEST). Elaborated by Pantaloni G. G

park, the latter project assumes the total replacement of agricultural soils in favor of a large urban park and forest-like vegetation.

Consequently, the trend of reduction of urbanized land uses and land cover (not counting, in this specific case, soils that fall into the urban greenery category) varies depending on the design proposals, in a range from − 13% (as in the case of the Trees project) to a maximum of − 35% in Stura Coexistence, affecting the biophysical performance levels of soils differently. Concerning the design intentions briefly described, Fig. 4.5 allows for the interpretation of these urban planning choices, to make explicit a more or less pronounced correspondence between new urban development and the achievement of specific goals of improving ecological-environmental conditions and welfare.

Without undertaking a critical and analytical reading of the four scenarios, the proposals make explicit, albeit with different emphases, a strong focus on a dimension that is not only local but also large scale. Indeed, they attribute to Basse di Stura a dual role: (i) an urban standard that is today not usable by the community and (ii) a fundamental piece of the GBI system that, by territorial extension and geographic location, would allow reconfiguring the ecological-environmental profile of the urbanized northern edge of Turin and inserting itself into an environmental system of metropolitan importance.

To prefigurate future scenarios, it is fundamental to know ecosystem values to investigate the quality and critical characteristics of soils in a framework of a vast

Table 4.2 Outline of the distribution and percentage of land uses and land cover. Comparison between the state-of-the-art and design scenarios

Basse di Stura: land use and land cover	State-of-the-art (%)	Design scenarios			
		Parco dei Parchi (%)	Trees (%)	Res non Aedificatoria (%)	Coesistenze di Stura (%)
Urbanized soils—residential	1	2	5	1	1
Urbanized soils—commercial and productive	14	9	12	17	0
Roads	1	10	1	2	3
Quarries and landfills	23	0	9	5	0
Urban greenery	13	27	20	37	48
Agricultural land	26	23	22	0	20
Natural and seminatural	16	23	27	33	24
Artificial reservoirs	5	5	5	5	4
Total	100	100	100	100	100

Fig. 4.5 Standardized level of average biophysical performance of HQ. Comparison of the state-of-the-art and design scenarios on the three ES. Elaborated by Pantaloni G. G

area and to contextualize its ecological-environmental conditions. In this perspective, some recent works (Giaimo et al. 2021a) have considered Basse di Stura within a broader territory identified with the term "Northern Quadrant," with an extension equal to about 27 km^2 of the territory North-West of Turin. The analyses conducted within this area have underlined how, although the regenerative transformation of Basse di Stura is still unfinished, it has higher HQ values than the surrounding territory. This result is attributable to the greater territorial extension of the "Quadrant" and the higher presence of anthropized soils that characterize the very dense urban fabric bordering the park. These initial considerations, although carried out by taking into consideration a spatial area that does not fully meet the requirements of a Functional Ecological Unit (Santolini and Morri 2017), highlight the potential that the regeneration of Basse di Stura expresses under multiple perspectives: urban settlement quality, fruition for the community, well-being, and health.

4.4 Discussion and Open Issues

The experimentation described above well highlights how the recovery of a compromised portion of land, interclosed but located in a peripheral context of the city and in close connection with ecological and environmental reticularities of supra-local relevance, represents a concrete opportunity to pursue an improvement of the ecological-environmental conditions of the context, as well as the redistribution of spaces for the community in a marginal area and partly lacking in public services. Indeed, the rehabilitation of this territorial area assumes a double relevance, both urbanistic and ecological-environmental. On the one hand, the PRG recognizes it as an urban standard intended for urban and river parks, while on the other hand, it constitutes a fundamental component of a system of GBI (Giudice et al. 2023). More specifically, concerning urban standards, it is worth mentioning that even though the quantity provided by the PRG is largely satisfactory, the territory surrounding Basse di Stura is still partly lacking them. All these considerations make Basse di Stura a place with a high potential to provide good livability and foster new forms of interaction between people and nature.

The outcomes of the experimentations show the need to adopt an integrated and multidisciplinary approach, including analyses of urban vulnerability and social and ecological-environmental aspects that consider the future park as a piece of a larger urban framework. For example, the implementation of the Basse di Stura Park needs to be pursued within a process that involves the entire Stura di Lanzo river.

Finally, what has been argued on spatial databases and ecosystem analysis modeling underlines how crucial attention must be paid to the type of data processed within computational software (as well as the functioning of computational algorithms). The experience highlights how the descriptive content of databases, as well as their accuracy, can strongly influence the outcomes that can be obtained through the use of ecosystem assessment models, as well as the need to put in place new mechanisms aimed at constructing the necessary information, such as the biophysical parameters that support ecosystem assessment, which is no longer consistent with existing databases. Finally, it is essential to recall that ecological-environmental assessment of soils cannot be identified as the bearer of absolute and all-encompassing information, but a multidisciplinary approach to issues affecting urban regeneration processes is needed.

4.5 Conclusion

These approaches highlight the importance of evaluation methods to design a GBI-based resilience. Evaluation methods allow for measuring the ecological quality of territories, identifying territorial and local stakes, and delineating strategic, transversal, and multiscalar design actions. It is challenging to decide which method provides better support to the objectives of resilience as it depends on different factors.

Furthermore, these approaches can be used to frame and guide design solutions, redesign the quality of urban spaces at local and vast scales, and rethink post-unlock cities with new performative "standards." The new park will be a node of a multi-scalar system for ES and biodiversity valorization, expanding the resilience of the surrounding areas by transforming a quarry into a new stepstone of the ecological system of the Turin metropolitan cities.

In this perspective, measuring ecological quality and the resilience of a local system is a fundamental requirement for the selection of territories to be transformed to create an interconnected and reticular green system guaranteeing multiple equilibria and the stability of a social-ecological system by increasing and maintaining ES.

Acknowledgements The text is the result of work coordinated and shared among the authors in which paragraphs 3.1.1 is attributed to Angioletta Voghera and Benedetta Giudice; paragraphs 3.2 and 3.3 to Carolina Giaimo and Giulio G. Pantaloni; paragraphs 3.1.2, 3.4, and 3.5 bring together methodologies and reflection shared by all authors.

In addition, we would like to thank Gabriella Negrini (Dist/CED-PPN) and Luigi La Riccia (Dist/SDG11 Lab) for their support in collecting cognitive data and their contribution during the discussion of the results.

References

Assennato F, Braca G, Calzolari C et al (2018) Mappatura e valutazione dell'impatto del consumo di suolo sui servizi ecosistemici: proposte metodologiche per il Rapporto sul consumo di suolo. Rapporti ISPRA

Burkhard B, Santos-Martin F, Nedkov S, Maes J (2018) An operational framework for integrated mapping and assessment of ecosystems and their services (MAES). One Ecosystem 3:e22831. https://doi.org/10.3897/oneeco.3.e22831

Costanza R, d'Arge R, de Groot R et al (1997) The value of the world's ecosystem services and natural capital. Nature 387:253–260

Giaimo C, Lazzarini L, Pantaloni GG (2021a) Paradigmi ecosistemici per il nuovo welfare urbano. Il caso dell'area Basse di Stura a Torino. In: Ricci L et al-(a cura di) "Città pubblica e nuovo welfare. Una rete di reti per la rigenerazione urbana", Urbanistica Dossier online, INU Edizioni, Roma, p 118–125

Giaimo C, Pantaloni GG, Vitulano V, Barbieri CA (2021b) Nuove tecniche e paradigmi per la pianificazione e progettazione urbanistica. Scenari ecosistemici per l'area Basse di Stura a Torino. In: Murgante B, Pede E, Tiepolo M (eds) Innovazione tecnologica per la riorganizzazione spaziale.

Atti della XXIII Conferenza Nazionale SIU DOWNSCALING, RIGHTSIZING. Contrazione demografica e riorganizzazione spaziale, Torino, 17–18 June 2021b, vol 09, Planum Publisher e Società Italiana degli Urbanisti, Roma-Milano, p 58–65. https://doi.org/10.53143/PLM.C.921

Giaimo C (2020a) Esiti di un workshop didattico multidisciplinare. In: Giaimo C (ed) Tra spazio pubblico e rigenerazione urbana. Il verde come infrastruttura per la città contemporanea. Urbanistica Dossier online, 17, INU Edizioni, Roma, p 126–128

Giaimo C (2020b) La strategia urbanistica del verde nel PRG di Torino 1995. In: Giaimo C (ed) Tra spazio pubblico e rigenerazione urbana. Il verde come infrastruttura per la città contemporanea. Urbanistica Dossier online, 17, INU Edizioni, Roma, p. 81–86.

Giaimo C (2020c) Rigenerare lo spazio pubblico. Standard, suolo e servizi ecosistemici. In: Giaimo C (ed) Tra spazio pubblico e rigenerazione urbana. Il verde come infrastruttura per la città contemporanea. Urbanistica Dossier online, 17, INU Edizioni, Roma, p 5–8

Giudice B, Novarina G, Voghera A (2023) Framing green and blue infrastructure. In: Giudice, B, Novarina G., Voghera A (eds) Green infrastructure. The urban book series. Springer, Cham. https://doi.org/10.1007/978-3-031-28772-5_1

ISPRA-CATAP (2012) Glossario dinamico per l'Ambiente ed il Paesaggio—Revisione marzo 2012. Available via https://www.isprambiente.gov.it/files/pubblicazioni/manuali-lineeguida/mlg-78.1-2012-glossario-dinamico.pdf. Accessed 26 Jan 2023

Ministero dell'Ambiente e della Tutela del Territorio e del Mare—MATTM (2010) Strategia nazionale per la biodiversità in Italia. Available via https://www.minambiente.it/sites/default/files/archivio/allegati/biodiversita/estratto_strategia_eng.pdf. Accessed 8 November 2020

Millennium Ecosystem Assessment—MEA (2005) Ecosystems and human well-being: biodiversity synthesis. World Resources Institute, Washington, D.C.

Nedkov S, Zhiyanski M, Borisova B, Bratanova-Doncheva S (2018) Mapping and assessment of ecosystem condition and ecosystem services across different scales and domains in Europe. One Ecosystem 3:e29288. https://doi.org/10.3897/oneeco.3.e29288

Provincia di Torino (2014) PTC2 Progetto definitivo. Linee guida per la rete ecologica, Torino. Available via http://www.cittametropolitana.torino.it/cms/risorse/territorio/dwd/linee-guida-sverde/lgsv_lgre.pdf. Accessed 26 Jan 2023

Ritchie H, Roser M (2018) Urbanization. Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/urbanization. Accessed 16 Jan 2023

Santolini R, Morri E (2017) Criteri ecologici per l'introduzione di sistemi di valutazione e remunerazione dei Servizi Ecosistemici nella progettazione e pianificazione. In: Arcidiacono A, Di Simine D, Oliva F et al (eds) La dimensione europea del consumo di suolo e le politiche nazionali. Rapporto 2017, INU Edizioni, Roma, p 149–154

TEEB (2010) The economics of ecosystems and biodiversity: mainstreaming the economics of nature: a synthesis of the approach, conclusions and recommendations of TEEB

United Nations—UN (2015) Transforming our world: The 2030 agenda for sustainable development, A/RES/70/1. Available via http://www.sustainabledevelopment.un.org. Accessed 15 Jan 2023

Voghera A, Giudice B (2019) Evaluating and planning green infrastructure: a strategic perspective for sustainability and resilience. Sustainability 11:2726. https://doi.org/10.3390/su11102726

Voghera A, Negrini G, La Riccia L, Guarini S (2017) Reti ecologiche nella pianificazione locale: Esperienze nella Regione Piemonte. Reticula 14:1–9