



# Why is the inclusion of the ecosystem services concept in urban planning so limited? A knowledge implementation and impact analysis of the Italian urban plans

Daniele La Rosa<sup>1</sup>

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## Abstract

This article analyses the explicit use of the ecosystem services (ES) concept in the Italian urban planning practice and evaluates whether and to what extent the concept is actually used to deliver planning choices to improve the overall urban sustainability. Based upon a systematic grey literature review of contemporary urban plans, the research reveals that out of 136 urban plans only a very limited number made an explicit reference to the ES concept, primarily in strategic environmental assessment procedures. The article explains reasons for the limited inclusion and explores the possibility to embed ES into urban planning through innovative laws and regulations at different levels of spatial governance.

**Keywords** Ecosystem services · Italian urban planning · Integration · Socio-ecological practice research · Urban plans · Knowledge implementation and impact analysis · Socio-ecological knowledge · Policy innovation

## 1 Ecosystem services and urban planning in Italy

### 1.1 Integrating ecosystem services into urban planning

Urban and regional planning has the capacity to produce changes in the quality and/or quantity of ecosystem services (ES), by providing land transformation options and regulating how these options are spatially translated within a given territory. Land-use changes and soil sealing can quickly produce severe ecological, economic and political issues or even increase the level of natural or anthropic hazards, therefore affecting the provision of services by those ecosystems that are directly involved in those changes (Mascarenhas et al. 2015, p. 159). For this reason, the effects of spatial planning on ES supply are perhaps more evident and straightforward than those of other types of planning (Geneletti 2011, p. 148). The explicit use of ES in land-use planning will allow

such effects to be considered and evaluated within the entire planning process.

Despite growing attention in recent years, the added value of ES for planning is still a debated field, and many challenges exist towards better integration of the ES concept into current planning process and spatial decision-making (de Groot et al. 2010; Hauck et al. 2016). One of the reasons is related to the many ES definitions and terminologies used in different scientific fields. As such, the concept has become difficult to grasp and deviated significantly from its original purpose (Gómez-Baggethun et al. 2010, p. 1217).

Furthermore, the use of ES to support real planning decisions as well as its integration into policies and planning has been reported as being poor or limited, especially in urban contexts (Hauck et al. 2016; Nordin et al. 2017; Lam and Conway 2018). One potential avenue towards integration lies in the possibilities offered by existing procedures that support planning, such as a strategic environmental assessment (SEA) (Geneletti 2011). SEA of spatial plans can play a role in ensuring that ES are taken into account when evaluating different planning alternatives. However, the integration of ES into SEA has so far been essentially limited to technical reports, leaving ES to be considered as generic environmental objectives.

Finally, the governance of ES requires the identification and inclusion of those actors who understand, manage and

✉ Daniele La Rosa  
dlarosa@dar.unicit.it

<sup>1</sup> Department Civil Engineering and Architecture, University of Catania, via S. Sofia 64, 95125 Catania, Italy

benefit from the services, as well as an appropriate knowledge of existing policies, institutional context and planning systems (Opdam et al. 2015, p. 4). However, most research suggests that current planning processes do not include (at least explicitly) the views and knowledge of practitioners, decision makers and other subjects who are the main actors in each spatial planning context. This is an important point as ES integration is unlikely to occur if spatial planners are unaware, for example, of what ES are, what the added value of their integration into spatial planning process could be and what tools could be used to achieve such integration.

## 1.2 The Italian planning system

In Italy, the existing typologies of spatial plans correspond to the differing levels of territorial and administrative organization (namely state, region, former province/metropolitan areas and municipality), with plans having increased regulatory and operational effects from the state level to the municipal one. The planning system is thus articulated in a pyramidal structure that governs the different aspects of city and landscape transformations (or protection/conservation, which is also a mode of transformation). The spatial plans while belonging to each level are distinct from the others as they offer different objectives. They include regional territorial plans covering regional areas, provincial territorial plans or metropolitan plans covering provincial or metropolitan areas and municipal urban plans covering the administrative boundaries of municipalities.

Due to a longer tradition and the highly fragmented Italian administrative municipal structure (with almost 8000 municipalities), the most widespread plans are urban municipal plans prepared by municipalities, firstly introduced by a national law in 1942. These are complex instruments that include different interventions, related not only to the built environment but also to economic and social actions. They also regulate the process of urban development and its relation to ecological systems by regulating the distribution of urban functions and settlements and the protection of open space. Municipal planning processes involve many diversified public and private actors and produce actions that are usually co-financed from different private or public sources. For these reasons, urban municipal plans have been the main drivers of land-use transformations, and they are the arenas where interests, expectations and requests from different stakeholders meet and often collide, generating trade-offs and, sometimes, political clashes. Thus, they represent the most interesting and effective level of planning (Colavitti et al. 2012) worthy of further analysis through the ES lens.

## 1.3 Spatial planning and ecosystem services

For Italy, a limited number of scholars have looked at how ES are being considered in spatial planning processes. Lai (2015) analysed the content of 46 SEA reports containing three categories of plans in Sardinia: land-use municipal plans, regional plans and management plans of protected areas. The author found that no municipal plans explicitly mentioned the ES (Ibid, p. 30). In a recent review, Cortinovis and Geneletti (2018) looked at 22 recent municipal plans of Italian cities, approved since 2012. In those plans, the authors analysed actions that addressed urban ES with recreation/cultural and water regulation of the ES categories most represented. Interestingly, the authors highlighted that the type and number of planning actions related to ES were much more comprehensive than the list of possible interventions proposed at the European level, therefore demonstrating the potential of planning processes to creatively make use of ES (Ibid., p. 312). These authors also concluded that the integration of ES in planning practices is proceeding through a sort of “internalization” process that builds on what has historically been the subject of the planning tradition and is somehow already included in the traditional portfolio of planning actions.

This work therefore analyses the trend of use and inclusion of ES in Italian spatial plans, with particular reference to municipal urban plans, chosen for their relevance in generating transformation on land use when compared to other types of spatial plans. Particularly, the article raises the following questions: to what extent, if ever, was the ES concept actually used in the Italian urban planning system for sustainability planning? Why? How could the ES integration with planning be further advanced? To answer these questions, the article proposes a systematic review of grey literature of web pages and relative official documentation of a range of public municipalities.

## 2 A review of Italian urban plans

Unlike others works that have investigated the integration of ES in urban planning (Cortinovis and Geneletti 2018; Lam and Conway 2018; Lorence Rall et al. 2015; Nordin et al. 2017; Woodruff and BenDor 2016), this review evaluates the explicit use of the ES concept in urban municipal plans. Since there is no national database or other comprehensive reference source for urban plans available, this research opted for a content analysis of planning documents from grey literature. Grey literature is intended as “anything that won’t stand up on a shelf on its own” or is difficult to catalogue (Mahood et al. 2014, p. 222). Grey

literature may be produced on all levels of government, academics, business and industry in different formats, but it is not controlled by commercial publishers (Schöpfel 2012, p. 17). Many guides and manuals propose various methodologies about locating possible sources for grey literature, with a general recommendation to search within online databases, web search engines and websites, university and institutional repositories, library catalogues, but also by directly contacting subject specialists and by consulting reference lists of relevant documents (Dobbins et al. 2008, p. 10).

As for the objective of this review, the only online sources containing official planning documents were the websites of public municipalities in charge of planning. The use of websites as primary sources of information correlates with the requirement of regional planning legislation wherein every planning act must be promoted (among other means) on the official website of the planning administration. For this reason, we opted to conduct web searches using Google. The review was based on the use of different sets of keywords (Table 1) in the advanced search mode of Google (Godin et al. 2015, p. 3), used to locate planning documents that explicitly mention the ES concept on their web pages. Due to the specific geographical context under analysis, we limited the search to results in the Italian language. The keywords represent the names assumed by urban plans in Italian regions, because each region has a specific land-use planning legislation. The review was performed between the 10 and 26 September 2018.

Web page results from the Google search engine were then analysed to identify urban plans, as well as related documents wherein the keywords were not used incidentally, rather intentionally for the planning process. For example, web pages that used the terms “ecosystem services” as a

general reference only were not included. In cases where clarity was needed in regard to the role of ES in the planning process, web pages of other municipalities were also accessed and analysed.

In contrast to the previous works that analyse the level of integration of ES in spatial plans (Mascarenhas et al. 2015; Lam and Conway 2018; Wilkinson et al. 2013; Cortinovis and Geneletti 2018), we did not consider the number of mentions to the ES concept to be an indicator of the level of adoption, or integration. However, we gave each planning document derived by the search an in-depth analysis in order to better understand if the ES was an effective approach to guide the planning decisions, a general objective of urban sustainability, or merely a reference to a scientific concept. To this end, selected planning documents were then reviewed according to criteria of relevance that aimed to analyse and specify the role of ES in the planning process. (La Rosa et al. 2016, p. 76).

The criteria were, as follows:

- ES were acknowledged or explicitly mentioned;
- ES were quantitatively evaluated and/or mapped;
- Planning choices were derived from the results of the ES assessment;
- The use of ES was mandatory or suggested in the existing planning system or framework.

Planning documents were excluded when the mention to ES was not linked to a specific planning objective. For example, documents were not included if they included a general reference to existing policies, and/or normative or global assessment (i.e. European Union policies or global ecosystem services frameworks).

### 3 Findings

For each set of keywords, Table 2 reports the number of web pages found along with the correlating number of plans. Many of the web pages did not deal with urban planning or were not the official websites of municipalities. In many cases (221), urban planning documents included simple references to other existing general strategies or studies (i.e. EU Sustainable Development Strategy or Millennium Ecosystem Assessment). In total, 978 web pages were screened, resulting in the identification of 136 unique plans.

Table 3 summarizes instances where the evaluation criteria could be found in the 136 reviewed plans. The most recurring criterion was the simple mention of ES in the plan (92 plans), often as a general objective of sustainability to be pursued or as simple acknowledgement of the importance of preserving ecosystems able to support and provide important functions. The second most frequent

**Table 1** The set of keywords used for the content analysis

Set of keywords
“servizi ecosistemici” AND “piano regolatore”
“servizi ecosistemici” AND “piano di governo del territorio”
“servizi ecosistemici” AND “piano urbanistico”
“servizi ecosistemici” AND “piano operativo”
“servizi ecosistemici” AND “piano strutturale”
“servizi ecosistemici” AND “piano di assetto”
English translation of the keywords
“servizi ecosistemici” = “ecosystem services”
“piano regolatore” = “regulatory plan”
“piano di governo del territorio” = “plan for land governance”
“piano urbanistico” = “urban plan”
“piano operativo” = “operative plan”
“piano strutturale” = “structural plan”
“piano di assetto” = “structural plan”

**Table 2** Number of pages and urban plans reviewed after each set of keywords

Set of keywords	# of pages found	# of unique plans found
“servizi ecosistemici” AND “piano regolatore”	229	40
“servizi ecosistemici” AND “piano di governo del territorio”	143	39
“servizi ecosistemici” AND “piano urbanistico”	135	4
“servizi ecosistemici” AND “piano operativo”	97	21
“servizi ecosistemici” AND “piano strutturale”	223	10
“servizi ecosistemici” AND “piano di assetto”	151	22
Total	978	136

See Table 1 footer for the English translation of the keywords

criterion related to the evaluation of ES (both qualitative and quantitative): this was found across 42 plans, but was not associated with any monetary valuation. Also, in 20 plans mapping of ES was present, although again not always informing final planning decisions. Finally, only in 11 plans was the assessment of ES useful in derived planning choices. Of these, six plans explicitly made use of maps, i.e. identifying hot spots for ES supply that required protection from development. These include the recently adopted municipal plan of the City of Pordenone (Friuli-Venezia Giulia) that employed specific analyses and mapping of some categories of ES (namely supporting and regulating) (Fig. 1). These analyses focused on soil, air and water components and included quantitative evaluations of biodiversity, recreational areas, CO<sub>2</sub> sequestration, protection of underground and superficial waters and qualitative evaluations of climate mitigation by urban greenery. This plan also proposes a “payment for ecosystem services” mechanism to maintain and increase—where possible—the supply of ES in the city and introduces a specific plan on the valorization of rural areas. Other positive examples came from small municipalities (i.e.

Romano di Lombardia, Mogliano Veneto, None, Bruino), where impacts of urban developments and transformations were assessed based on a change of the supply of ES.

No occurrence was found for which the ES evaluation/assessment was mandatorily requested by regional planning law. This is a direct consequence of the absence of direct and precise indication on how to include and operationalize the ES concept in urban planning across Italian regional planning laws.

As introduced in Sect. 1, Italian municipal urban plans may include different documents/maps such as reports, technical norms or regulations, maps and documents for the SEA. For each of these documents, Table 4 summarizes the number of references found according to the relevance criteria of Table 1. In some cases, a single plan included more documents that mentioned or evaluated ES.

The analysis of the plans highlighted how ES were cited in different types of planning documents. This was due to the heterogeneity of urban planning processes in the 20 Italian regions that all follow different regional laws and administrative procedures. The most recurring type of document was the strategic environmental assessment (85 documents), a requirement by current national and regional planning laws in order to assess the environmental impacts of spatial planning alternatives. Of the majority of SEA documents, ES were only a general objective of sustainability (54 documents) and 25 documents included an assessment (qualitative or quantitative) of the impacts of planning choices on ES; in only six cases did such assessment really inform final planning choices to minimize environmental impacts. The second most recurrent types of documents were the general reports of the plans (41) that included evaluations/assessments in 12 instances, but in only three cases were they actually used to inform the final planning decision. Results also showed that ES mapping is still limited (only 24 examples) and only a lower number of maps could be found in the ES evaluation phase (7). Finally, ES were included in seven documents prescribing norms/regulations (“*Norme Tecniche di Attuazione*” or similar documents) that, in the Italian planning system, make the urban plan a binding and regulative planning act.

**Table 3** Number of plans addressing the relevance criteria. The sum of the total number of plans is higher than the number of unique plans found (Table 2) because each plan could address more than one criterion

Relevance criteria	# Urban plans addressing the criteria
ES were explicitly mentioned or at least acknowledged	92
ES were quantitatively evaluated (and/or mapped)	42 (20)
Planning choices were derived from the results of the ES assessment	11
The use of ES were mandatory or suggested in the existing planning systems/framework	0



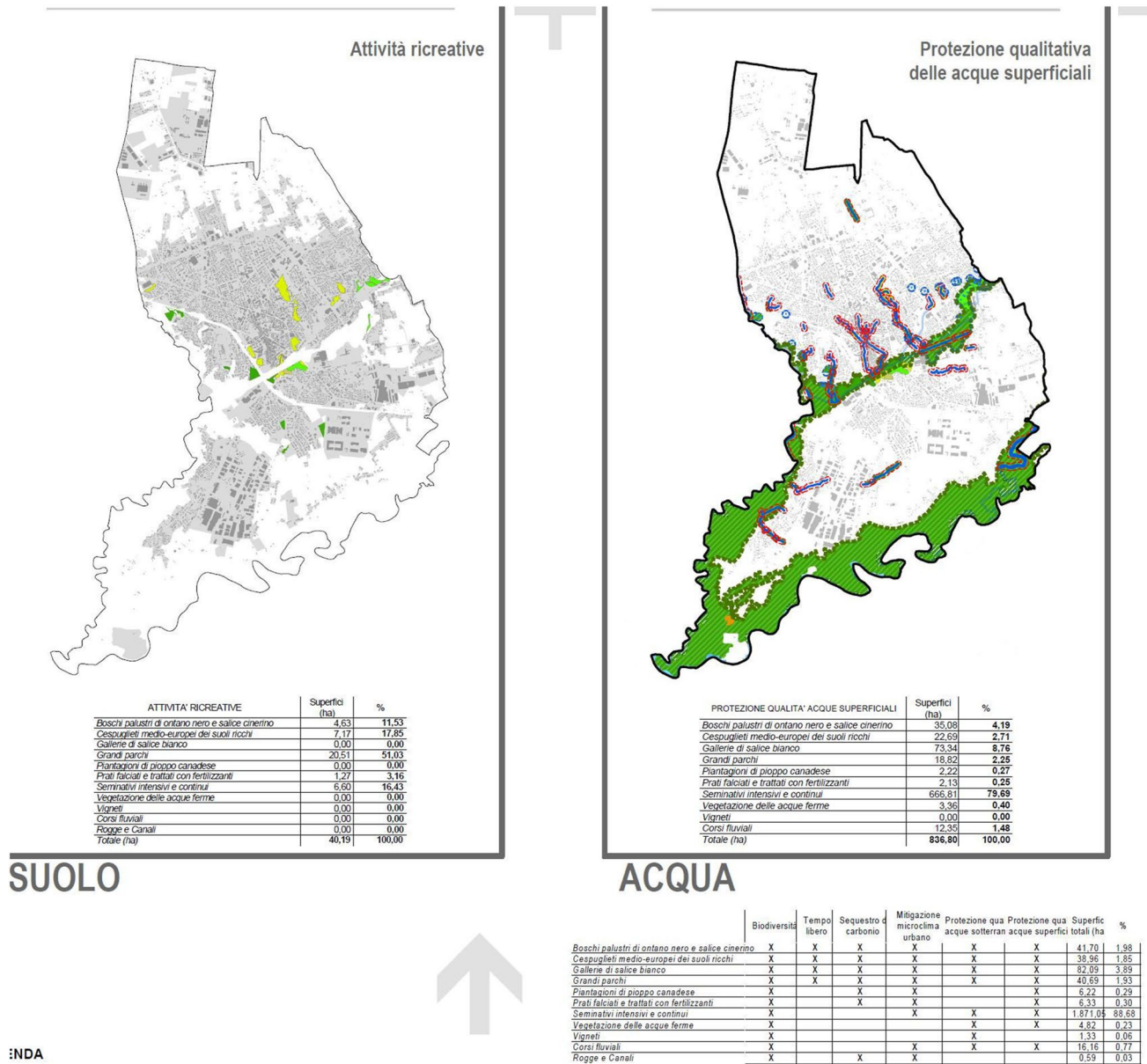


Fig. 1 Maps of the ecosystem services provided by soil and water for the City of Pordenone source: Comune di Pordenone 2017

Table 4 Number of plans for each type of planning documents: each urban plan could include different documents

Type of planning documents	The ES concept was explicitly mentioned or acknowledged	ES were quantitatively evaluated and/or mapped	Planning choices were derived based on the results of the ES assessment	# Urban plans
Reports or other official documents	26	12	3	41
Technical norms or regulation	4	2	1	7
Maps	15	7	2	24
Document/maps for the strategic environmental assessment	54	25	6	85
Total	99	45	12	156

## 4 Discussions

### 4.1 Methodological assumptions

From a methodological perspective, the web search through Google was subject to some assumptions. First, Google filters result on the basis of the browser being used, geographic location and previous search strings (Bates 2011). Although this might raise some issues regarding reproducibility, it would be relevant in the case of this review that explicitly focused on a national context. However, the continuous indexing of web pages by Google may produce slightly changing numbers of found web pages. For this reason, it is recommended that any repeated study be concentrated over a limited number of days/weeks. Furthermore, very recent urban plans may not have been included in the review as they might have yet not been indexed.

This review analysed urban plans that included the explicit reference to ES, but other urban plans that have pursued the same objectives did not explicitly mention that ES may exist. For example, the work by Cortinovis and Geneletti (2018) looked at a sample of spatial plans of Italian cities and assessed the general inclusion of ES in urban plans at three different levels (information, visions/objectives and actions). They found that urban plans already include a high number of ES-related actions and a variety of tools for their implementation—even if there is no specific reference to ES (Ibid., p. 311).

A technical issue that might limit the number of documents obtained by the Google search is related to the way the planning documents have been produced in digital formats. Although present in the institutional websites, some documents can indeed be published through scanned images; in such cases, the documents cannot be found by the search engine because they do not include any text.

### 4.2 Lack of integration of ES in municipal urban plans

Results from the performed review clearly demonstrate that the ES concept is not being used as to inform planning decisions and shape or address specific choices of land-use transformation. The majority of the plans surveyed instead used ES as a straight and simplistic label to encapsulate or reiterate general environmental/ecological objectives. The widespread reference to ES within different planning statements and general planning strategies was found to not be explicitly translated into planning actions. This aspect can be found in many instances of the preliminary studies/analyses regarding the planning of local ecological

networks as noted within SEA documents (especially for scoping purposes). We also noted how ES were mainly used to benchmark scenarios of land-use transformations within the current pre-transformation conditions. The evaluation of ES is rarely used, for example, to identify scenarios to maximize the overall provision of ES or to minimize the impacts on them.

These limitations are in line with what was found in other reviews (Cortinovis and Geneletti 2018; Mascarenhas et al. 2015), showing that the ES concept was only implicitly part of urban spatial plans and that a mismatch between planners' perceptions and its real level of integration exists. Existing sustainability-based planning perpetuates the traditional approaches of recognizing ecosystem services without explicitly using them to improve land-use decisions. As such, practitioners interested in using an ecosystem service-based framework for planning have no reference for the type of norms, goals, information and strategies they should take into account (Woodruff and BenDor 2016, pp. 97–98).

As reported in Sect. 3, only a limited number of plans derived actual planning decisions from analyses or assessments of ES; the few examples included sites where high cultural (recreation areas) or provisional services (areas with historical agricultural value) were recognized. For these sites, specific new forms of protection/conservation have been proposed, including the creation of new areas for recreation (peri-urban parks), the enlargement of existing protected areas or the safeguarding of farmlands with traditionally high-profitable crops (vineyards, local orchards, etc.).

In this scenario, a couple of examples not included in the review shed some lights on more concrete possibilities of increasing the level of ES inclusion in urban plans. Several important Italian cities have just started new planning processes that explicitly make use of ES, including recent and ongoing revisions of the urban plans of Milan and Trento. In the urban plan of Milan, all environmental aspects are analysed through the ES approach, and the city will adopt ES as a new environmental standard to evaluate the impacts of land-use transformations for the first time (Comune di Milano 2018). Similarly, the new urban plan of Trento aims to integrate the results of ES assessments into the definition of performance requirements for future urban transformations (Cortinovis and Geneletti 2018, p. 306). Such options range from the design of compensation schemes based on the expected impacts of planning interventions on ES supply, to more innovative approaches where the required performances are tailored to the existing types and levels of demand for ES in different parts/districts of the city.

Results of this review depict a scenario not so different than other countries. For many years, the limited and implicit inclusion of ES in urban planning discourse has been identified in Europe and worldwide (e.g. Mascarenhas

et al. 2015; Rozas-Vásquez et al. 2018; Woodruff and Ben-Dor 2016). This can be partially due to the lack of legal obligations for protecting and restoring urban ecosystem services at different scales and governance levels (Sirakaya et al. 2018, p. 211). More relevant examples of urban plans that have started to include ES voluntarily in urban planning can be found in Sweden, where selected municipalities have planned the specific protection of habitats for biodiversity, recreation and well-being (Nordin et al. 2017, p. 11). A review of regional plans in western Switzerland found that ES were more present in non-binding operational sections than in binding sections of the planning documents (Jaligot and Chenal 2019, p. 7–8), identifying the opportunity for the Swiss cantons to take up the concept into the binding parts of their structural plans. The non-explicit reference to ES characterizes urban planning documents in Canada, where Lam and Conway (2018) showed that the term ES was rarely used, although analysed urban plans included several ES-related concepts.

### 4.3 Reasons for the limited impacts and needs for governance and normative innovation

One of the reasons for the resistance in having planning decisions based on ES assessment could be related to the different scientific and disciplinary fields from which the ES concept has originated. Indeed, in the reviewed plans, frequent references to ES are present in analysis/evaluation of ecological networks and where natural ecosystems are mentioned in a general sense for their ability to provide functions and services. Interestingly, urban ecosystems and agroforestry systems were almost not mentioned, despite the general growing attention to new forms of urban agriculture in urban contexts as demonstrated by initiatives that are flourishing in a high number of Italian cities (La Rosa, in press).

The results of the review also highlight a straightforward, but interesting point. Urban plans that explicitly integrated ES more effectively were from regions that promulgated planning laws recently and included some references to ES, despite its relative immaturity at the time. This is the case for some northern Italian regions such as Lombardy, Emilia-Romagna and Liguria. Plans from southern Italian regions that referenced ES were absent, with few exceptions.

Another reason for the limited integration of ES is the absence of mandatory inclusion in planning processes. This was evident when no plans meeting this criterion were found (Table 3). In all likelihood, the lack of plans requiring ES integration is also due to the historical relation between spatial planning and national planning systems, which shape the scope and content of each plan (Rivolin 2008, p. 168). Therefore, it suggests the opportunity to embed ES through new forms regulations and planning standards. Theoretically, ES provide an opportunity to improve spatial planning

by recognizing and explicitly highlighting the relationship between ecosystems and human well-being. To achieve this potential, new standards for high-quality ecosystem service plans should be set (Woodruff and Ben-Dor 2016). In the Italian context, for example, one possible way could be to design a new way to define urban services that are required by the 1968 national law for urban minimum requirements (“Standard Urbanistici”). For example, Pelorosso et al. (2017) propose new standards for spatial planning based on ecological processes and the relative functions of all open spaces and semi-natural areas delivering ES. Such standards should be based on new measurements able to quantify ES at different scales (Leone et al. 2018, p. 86). These new measurements would also be able to quantify the performance of planning decisions and alternatives (Steiner 2019, p.39), thereby providing each ecosystems with spatially explicit values (La Rosa et al. 2016, p.13).

New and innovative regional planning laws are starting to utilize a similar approach. For example, the new regional planning law for Liguria, although yet to be approved, safeguards the integrity of the “Natural Capital”, in terms of ES provision in the normative section. (Regione Liguria 2017a, b) This law proposes the potential for each municipal urban plan to identify the areas where new developments are allowed providing they are compensated by actions for increasing slow mobility (i.e. pedestrian or cycling pathways) and public green spaces. Interestingly, the law foresees the introduction of a specific compensatory mechanism-based, not on the quality/quantity of development areas, but on the potential ES that these new public areas could provide.

Moving to a higher level of spatial governance and planning, further integration should also lead to the inclusion of ES in strategic objectives, as well as the identification of demands and beneficiaries (Cortinovis and Geneletti 2018) as a mean to strengthen planning decisions and increase the quality of current urban plans (Wilkinson et al. 2013). This is particularly important in context to larger urban areas where ecosystems are also a part of even larger metropolitan surroundings, requiring cross-administrative attention and strategic governance.

## 5 Conclusions

The review of Italian urban municipal plans has shown that the explicit and voluntary use of the ES concept in spatial planning is still limited; only a low number of urban plans have used ES evaluations and assessments to derive actual planning decisions to protect or better manage urban ecosystems and their services. This aligns with the resistance against and inertia in putting socio-ecological knowledge into practice and improving socio-ecological practices,

especially regarding the effectiveness of the ES concept in planning (Xiang 2017). The promise that ES-based planning could facilitate the combination of environmental information and community values and ensure that a shared set of services are protected after urban transformation, remains unfulfilled for Italian urban planning.

Different from other approaches proposed for the mainstreaming the ES concept (e.g. Scott et al. 2018), the findings of this work indicate the need for a reform of the current planning laws at different administrative levels (national or regional) that mandate the evaluation of ES in urban plans of municipalities. A normative reform might offer a possible path towards the mainstream of this concept to local practitioners and planning administrations. This could have positive impacts on the overall national planning context, considering the high number of Italian municipalities and the strong potential for the territorial transformation of urban plans. To this end, the role of scholar–practitioners (Xiang 2019) in proposing procedural and technical innovation of existing planning norms, as well as laws and regulations, will be crucial and allow for the integration of contemporary scholarly knowledge into daily technical and administrative domains.

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mental indicators, Environmental Strategic Assessment, Land Use science and landscape studies.

Daniele La Rosa (Ph.D. in Urban and Regional Planning) is Assistant Professor (with National Habilitation and tenure track) in Urban and Environmental Planning at the Department Civil Engineering and Architecture of the University of Catania (Italy). He teaches spatial planning and urban design in Building Engineering M.Sc. course at the University of Catania. His research topics include sustainable planning, Ecosystem Services, GIS applications for urban and landscape planning, environ-