



Ecosystem services in urban plans: What is there, and what is still needed for better decisions



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ABSTRACT

In cities, land-use decisions made during planning processes determine the availability of ecosystem services fundamental to the wellbeing of urban population. Hence, the inclusion of ecosystem services in planning is essential to promote sustainable urban development. This article investigates to what extent ecosystem services are currently included in urban plans. The ultimate objective is to understand what ecosystem service information is already used, and what is still needed to improve planning decisions. We developed a methodology to review the content of planning documents irrespective of the terminology adopted to refer to ecosystem services, and examined the inclusion of nine urban ecosystem services across three plan components. In our sample of 22 urban plans of Italian cities, we found a high number of actions to address urban ecosystem services and a variety of tools for implementation. However, a two-speed integration emerges: a set of ecosystem services (i.e. recreation and some regulating services linked to typical urban environmental problems) are widely addressed, while others are hardly considered. Shortcomings can be partly ascribed to gaps in the scientific literature. Usable methods to assess urban ecosystem services at the right scale and resolution while also accounting for the multi-functionality of urban green infrastructures are still needed. On the other hand, future urban plans would benefit from a further appropriation of the ecosystem service approach by practitioners and decision-makers. Acknowledging the whole range of urban ecosystem services, defining strategic objectives related to their provision, and explicitly identifying demand and beneficiaries could increase awareness of the values at stake, ensure long-term commitment in the implementation phase, and strengthen planning arguments against conflicting interests.

1. Introduction

Many recent works, from both a research and a policy perspective, advocate the inclusion of ecosystem services (ES) in decision-making to promote sustainable development (Díaz et al., 2015; Guerry et al., 2015; TEEB, 2010a). In real-world cases, ES knowledge has demonstrated to improve decision-making processes at different levels, by raising stakeholders' awareness and reframing dialogues (conceptual level), by providing support for plans and policies (strategic level), and by guiding specific decisions (instrumental level) (Mckenzie et al., 2014). At the strategic level, planning processes and tools benefit from decision-makers' knowledge on ES to produce sustainable land-use decisions (Posner et al., 2016). Integrating concerns for ES at this level is expected to provide a more comprehensive understanding of the values at stake and of the trade-offs that may arise from land-use decisions (de Groot et al., 2010). This should lead to a more informed assessment of the long-term outcomes of planning actions on both

biodiversity and human well-being (Haines-Young and Potschin, 2010). However, authors report a still limited up-taking of ES in decision-making (Ruckelshaus et al., 2013), particularly in planning practices (Albert et al., 2014a, 2014b; Geneletti and Zardo, 2016; Sloomweg, 2015).

Urban ES provide fundamental contributions to the wellbeing of population (Gómez-Baggethun and Barton, 2013), and their benefits are linked to many of the most pressing challenges for cities, from climate change adaptation and mitigation (Demuzere et al., 2014), to citizens' health (Tzoulas et al., 2007). The provision of urban ES depends on the availability and spatial distribution of green and blue areas, hence on the strategic decisions on land-use allocations that are made during planning processes. Urban planning also determines the distribution of population and functions within the city, which affects the demand for ES (Baró et al., 2016; Burkhard et al., 2012), as well as other properties of city physical structure (e.g. accessibility), which play a key role in defining who benefits from ES (Barbosa et al., 2007). Therefore, the

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incorporation of ES in urban plans is considered an indicator of their quality (Woodruff and BenDor, 2016) and, ultimately, of their capacity to put in place strategic actions towards more sustainable and resilient cities (Frantzeskaki et al., 2016). Using Italy as a case study, this article explores how urban plans integrate knowledge on ES to secure or improve ES provision by conserving, restoring, and enhancing urban ecosystems. The ultimate objective is to shed light on what ES information is already included in current urban plans to support planning actions, and what is still needed to improve their content and decisions.

Scientists have monitored the uptake of ES in planning practices mainly following two approaches. The first approach investigates how practitioners, policy-makers, and stakeholders understand the concept of ES. Perceived opportunities and limitations in the use of ES in planning are usually elicited from key informants through interviews. For example, Niemelä et al. (2010) identified advantages and disadvantages according to the opinion of 24 professionals working on land-use planning and environmental management in Finland. Other successive studies report on interviews to policy-makers from the European Commission and Member States (Hauck et al., 2013a), German landscape and regional planners, (Albert et al., 2014a, 2014b), Portuguese regional planners (Mascarenhas et al., 2014), and Swedish stakeholders and planners at the municipal level (Beery et al., 2016; Palo et al., 2016; Kaczorowska et al., 2015). Addressing self-reported perceptions and opinions, these studies do not measure the actual implementation of the ES concept into planning practices. However, their results can be useful to understand the mechanisms according to which this integration may take place.

The second approach reviews the content of documents, including strategic plans (Piwowarczyk et al., 2013), environmental policies (Bauler and Pipart, 2013; Maczka et al., 2016), Environmental Impact Assessment and Strategic Environmental Assessment reports and guidelines (Honrado et al., 2013; Mascarenhas et al., 2015), environmental laws (Matzdorf and Meyer, 2014), and, more recently, urban plans (Hansen et al., 2015; Kabisch, 2015; Rall et al., 2015). These studies usually apply a content or keyword analysis. Some searched for the explicit use of the term “ecosystem service” inside the documents as an indicator of the influence of the ES paradigm on the policy discourse. However, this method does not reveal if and how well the concept is actually applied (Hansen et al., 2015). Moreover, a lack of explicit reference to ES does not necessarily mean that the underlying concept is missing. Previous results suggest that planners may perceive a high level of ES integration even when the term is absent from planning documents (Mascarenhas et al., 2014), and that linguistic preferences related to local habits or established practices may limit the explicit mention of ES even when the concept is accepted and acknowledged (Niemelä et al., 2010). Hence, one may gain a better understanding of the integration of the ES concept in planning by accounting for its implicit use, either through larger sets of keywords (Maczka et al., 2016; Mascarenhas et al., 2015) or through deeper content analyses (Hansen et al., 2015).

Investigating the uptake of ES as a new planning paradigm and strengthening its newness compared with other approaches may lead to overlook the fact that urban plans have a tradition of accounting for – at least some – ES. ES-inclusive approaches have routinely been used in planning, even though under different names, as it clearly emerges from both planners opinions (Beery et al., 2016) and historical analyses of planning documents (Wilkinson et al., 2013). To understand how the ES approach can contribute to improve the current planning practices, it is necessary to identify which urban ES are addressed and how, and to what extent the conceptual framework of ES is already integrated in urban plans. To this aim, our research investigates the contents of plans searching for implicit references to ES and classifying the information based on the use within the plan. Section 2 describes the methods adopted and the selection of the sample. The main findings of the analysis are presented in Section 3 and discussed in Section 4, focusing

particularly on what is already there in terms of actions and tools for their implementation, and what is still needed for an effective integration of ES in urban plans. Finally, conclusions are drawn in Section 5.

2. Materials and methods

2.1. Analysis of planning documents

The analysis of planning documents is based on a directed qualitative content analysis, which aims at interpreting the contents of a communication starting from an existing theoretical framework (Hsieh and Shannon, 2005). The framework provides the key categories that are used to classify the contents based on similar meanings, thus following a deductive approach (Elo and Kyngäs, 2008; Hsieh and Shannon, 2005). Since urban plans are “communicative policy acts”, this analysis is a suitable way to systematically investigate and assess their contents (Norton, 2008), as shown by previous applications in plan quality evaluation (Lyles and Stevens, 2014). The analysis is composed of three steps, which are described in the following subsections.

2.1.1. Assessing the breadth of ES inclusion in urban plans

The key categories of interest in this research are urban ES and plan components. That is, we aim to analyze how different urban ES are addressed in different plan components. We define urban ES as those services “provided by urban ecosystems and their components” (Gómez-Baggethun and Barton, 2013). Hence, urban ES are those directly affected by planning decisions and actions at the urban scale. Building on the classification provided by Elmqvist et al. (2016) and Gómez-Baggethun and Barton (2013), we consider nine urban ES: food supply, water flow regulation and runoff mitigation, urban temperature regulation, noise reduction, air purification, moderation of environmental extremes, waste treatment, climate regulation, and recreation. Following previous content analyses of urban plans (Baynham and Stevens, 2013; Berke and Conroy, 2000; Geneletti and Zardo, 2016; Heidrich et al., 2013; Woodruff and BenDor, 2016), we identify three main plan components: information base, vision and objectives, and actions. The *information base* component illustrates the background knowledge that supports planning decisions. The *vision and objectives* component states the long term vision of the plan and the targets (either qualitative or quantitative) that the plan pursues. The *actions* component illustrates decisions taken by the plan, including strategies and policies (projects, regulations, etc.) that are envisioned to achieve the objectives.

Urban ES and plan components are cross-tabulated in a table (Table S.1 in the Supplementary material), which is filled for each plan under investigation by analyzing both its textual and cartographic documents, and reporting the relevant content. To measure the overall breadth of inclusion of the analyzed ES, we adopted the formulation of the breadth score indicator proposed by Tang et al. (2010) and later applied by Kumar and Geneletti (2015), which is defined as the percentage of plans that include relevant content on the specific ES. We calculated the breadth score both for the whole plans and for each component individually. Then, the inter-component coherence, i.e. the presence of the same ES across the different components of the plans, was assessed by applying a Chi-squared test for independence to all the possible combinations of two components (*information base/vision and objectives*, *vision and objectives/actions*, *information base/actions*).

2.1.2. Assessing the quality of ES inclusion in urban plans

Following a common approach in the existing literature on plans evaluation (Baker et al., 2012; Berke and Conroy, 2000; Geneletti and Zardo, 2016; Kumar and Geneletti, 2015), we developed a scoring protocol to assess the quality of ES inclusion in the plans. Quality is conceptualized as the presence of desired characteristics and is

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