Mainstreaming the Ecosystem Services Values in the Context of Green Public Procurements

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Abstract. The Public Procurement serves as strategic instruments that can steer the sustainable transformative change of territorial transition. Its intrinsic value to be used actively for supporting the supply the Ecosystem Services (ES) globally remains underpinned and few attentional in the sectorial scientific literature. This contribution is oriented to investigate how Green Public Procurement (GPP) can serve as instrumental bridge to renewal traditional approach toward nature-positive paradigm that support the production for ES in multiple and diversified contexts. To tracking the underground principles that link procurement mechanism with assessment practices related to the ecosystem services, the expected outcome of the works consists in the proposal of an operational framework for integrating nature assessment in procurement outline. The study is supported also across the study of a demonstration case about the "100Parks of Rome" initiative, that represents an example of green infrastructure investment nature-positive pro ES production. The paper concludes with the description of main challenges that face during the implementation, and with the sharing of policy directions to follow for facilitating the mainstreaming the accounting of ecosystem services in nature-positive procurement procedures.

Keywords: Ecosystem Services · Green Public Procurement

1 Introduction

The global decline of nature footprint has significant implications not only for ecosystem integrity and connectivity, but also for the ecosystem services values that drive the transformation of societal and economic systems. The capacity of ecosystems to provide services that could restore, maintain and/or improve biodiversity, affects the resilience attitude of the economic-societal communities to face environmental risks and resulting impact [1]. The latter extend across multiple sectors, including (e.g.) well-being, water resilience, economic development, with substantial increasing of social cost of mitigation and restoration strategy actions [2].

Building nature-people communities for a positive and resilient green transition raises issues relating to biodiversity loss, and subsequently to economic security prosperity, social well-being, and environmental justice. Each of these challenges is interlinked, yet they are often addressed in isolation rather than in a complementary manner; a systemic, top-down and bottom-up approach is therefore required. From this perspective,

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NbS could represent an innovative values-sharing platform, where multiple decision-making spheres engage in dialogue towards a common synthesis of knowledge, whilst maintaining their integrity [3].

IPBES highlights the need for new ways of thinking about economics that can account for non-instrumental and non-individual values, recognizing that they are incommensurable within conventional economic framing because they are difficult (or inappropriate) to incorporate into preference based trade-off analyses (e.g., cost–benefit analysis) or monetize [4]. A synthetic perspective on how to incorporate more diverse values in biodiversity economics - the area of economics that studies the role of nature, biodiversity and ecosystems in the production, consumption, valuation, allocation, and exchange of goods and services, how those economic processes affect nature, and the way they are institutionalized and governed - remains absent [5].

Addressing these interconnected challenges requires transformative change – a fundamental, system-wide reorganization of technological, economic, and societal systems [6]. This transformation involves shifts not only in policies and governance arrangements, but also in underlying societal values, economic incentives, and decision-making paradigms [7]. Achieving such change requires moving beyond fragmented, sector-specific interventions toward cross-fertilization knowledge paradigms that explicitly recognize the interdependence between ecological integrity, climate resilience and people-nature values [8]. Through complementarities, different knowledge systems can contribute to an enriched picture. The analysis of the enriched picture, including synergies and contradictions across diverse knowledge systems, can enhance the understanding of environmental conditions and change, and the potential for sustainable governance practices values based [9].

Despite their potential to be eligible as values-shared communities, the large-scale uptake of NbS across the EU remains constrained due to multi-sectorial value transfer boundaries. These are concerned with jeopardized governance and policy frameworks that address biodiversity, economic development, and well-being sectorally. These domains are often managed through separate policy processes and institutional structures, resulting in siloed decision-making that fails to capture the interactions between ecological processes, socio-economic dynamics, policy systems under the length of the mutual knowledge permeability. This fragmentation significantly hinders the effective integration of NbS as potential driver of interconnection across pluralistic knowledge systems in the fields of policy and decision-making [10].

The Public Procurement (PP) stands for a tool for encouraging nature-positive transition, by performing radical influences on markets dynamics, innovation trajectories and environmental targets achievement [11]. With this in mind, and with a view to encouraging the various stakeholders to play an active role in the transition to a greener economy, Directives at European level direct the Countries Members in integrating the sustainability measurement in public procurement mechanism toward the using of PP as strategical policy instrument oriented to contribute to broader goals.

On the basis of it, Green Public Procurement are proposed at internation level to substantiate the intent to mainstream the impact assessment on the environment giving attention to the minimization of waste production, lowering pollution emissions and

water quality standard. This is pursued referring to the life cycle of good and services, to integrate environmental considerations into procurement decisions process [12].

This document analyses the limitations of the current assessment of ecosystem services in the context of 'nature-positive' public procurement. The aim is to examine, from a theoretical perspective, the importance of integrating ecosystem service indicators into public decision-making to ensure sound governance practices (Sect. 2); with a view to supporting the transition from green public procurement to management approaches that have a positive impact on nature (Sect. 3), including through operational tools to be used to implement ecosystem service accounting during the procurement process. An urban regeneration initiative was examined as a case study demonstrating the attempt to incorporate the valuation of natural capital into the planning and regulatory framework relating to transformations in urban and peri-urban contexts Sect. 4).

2 Ecosystem Services Valuations in the Urban Governance

Ecosystem services refer to the goods and services that natural capital is capable of providing to people in the form of benefits that are beneficial to human health [13]. The significance of ecosystem services depends on the reference assessment context, as well as on the underlying structure of relationships between cross-sectorial fields [14]. Significant references in the scientific literature in this field associate ecosystem services with spatial planning and governance, treating them as drivers of sustainable land transformation [15]. Within this analytical framework, the aim is to guide land management and land-use policies with a view to ensuring, over time, the production and provision of pre-established service targets capable of fully meeting the demand for social well-being. To this end, a range of tools is being implemented to regulate the allocation of land-use designations in a manner compatible with the useful life of existing natural capital [16].

The application of ecosystem service assessment mechanisms within a policy and planning context results in a fragmented and complex picture. The study by Kremer et al. (2016) is noteworthy because it examines the disparity, particularly in an urban context, between decision-making processes and ecosystem service assessment mechanisms. This is mainly due to: *i*) difficulties in unambiguously defining the meaning of an ecosystem service that can be widely recognised by the scientific community in general in relation to the urban environment; *ii*) a lack of shared methods and standardised scientific databases to measure and analyse various types of data on the availability of ecosystem services in relation to different land-use types, depending on the intervention to be implemented; and *iii*) an inability to appreciate the benefits that natural resources provide over a short- to medium-term analytical timeframe [17].

It is useful to address the challenges associated with biodiversity conservation, sustainable land-use planning and natural resource management in order to create a green market, by drawing on frameworks at different scales. Some of these have been developed

with the aim of integrating the accounting of ecosystem services into the entire decision-making process. For example, the UN (2012) proposed the System of Environmental-Economic Accounting (SEEA) to guide public and private bodies in their decision-making when taking into account the provision of ecosystem services. To assist governments in creating and implementing coherent policies, the Policy Coherence for Sustainable Development Framework was established. Others, such as the Building System Carbon Framework (2020), aim to achieve net-zero emissions in the built environment. The Cooperation Framework (2022) defines the roles that the United Nations development system plays within a country and influences how the UN resources required both within and outside the country are organised (UN, 2022). Their differences stem from the different analytical frameworks used, rather than from the objectives they sought to achieve [18].

Nature-based Solutions (NbS) can simultaneously improve human well-being and biodiversity, but current frameworks are unable to account for this complexity. This highlights the potential drawbacks of applying the internationally published framework, even in the absence of a standardised operational strategy for environmentally responsible transformative change at multiple spatial scales [19]. The implementation of NbS at different levels of governance is influenced by land-use policies and practices, as well as by the regulations governing land conversion through the adoption of appropriate design measures. Among the tools that can influence the practical implementation of nature-positive investments in support of ecosystem services are codes of conduct for public procurement [20].

Public procurement acts as a channel for dialogue between territorial governance policies and the decision-making systems that regulate territorial transformation, based on the relationship between the public sector, the private sector and citizens. It serves as a tool for the exchange of knowledge between multi-value systems of an economic, social and environmental nature [21]. The system of interrelationships between multiple decision-making spheres is a distinctive feature of public procurement in relation to the instrument's purpose of regulating the flow of goods and services during the planning, design and implementation of territorial development actions [22].

Ecosystem services, as elements arising from the interaction between the human and natural systems, are in themselves potential drivers of ecological transition that should form the basis of public procurement. The latter may take the form of either green public procurement or public procurement that has a positive impact on the environment.

The first specifically concerns the design of new green spaces and/or the improvement of the existing ecosystem; the second, on the other hand, concerns the implementation of measures assessed on the basis of their potential impact on the environment [23].

How can public procurement become 'nature-positive' through greening initiatives? To what extent could ecosystem services be considered key factors in the evaluation of public procurement contracts? Are there any criteria and indicators that can be used as tools during the evaluation process and the monitoring phase?

To address the questions set out above, the following sections will provide a brief overview of green and nature-friendly public procurement as presented in the existing literature (Sect. 3). Subsequently, based on the analysis of a case study (Sect. 4), a suitable

framework will be outlined regarding the criteria and indicators to be used to support the evaluation of public procurement using an ecosystem-based approach (Sect. 5).

3 Green Public Procurement Nature-Positive

Green Public Procurement (GPP) is a regional policy tool promoted by European Union directives to restore ecosystems and support environmentally sound transitions. It is characterised by a focus on enhancing natural capital, with the aim of countering its excessive use for productive purposes [24]. Through the incorporation of new green elements or measures to protect ecosystems using nature-based solutions, green public procurement seeks to mitigate the environmental impact of productive activities in terms of pollutant emissions [25]. This significance of GPPs fits perfectly with the objectives on transition of the European Sustainable Finance strategy, namely low environmental impact purposes in compliance with the Do Not Significant Harm (DNSH) principle. Frequent references to GPPs refer to entrepreneurial initiatives in the production sectors, and few with reference to nature-based solutions aimed at restoring and defending existing ecosystems [26]. Especially in cases of industrial productivity, particular account is taken of the effects of production on the environment, focusing on the alteration of the climate balance by means of pollutants [27]. That is, within the context of GPPs, a single-value evaluation process is taken into account according to "input-output" logics between production factors and the outcome of production activities. The evaluation approach underlying GPPs is also reflected in the adoption of appropriate and coherent evaluation methods and tools, such as life cycle analysis, goal programming analysis techniques, and the use of minimum environmental criteria. LCA in particular is widely used in the context of GPPs in order to de-write the production process in the phases that distinguish it, and by associating the possible environmental impacts as well as the costs incurred with each [28–30] (Fig. 1).

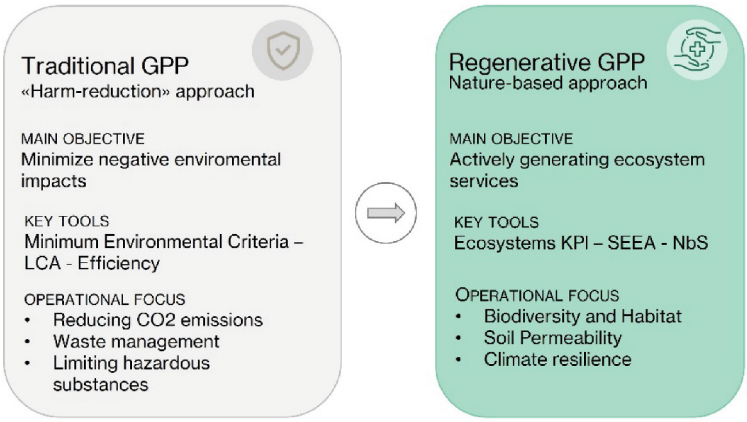

Fig. 1. From Traditional GPP to Nature-Positive GPP.

Although there is a focus on the life cycle of, for example, a production activity in the evaluation of GPP, it is limited to taking into account only air pollution-related disruptions. Extra-environmental aspects, which also are during the supply chain, are not considered. From an ecosystem perspective, this means that ecosystem services of regulation, support, supply, and culture are not judged equally and as elements to be brought in GPP evaluation processes. Therefore, a paradigm shift in GPPs is needed in the direction of nature-positive GPPs, that is, public procurement as a policy tool to aid the production of ecosystem services [31–33].

The scientific literature on ecosystem services and public procurement attempts to highlight the relational values that link economy, society, and the environment, according to the ES international classifications. These are attempts that explore their functional interdependencies, proposing evaluation metrics that are not standardized but dependent on the decision-making context of study. Productive performance variables, as well as environmental impact variables, often come into play, and metrics related to social aspects are unlikely to be found, except in cases where participatory practices are implemented. In the latter, in fact, information is often obtained, for example, on the potential likability of people for an element of existing natural capital, while also noting their willingness to pay for its protection [34]. As internationally recognized, several attempts have been developed to standardize the integration of ecosystem service values within the processes on which territorial development is based. Noteworthy among these is the United Nations (UN) System of Environmental-Economic Accounting (SEEA), which reevaluates the biophysical structure with economic appreciation. The bridge between ecosystem and economy occurs through monetization practices aimed at expressing the monetary significance of ecosystem services in relation to the characteristics of the production process. SEEA consists as an innovative regional policy instrument oriented towards nature-based solutions [35]. Through the accounting of ecosystem services, it serves as a useful strategic tool to guide development in an ecological and green direction towards the improvement of ecosystem conditions [36–39].

Despite the requirement to use minimum environmental criteria in public procurement, it is possible to detect a lack of a set of standard metrics that can be used in ecosystem-based GPPs. This is for reasons related to the difficulty of measuring certain intangible aspects of GPP, such as those related to sociability; the riskiness of pre-assessment practices without uncertain metrics; and the lack of immediate understanding of the relationship between GPP, economic development, financial convenience, and non-environmental impacts. In order to be able to make an initial contribution in the provision of standard metrics in the evaluation of GPPs from an ecosystemic perspective, i.e. taking into account ecosystem services, the aim is to provide empirical evidence of the possible metrics to be adopted in the case of nature-positive GPPs starting from the analysis and study of a demonstration case. The latter concern greening programme initiatives in Rome (Italy), in which case the municipality adopts multiple parameters to be used to evaluate the various public procurements with an ecosystem approach, as described in the following Sect. 4.

4 Putting into Practice Accounting for ES in GPP

In order to be able to take into account ecosystem services in green public procurement, it would be appropriate to have available standard metrics that can be used in the evaluation processes of public interest, especially those aimed at improving the greening footprint of the transformative context of interest. To this end, in order to provide an initial indication of which metrics could be used based on green public procurement evaluated from a nature-positive perspective, it is intended to start with the description and analysis of a pilot case, specifically the 100 Parks program in Rome, Italy. The approach to the issue of integrating the evaluation of ecosystem services in public procurement was chosen in light of the lack of standardization of the metrics to be considered during the analysis of project proposals. Hence the use of a bottom-up analytical approach starting from a case study. The study and content analysis of the case of interest were conducted by analysing the available public administration documentation that describes the characteristics of the initiative program and the requirements that projects must have at the submission stage.

In the following subsections, the demonstrative case (4.1) is outlined and the results of the content analysis are summarized (4.2).

4.1 Demonstration Case Description

The *100 Parks* Program of the City of Rome's municipal administration has as its primary objective the redevelopment of 100 urban and peri-urban green spaces, restoring their public use to the community. This program comprises a series of urban redevelopment initiatives to be implemented in the decade following 2024, the year in which the program's first 16 projects were funded. The initiatives involve urban parks as well as green spaces located in Rome's suburbs. Because green redevelopment encompasses the entire city, the *100 Parks* program encourages territorial development by building on existing natural capital and enhancing its characteristics. This also contributes to climate change mitigation, biodiversity restoration, and environmental justice, thereby avoiding socioeconomic disparities within a single urban area.

In 2024, the following 16 redevelopment projects were funded:

1. "Via Valsolda"
   The project involves the general redevelopment and creation of connections along the Aniene River and the open spaces, creating a new linear park serving the neighborhood's residents.
2. *Caio Sicinio Belluto Park*
   The goal is to enhance historical elements and strengthen ecological and physical connections between the various parts of the Aniene Reserve park and the Montesacro neighborhood.
3. "Via degli Alberini Park"
   The project involves the completion of slow-mobility paths and the creation of a path along the river.
4. *Madre Teresa di Calcutta Park*
   To improve the safe use of the park, the project includes the construction of a plaza with a multipurpose sports facility that will serve as a social hub.

5. *Green Area via M. Candia*
   The project involves the redevelopment of the existing area through the design of a children's play area.
6. "Parco degli Acquedotti"
   The project involves the redevelopment of the area, aiming to enhance the existing archaeological remains of considerable historical interest.
7. "Parco della Romanina"
   The project involves the creation of a cycle/pedestrian path connecting a large sports area and spaces for urban gardens.
8. "Giardino Pisino"
   The new garden project characterizes it as a space dedicated to children with play areas.
9. "Parco Tre Fontane"
   The project intends to enhance the park as a link between urban greenery and agricultural spaces, also strengthening the cycle/pedestrian network.
10. "Parco Cesare Pavese"
    The project involves the redevelopment of the vegetation, the system of paths, and the facilities.
11. "Parco dei Ravennati"
    The redevelopment project aims to preserve the characteristics of a historical-archaeological park and integrate them with the new needs of functional, equipped areas.
12. "Piazza Augusto Lorenzin"
    The project involves the redevelopment of the area to create rest areas.
13. "Villa Flora"
    The project's goal is to combine the enhancement of the historic garden with improved usability as a public park.
14. "Villa Veschi"
    The project aims to relocate the area within an ecological and environmental network.
15. "Parco della Cellulosa"
    The project involves the regeneration of the tree population, the restoration of the paths, and the installation of recreational facilities.
16. Lucchina Garden
    The project involves the redevelopment of the green area with new permeable paths, the creation of a playground, and a fitness area.

These are projects for the restoration of existing natural capital that involve the redevelopment of urban parks or even the reforestation of communication roads between parts of the same territorial context. This also aims to restore the ecological connection in the city over time by promoting the accessibility of the areas to residents and non-resident communities nearby. Through targeted actions, the creation of green infrastructure between distant urban areas is encouraged over time, thus implicitly promoting the development of intermediate areas within the green network.

4.2 Accounting Evidence of Ecosystem Services

La valutazione dei 16 progetti finanziati nel 2024 tiene conto di un approccio sistemico, ovvero sono tenuti in conto aspetti legati all'ambiente, ecologia, socialità ed economia. Nei GPP a base di ciascuna iniziativa sono assunti quali strumenti di valutazione delle proposte progettuali alcuni criteri afferenti rispettivamente alla sostenibilità ambientale, economica e sociale del progetto. Nello specifico, si tratta di criteri che possono trovare una loro collocazione semantica e finalistica nelle categorie sui servizi ecosistemici come proposte in ambito internazionale. The following Table 1 organizes the evaluation criteria derived from the analysis of the 16 projects proposed for the 100 Parks program, organized according to the four thematic categories of the classification proposed by *The Economics of Ecosystems and Biodiversity* (TEEB) on ecosystem services. The criteria are derived through a content analysis of the available documents relating to the 16 projects. The table shows the TEEB ecosystem services that are used as evaluation criteria for the 16 redevelopment projects. These criteria constitute a reference for implementing nature-positive GPPs with a view to promoting the ecological transition of urban agglomerations through the ES provision.

Table 1. Ecosystem Services Criteria for GPP nature-positive.

ES TEEB Categories	Ecosystem Services	ES Criteria
Provisioning	Food	
	Water	
	Raw materials	
	Genetic resources	
	Medicinal resources	
Regulating	Air quality regulation	●
	Climate regulation	●
	Moderation of extreme events	
	Regulation of water flows	●
	Waste treatment	
	Erosion prevention	
	Maintenance of soil fertility	
	Pollination	●
	Biological control	
Habitat	Maintenance of life cycles	
	Maintenance of genetic diversity	
Cultural	Aesthetic information	
	Opportunities for recreation and tourism	●
	Inspiration for culture, art and design	●
	Spiritual experience	
	Information for cognitive development	
	Existence, bequest values	

5 Conclusions

The ecological transition of a territory, such as consolidated urban agglomerations, requires the adoption of specific evaluation mechanisms aimed at promoting ecosystem-based territorial development. From this perspective, Green Public Procurement plays a central role in guiding the implementation of governance policies while respecting existing natural capital and the targets of the *New Restoration Law* and biodiversity conservation. The need to promote the restoration of existing natural capital requires evaluation metrics not strictly linked to the natural characteristics of ecosystems, but also to the ecosystem services they provide. Hence the search for appropriate evaluation criteria for green public procurement that reflect not only the biophysical conditions of natural assets, but also the benefits derived from them.

To contribute to this direction, an empirical content analysis of urban regeneration cases involving parks and green infrastructure in the city of Rome is conducted. The criteria derived from the documentary screening and compared with the ecosystem service categories proposed by the TEEB constitute evaluation tools to be used as the basis for green public procurement with an ecosystem services perspective.

To obtain results that can be generalized at the national scale, it is necessary to expand the set of case studies to include urban redevelopment initiatives for existing green areas. The next step in the research will consist of introducing appropriate biophysical-monetary accounting metrics corresponding to the evaluation criteria derived from the screening and comparison with the TEEB list of ecosystem services. This will be complemented by operational considerations on the use of appropriate multi-criteria evaluation tools useful in selecting and ranking the project alternatives gathered during the tender process.

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