Boletín de la Asociación de Geógrafos Españoles, (101)
eISSN: 2605-3322

How to cite this work: Arcila-Garrido, M., Ramírez-Guerrero, G., García-Onetti, J., & Chica-Ruiz, J.A. (2024). Socio-ecosystem Services for Integrated Heritage Assessment (IHA): a new approach to valuing cultural heritage. *Boletín de la Asociación de Geógrafos Españoles,* (101). https://doi.org/10.21138/bage.3497

Socio-ecosystem Services for Integrated Heritage Assessment (IHA): a new approach to valuing cultural heritage

Servicios Socioecosistémicos para la Evaluación Integrada del Patrimonio (EIP): un nuevo enfoque para la puesta en valor del patrimonio cultural

Manuel Arcila-Garrido

manuel.arcila@uca.es

Department of History, Geography and Philosophy

University of Cádiz (Spain)

Gema Ramírez-Guerrero

gema.ramirez@uca.es

Department of Marketing and Communication

University of Cádiz (Spain)

Javier García-Onetti

javier.onetti@uca.es

Department of History, Geography and Philosophy

University of Cádiz (Spain)

J. Adolfo Chica-Ruiz

adolfo.chica@uca.es

Department of History, Geography and Philosophy

University of Cádiz (Spain)

Receipt: 14.09.2023 **Acceptance:** 15.06.2024 **Publication:** 20.09.2024

Abstract

This paper introduces a conceptual framework that adapts the ecosystem services approach to identify the benefits of conserving cultural heritage. This novel approach aims to enhance the social valorization of this heritage. The proposed service categorization and classification are based on anthropic units that offer benefits, complementing the existing classification for services provided by biotic and non-biotic units with a systemic perspective. The Common International Classification of Ecosystem Services (CICES) and the European Union project "Mapping and Assessment of Ecosystems and their Services" (MAES) serve as the primary references. The main objective is to transcend the concept of heritage as an object-based, historical, and aesthetic treasure and instead develop a more comprehensive definition that encompasses geographical, physical-natural, social, and cultural dimensions while also recognizing the value of usage. This proposal has been validated through the analysis of over 200 cultural asset cases from the European Union. It paves the way for a new avenue of research to better comprehend and appraise cultural heritage, as well as any man-made structure that provides benefits to society. By utilizing a language equivalent to the benefits associated with natural assets, we aspire to contribute to the advancement of a more integrated and interdisciplinary approach to spatial and urban planning.

Key words: enhancement; tourism; heritage management; territorial marketing; social welfare.

Resumen

Este documento presenta un marco conceptual que adapta el enfoque de los servicios ecosistémicos para identificar los beneficios de la conservación del patrimonio cultural. Este nuevo enfoque pretende ayudar a mejorar la valorización social de este patrimonio. La categorización y clasificación de servicios que se propone se basa en unidades antrópicas que brindan beneficios, complementando con una perspectiva sistémica la clasificación ya desarrollada para servicios de las unidades bióticas y no bióticas. Se ha tomado como referencias principales la Clasificación Internacional de Servicios Ecosistémicos (CICES) y el proyecto de la Unión Europea "Mapeo y Evaluación de los Servicios Ecosistémicos" (MAES). El objetivo principal es superar el concepto de patrimonio como un tesoro histórico y estético, y desarrollar una definición más amplia que incluya dimensiones geográficas, físico-naturales, sociales y culturales, pero que también reconozca el valor de uso. Esta propuesta ha sido validada mediante el análisis de más de 200 casos de bienes culturales de la Unión Europea. Esta propuesta abre una nueva línea de investigación para comprender y valorar mejor el patrimonio cultural. Al utilizar un lenguaje

equivalente a los beneficios asociados con los bienes naturales, pretendemos contribuir al desarrollo de una planificación espacial y urbana más integrada e interdisciplinaria.

Palabras clave: puesta en valor; turismo; gestión del patrimonio; marketing territorial; bienestar social.

1 Introduction

Valuing heritage, both natural and cultural, presents challenges. While the theory of ecosystem services has been instrumental in emphasizing the essential contribution role of biodiversity in human welfare (De Groot et al., 2002; Gómez-Baggethun et al., 2010), its application to the valuation of natural systems has improved societal awareness of their significance. This prompts the question: Could this methodological approach also enhance the valuation of other types of systems?

Peterson et al. (2010), assert that the concept of ecosystem services has effectively conveyed the value of ecosystems to humanity by demonstrating their provision of vital services. Could a similar approach be adapted to underscore the value of cultural heritage beyond its aesthetic and historical dimension?

Cultural heritage, in its original form and contemporary context, is an integral part of society (Martín, 2007). However, its contribution to human welfare often goes unrecognized, and there is a lack of consensus on methods to measure its significance. While heritage awareness has led to various conservation strategies, it is evident that pure conservation efforts may not suffice, necessitating the identification of practical uses for preserved heritage (Ballart Hernández & Juan i Tresseras, 2008).

The emergence of Cultural Charters in the 20th century reflects a collective concern for the restoration, conservation, and promotion of heritage structures and sites (Charter of Athens, 1933; The Venice Charter, 1964; European Charter of the Architectural Heritage, 1975 or the Declaration of Amsterdam, 1975) However, alongside conservation efforts, there arose a need to understand and quantify the value of heritage, particularly with the rise of tourism in the mid-20th century (Poiraud et al., 2016).

Various methodologies have been developed to measure the value of cultural heritage, ranging from economic perspectives to holistic approaches considering historical contexts (Ehrentraut, 1993; Choi, et al., 2010; Goicochea, 2011; Ojeda, 2013). Conversely, these methods often yield subjective qualitative assessments, highlighting the need for innovative approaches (Viñals, 2011), that allow a systematic and relatively objective measurement of something as abstract as the

valuation of heritage, which, whether natural or cultural, is always a challenge (Brown & Weber, 2012).

In this way, the perspective used for natural heritage based on ecosystem services (therefore ES) and its impact on human well-being represents an unexplored approach to cultural heritage valuation methodologies. The ES approach has achieved an important position among academics, conservationists, development agencies, policy makers and governments (Portman, 2013). This is due to its versatility as a theoretical framework, analytical tool, and instrument for management, political discourse, and awareness (Rojas & Pérez, 2013). At present, it is not only an analysis instrument for academics but also a powerful discursive tool for policymakers and conservationists (Daily et al., 2009; de Groot et al., 2010; Fagerholm et al, 2016; Muradiana & Rival, 2012).

The cultural benefits that heritage offers to society are already recognized (though not always well-valued). It can provide undeniable aesthetic and landscape values, the mere contemplation of which is a benefit itself. In various international agreements on heritage, such as those within the UNESCO and ICOMOS frameworks (UNESCO, 1972, 2001), this heritage is also acknowledged as a resource for identity and cohesion, and, of course, for scientific and educational purposes (Martini, 2002). It is easy to identify a parallel here with the classification of cultural services in the ecosystem services approach.

Likewise, the Convention concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972) defines "cultural heritage" as including heritage "sites", understood as "works of man or the combined works of man and nature". The World Heritage List also includes some properties as "mixed cultural and natural heritage". This geographical perspective, which focuses on the setting and context surrounding a heritage element, inevitably links natural and cultural heritage, which is the basis of this study.

However, to conserve heritage entities solely for their cultural value, without explicit recognition of their potential use (service), has no guarantee of continuity over time (Ballart Hernández & Juan i Tresserras, 2008). Consequently, it is necessary to design new approaches that identify and classify the value of these uses or services to secure their contributions to human well-being.

Considering the above, this paper aims to overcome the concept of heritage as an object-based, historical, and aesthetic treasure and develop a broader definition which includes geographical, physical-natural, social, and cultural dimensions, but also recognizes the usage value. What is sought for cultural heritage, is a new way of valuing both the heritage function (the traditional cultural valuation), but also its possible current and future urban functions, according to the

characteristics and attributes. These functions provide services to society, so they can be identified and even modified, to maximize that source of services and improve their usability, valorization and, therefore, their conservation. This re-valuing will evolve into a multidimensional perspective, blending the visual, the functional, and the historical. In conclusion, this study intends to better recognize how cultural heritage contributes to human well-being.

This could contribute to improving not only the management of cultural heritage from the perspective of services, but also to constructing a complementary argument that reinforces the actions of decision-makers in the conservation of cultural assets. From this perspective, the proposal can also contribute to the development of more integrated and interdisciplinary spatial and urban planning.

1.1 Background of ecosystem services as a reference approach for better valuing of heritage

The concept of ecosystem services (ES) emerged in the late 1960s and early 1970s, with authors such as King (1966), Heliwell (1969), Hueting (1970), and Odum (1971) analysing the way in which "nature functions" provide certain services and space and benefits to humans and their social systems (De Groot et al., 2002; Gómez-Baggethun et al., 2010). The term "ecosystem service" itself was first used in the early 1980s by Ehrlich and Mooney in 1983 (Balvanera & Cotler, 2007; Costanza et al., 2017) and Ehrlich in 1987 (Fisher et al., 2009; Gómez-Baggethun et al., 2010), gaining significant traction especially in the 21st century, as some authors began referring to it as the science of ecosystem services (Balvanera, 2012).

Notably, the Millennium Ecosystem Assessment (MEA) conducted between 2000 and 2005 by approximately 1,300 scientists marked a pivotal effort in this field (UN, 2005), further echoed by the recent "IPBES 2019 Global Assessment Report on Biodiversity and Ecosystem Services" building upon the MEA's groundwork (IPBES, 2019). Other significant contributions include the monetary valuation of nature by Costanza et al. (1997, 2014), De Groot et al. (2012) and The Economics of Ecosystems and Biodiversity (TEEB) project, initiated in 2007 (Bishop, 2010; De Groot et al., 2010; Costanza et al., 2017).

The Common International Classification of Ecosystem Services" (CICES) serves for this paper as a fundamental reference point, particularly for the classification of ecosystem services. CICES has been developed addressing the evolving needs of standardization and systematic approaches to ecosystem service naming and description, with the support of the European Environment Environment Agency (EEA) and the System of Environmental and Economic Accounting (SEEA),

led by the United Nations Statistical Division (UNSD). In this paper, it has been manly used V5.1 classification version (Haines-Young & Potschin, 2018), widely used to help measure, account for and assess ecosystem services. Nevertheless, revised versions (V5.2) has been recently presented, prepared in collaboration with the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), aligning CICES with the "UN SEEA Ecosystem Accounting standard" (Haines-Young, 2023). CICES defines ecosystem services as contributions of ecosystems to human welfare, distinct from the goods and benefits derived from them, categorised as provisioning services, regulating services, and cultural services.

In this paper, we aim to extend this framework to anthropic units that also provide services, whit the hypothesis that those can be classified into equivalent categories and subcategories. This would allow the managers of cultural heritage to take advantage of the extensive efforts already advanced for the development of methodologies derived from CICES (design of indicators, mapping or assessment of services) facilitating decision-making in spatial planning and heritage enhancement. The methodology developed draws inspiration from the European Union project "Mapping and Assessment of Ecosystems and their Services" (MAES) and the Integrated Ecosystem Assessment approach. This approach acknowledges the complexity of integrated assessments and emphasizes an adaptive process (Dickey-Collas, 2014).

In this context, the University of Cadiz spearheaded the INNOVACONCRETE project, backed by the European Union's Horizon 2020 initiative, aimed at fostering social awareness and appreciation of 20th-century concrete-based cultural heritage. One case study within this project was the Zarzuela racecourse in Madrid, Spain. Despite its significance as a 20th-century architectural marvel with cultural, aesthetic, and social importance, the Zarzuela racecourse remains overlooked by many tourists visiting Madrid. It lacks cultural and heritage recognition among the general population (Ramírez-Guerrero et al., 2020; Ramírez-Guerrero et al., 2021a). Therefore, implementing the developed tool at the racecourse presents an opportunity to streamline decision-making processes for its cultural valorization, enhancement, adaptive reuse, and preservation.

2 Objectives and methodology

The core concept of this study resolves around recognizing cultural heritage as an integral component of the social-ecological system and exploring the benefits associated with its conservation and protection.

The primary objective of this research is to devise an adjusted approach for assessing the value of cultural heritage, developing a standardizable classification system of its potential services. In pursuit of this goal, a conceptual framework has been devised that extends the ecosystem services approach to encompass cultural heritage as a socio-ecological system. This adaptation proposes the introduction of a novel category termed "socio-ecosystem services" for Integrated Heritage Assessment (IHA). This endeavor presents challenges, given that, to our knowledge, the ecosystem services methodology has predominantly been applied to evaluate the conservation of natural heritage.

The specific objectives of this study are the following:

1. To categorize and classify of buildings of cultural heritage significance.
2. To conduct categorization and a comprehensive classification of the services provided by these buildings; and to tailor the theoretical framework developed for ecosystem services.
3. To validate the developed methodology in order to detect possible deviations or limitations in the application and conceptual approach presented here.

By delineating these objectives, this study endeavors to contribute to the advancement of methodologies for assessing the value of cultural heritage within the broader context of socio-ecological systems.

2.1 Methodology

The methodology carried out during the elaboration process of the study consisted of the following ten key steps:

1. Literature review: Comprehensive search was conducted to analyze existing methods for valuing cultural heritage, as well as urban management and planning approaches.
2. Exploration of ecosystem services methodology: A thorough examination of the ecosystem services (ES) methodology was conducted, focusing on its application in valuing natural heritage.
3. Conceptual framework development: A conceptual framework was formulated to adapt the ES method to meet the specific requirements of study, aiming to create a straightforward and understandable methodology for valuing cultural heritage.
4. Classification development: A new classification of anthropic or socio-ecosystem services for cultural heritage valuation was devised, drawing from the ES theory and the classification outlined by the Common International Classification of Ecosystem Services (CICES).

5. Testing and adjustment of classification: The new classification was tested and refined through analysis of databases on urban functions and activities, including the United Nations classification of economic activities (UN, 2008) and academic research on urban uses (Pissourius & Lagopoulus, 2017).
6. Further testing and adjustment: The classification was further refined through analysis of real heritage units, utilizing a database comprising 222 identification badges of significant concrete-based cultural Interest assets provided by the International Committee for the Documentation and Conservation of Buildings, Sites and Neighbourhoods of the Modern Movement (DOCOMOMO) and the International Scientific Committee on Twentieth Century heritage (ISC20C) of the International Council on Monuments and Sites (ICOMOS).
7. Process development: A step-by-step process was developed for implementing the analysis and valorisation of a heritage unit with the systemic context of its location.
8. Exploration of potential applications: The potential utility of the developed approach for decision-making, heritage management, urban planning, and territorial planning was explored.
9. Application to real case: The step-by-step process was applied to a real case study, specifically the Zarzuela Racecourse (Madrid, Spain).

By following these steps, the study aims to develop a robust methodology for valuing cultural heritage that could be applied effectively in real-world contexts.

3 Conceptual framework for a new approach

As human beings and a part of the planet's biodiversity, we have learned to modify our environment to fulfill our needs, much like other species, aiming to maximize the benefits we derive from nature. That is why we build units to obtain "advanced" services, such as a "habitat" more suitable for resting, reproducing and raising our children, or in which we can transform what we obtain from nature to "supply" ourselves with processed food and other goods. Some of this built units allows the regulation flow of people or basic urban services supplies. And of course, we have learned to create architectural art and built landscapes to please our eyes. These constructive processes, of course, involve the use of biotic (i.e. wood) or abiotic (i.e. iron, granite) ecosystem services. Applying a historical perspective, we have only complicated the process of benefiting from nature and our environment, bringing new units to socio-ecological systems, with new associated systemic processes. But our needs are essentially similar to other species. This allows us to categorize the functions developed by these built (anthropic) units and, therefore, cultural heritage, according to the needs they meet, classifiable in the same categories developed for ecosystem services.

3.1 General Systems Theory: ecosystems and sociosystems

The ES methodology, rooted in General Systems Theory (Bertalanffy, 1989), defines a system as a collection of elements interacting through functions and processes within their environment. Ostrom (2009) characterises these systems as a socio-ecological system, comprising various subsystems ecological and social processes intertwined. These components, deemed as units or assets, supply services utilized by humans and ecological and social processes interacting with each other (Azcárate & Fernández, 2017). Recognizing human influence in nearly all natural spaces, these methodologies advocate for the inclusion of the human dimension within the ecosystem definition (UN, 2005; Murawski, 2007). However, historically, the focus of these methodologies has predominantly been on natural components (or at most mixed systems or slightly transformed) (Haines-Young & Potschin, 2018).

While discussions of agroecosystems and urban ecosystem services exist, they primarily revolve around services associated with natural units (e.g., urban parks) (MA, CICES, IPBES, TEEB). Given this emphasis on the contribution of natural capital, particularly biodiversity, to human well-being, it becomes pertinent to recognise cultural heritage's role in human welfare (IPBES, 2013, 2019).

Therefore, considering that this study emphasises the fundamental contribution that cultural heritage makes to human well-being, buildings and heritage infrastructures could be referred to as anthropic units/assets or 'socio-systems', that provide services for human welfare, in the same way we talk about ecosystems as those units/assets supplying services of natural origin (IPBES, 2013, 2019). This perspective has already been addressed in previous studies by Ramírez-Guerrero et al. (2021b), where an in-depth application of a method based on the analysis of ecosystem services and applied in cultural settings is presented.

3.2 Ecosystem and anthropic services for well-being from a cultural point of view

As previously mentioned, CICES defines ecosystem services as the contributions ecosystems make to human welfare, distinguishing them from the subsequent benefits derived by people. Hence, it is feasible to recognise the contributions of "socio-ecosystems" to human welfare and refer to them as "social services" or "anthropic services". This encompasses services of both natural and human origin.

From a cultural heritage perspective, the ethnographic heritage associated with the primary sector (anthropic structures for agriculture, fisheries, livestock), facilitates a rapid comparison because of the direct relationship between the anthropic and natural units. In that case, following the Millennium Ecosystems report of the United Kingdom (Elliott, 2011), we could talk about "third level services

or advanced services", because human knowledge is needed, as well as sometimes physical structures, to transform ecosystem services into benefits. In this case, those would be services developed by man, socio-services, but based on natural assets.

It is important to highlight that in addition to *traditional* ecosystem services, there is a special category known as Cultural Ecosystem Services (CES). These services are those that have cultural or symbolic value for human communities and are closely linked to cultural heritage (Normyle et al., 2023). Socioecosystem services include both cultural and environmental benefits, thus recognizing the importance of cultural heritage in the context of ecosystem services. Integrating CES into the proposal of socioecosystem services provides a more comprehensive view of how ecosystems contribute to human well-being not only through environmental services but also through services that have cultural value for local communities (Xia et al., 2024). Some specific examples of CES related to cultural heritage include cultural tourism, environmental education based on local history, and traditional resource management that reflects ancestral cultural knowledge and practices (Smith & Ram, 2017). These examples illustrate how ecosystems not only provide material benefits but also meaningful cultural experiences and connections for human communities.

3.3 Types of service provider units

If the definition of "ecosystem" already includes human elements and processes (UN, 2005), the division between ecosystems and socio-systems loses significance. However, for the sake of clarity in this study, the separation will be maintained and extended to services, aiming to simplify comprehension of a complex reality (Dickey-Collas, 2014). Hence, the following terms will be strictly employed: barely-altered or natural ecosystems, altered/transformed ecosystems, highly-transformed ecosystems, and anthropic or totally-transformed ecosystems (including man-made systems). For instance, the Millennium Ecosystems Assessment distinguishes between non-human ecosystems (natural ecosystems) and human ecosystems (the urban system) (McGranahan et al., 2005).

Similarly, services provided by these units should be classified, ranging from natural or semi-natural origin to more anthropic origin (or man-made) services. However, some systems may supply both categories of services (e.g. agro-ecosystems), while others may predominantly offer one type over the other (e.g. urban systems). To aid readers unfamiliar with the ecosystem services framework, the aforementioned nomenclature will be maintained, ensuring theoretical clarity.

In line with Ostrom's (2009) anticipation, socio-ecological systems or socio-ecosystems are understood here as a combination of units (assets) or subsystems performing functions, characterized by complex interrelations between components and processes of biotic (living natural elements, e.g. fauna and flora), abiotic (non-living natural elements, e.g., rocks, sands, atmospheric components), and anthropic (not natural, made by man, e.g., buildings, roads) origins, such as buildings and roads.

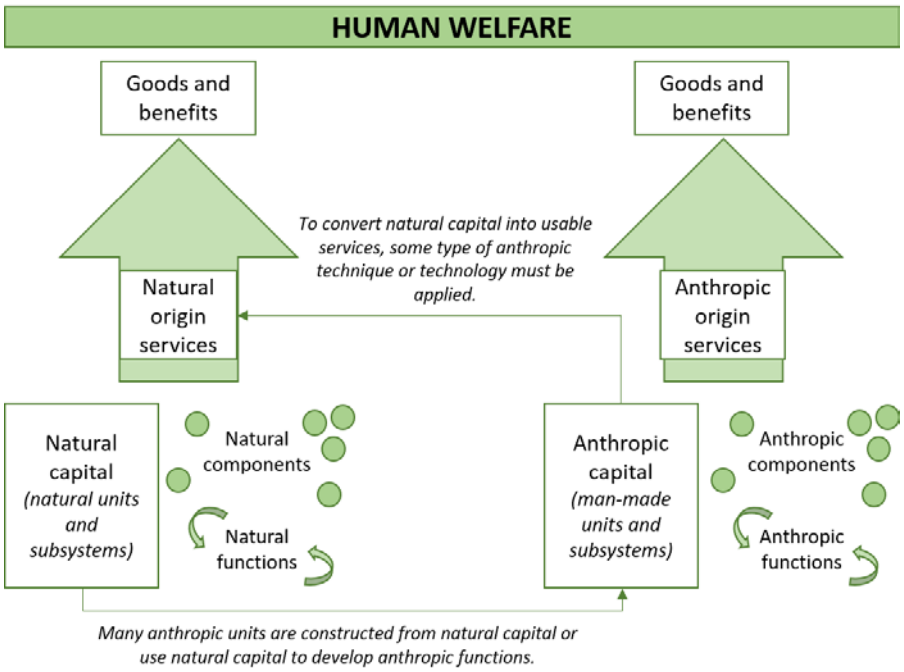
3.4 Services classification according to their origin

In this context, services are generalized and classified based on the proportion of main elements, assets, and functions that generate them according to their origin. MA, TEEB, IPBES, and CICES inherently consider services of biotic origin in their classification of ecosystem services. In the recent proposals, CICES expanded its classification to include the abiotic category, recognizing the importance of physical characteristics and behaviours of natural systems to people (Haines-Young & Potschin, 2018). Following this classification logic, services originating from anthropic units could also be accounted for.

Therefore, the proposed categories are as follows: biotic services, associated with units or systems primarily composed of living natural elements; abiotic services, provided by units where non-living natural elements predominate; and anthropic services, linked to highly transformed or unnatural element built by humans. Given that ecosystem services fundamentally arise from living structures and processes (Haines-Young & Potschin, 2018), it is reasonable to consider human structures as providers of services for the practical aims of this study.

It is important to note that anthropic units or assets, with few exceptions, rely on services associated with natural units or assets for their construction. Additionally, anthropic units may develop their own processes of purely human origin to produce benefits (e.g., cultural functions). Figure 1 illustrates this relationship between anthropic and natural processes and their impact on human welfare.

Figure 1. Relationship between services according to their origin and their relevance for human well-being



Source: authors' own elaboration

3.5 Four service categories

As previously noted, CICES utilizes categories from TEEB and the Millennium Ecosystem to classify final ecosystem services into three categories: provisioning, regulation, and cultural services. This study aligns with this classification logic, as the primary human needs fulfilled by functions developed by various anthropic structures can neatly fit into these categories. To test this hypothesis, an exercise was conducted to classify major economic activities, defined by ISIC (UN, 2008), and key urban functions, as described by Pissourius & Lagopoulos (2017).

However, a new category has been included: spatial support, associated with space and physical support, offered by certain anthropic structures (Onetti, 2017). This represents a significant adaptation to the original classification, as this function was not initially included in the CICES service-classification system. Further analysis of this addition will be provided in the subsequent section.

Table 1 outlines the adaptation proposed in the Integrated Heritage Assessment (IHA) framework. It presents the categories developed by CICES and demonstrates how they have been adjusted for anthropic systems.

Table 1. CICES and IHA Proposal classification comparison

CATEGORY	CICES DEFINITION (for natural systems)	IHA Proposal (for anthropic systems)
Provisioning services	Products obtained from ecosystems (natural or mixed units).	Products obtained from anthropic units (transformed and handmade / artificial units).
Regulating services	Benefits obtained from the regulation of ecosystem processes (natural processes).	Benefits obtained from the regulation of social processes (human relations, activities...).
Cultural services	The nature elements characteristics that provide opportunities for people to derive cultural goods or benefits (visual, experiential, sensitive, emotional, and cognitive benefits).	The anthropic systems characteristics and elements that provide opportunities for people to derive cultural goods or benefits (visual, experiential, sensitive, emotional, and cognitive benefits)
Spatial support	Not considered	Space and/or the physical support necessary to allow or sustain certain needs and functions.

Source: authors' own elaboration

3.6 Considering space and spatial support

The new category of services, 'Spatial support', does not exist in the main references analysed, but it has been considered necessary for the objectives proposed in this study. Some background information aligns broadly with aspects of this category's proposed approach (Maynard et al., 2010; Atkins et al., 2011; Ahlhorn et al., 2013; Piwowarczyk et al., 2013; Asmus et al., 2015; Van der Meulen et al., 2016; García-Onetti, 2017; García-Onetti et al., 2018; Ramírez-Guerrero et al., 2021).

From a practical standpoint, we asset that the space availability holds sufficient relevance to warrant inclusion in the general classification, consistent with the perspective of García-Onetti et al. (2018, 2017). Through the experience gained in this study, space is to be considered in both the anthropic and ecosystem services classifications. This alteration prompts a deeper theoretical discussion process, albeit beyond the current study's scope, yet essential for future consideration. While CICES suggests that "space" itself is not am ecosystem service and is better addressed in land accounting systems (such as the SEEA Central Framework) (Haines-Young & Potschin, 2018), some scenarios blur the distinction between what constitutes an ecosystem service provided by natural functions included by CICES. For instance, geomorphological aspects associated with river valleys and deltas, or the support provided by certain ecosystems like coral reefs to other species can be considered.

A point of debate revolves around whether space should be categorized as an intermediate or final service. While all services require space and physical support as intermediate services, warehouse, for example, provide a final service. Currently, the term "space provision" is considered a separate category rather than integrated into the "Provision" category as suggested by Atkins et al. (2011), Van der Meulen et al. (2016), and Maynard et al. (2010). This decision is substantiated by the dual benefits associated with space provision: fulfilling specific surface area or volume needs and providing adapted surfaces to facilitate physical support, such as transportation infrastructure.

The crux of the "spatial support" service lies not in the physical state of the unit at any given moment or the intensity of what it transports but rather in its passive quality-the availability of useful space and physical support to facilitate various activities. This category encompasses space reserved for expansion of buffer areas with restrictions.

Regarding the provisioning service category, it involves the supply of material elements, an active flow of material, supplies, people, vehicles, and money, including information, knowledge, and professional services. These aspects primarily pertain to the production process rather than intellectual growth.

In anthropic system, intrinsic cultural value is inherent due to the presence of cultural heritage. In addition to their original function, buildings possess cultural significance derived from their history, architectural value, or the individuals associated with them. Special attention must be given to the development of ecosystem services for cultural services within the context of heritage management, whether in a natural or territorial sense.

4 The Integrated Heritage Assessment (IHA) approach

The results obtained can be summarized in three blocks: 1) The construction of the conceptual base associated with the methodology of the socio-ecological assessment tool; 2) the classification of anthropic services; 3) the development of the application methodology itself through the step-by-step process.

4.1 Conceptual basis

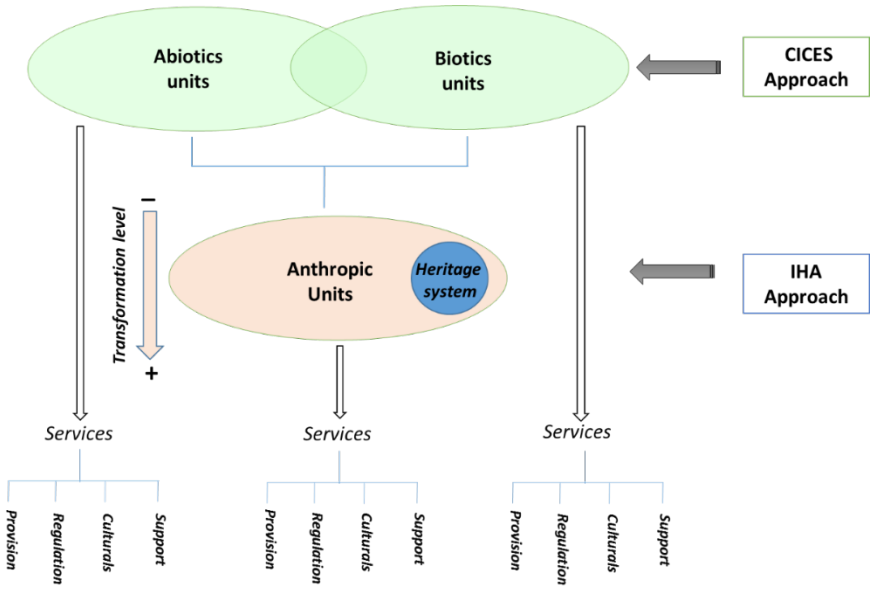
A summary of the conceptual contributions of the study is presented.

- Socio-systems: Anthropogenic units/assets responsible for providing services for human welfare, encompassing man-made structures, buildings, heritage infrastructures, etc.
- Anthropic services: Contributions from socio-systems to human well-being.

- Spatial support services: A novel service category introduced here, defined as the space provision of space physical support necessary to accommodate or sustain specific needs and functions.
- Socio-ecological systems (for the IHA approach): A combination of units (assets) or subsystems that develop functions, featuring complex interrelations among their components and processes from various origins, including biotic, abiotic, and anthropic.

Figure 2 summarizes the conceptual construction developed for the IHA approach and adapted from the ecosystem services methodology.

Figure 2. General scheme of the conceptual base developed



Source: authors' own elaboration

4.2 Classification proposal for the socio-ecosystem services

The methodology applied in this study has yielded a classification proposal for anthropic services. This section aims to introduce a well-organized classification system encompassing the aforementioned service categories. Table 2 provides a succinct overview (extended in Annex 1) of the developed classification, adhering to the logic employed by CICES for ecosystem services (Maes et al., 2018).

In Annex 1, the table displays the associated service category in CICES, the category developed, examples of heritage building types, and category examples among the 222 analysed throughout Europe (part of this sample can be seen at https://100of20.innovaconcrete.eu/). Each service category is briefly described based on the benefits it can generated in society, along with examples

of buildings that can fulfill the associated functions. This work is part of the process of validating the conceptual framework regarding the association of the different services linked to the categories mentioned above.

Table 2. Classification of anthropic services

Category	ID	Type
1. Spatial support	1.1	Necessary space for resting and/or housing
	1.2	Operative space for the development of human activities
	1.3	Space to store, deposit and/or reception
	1.4	Necessary support to allow movement and transport
2. Provisioning services	2.1	Human mobility to allow other anthropic activities
	2.2	Provider of goods and products to allow other anthropic activities
	2.3	Provider of basic urban services
	2.4	Provider of goods and products through the transformation, processing and handling of the materials
	2.5	Provider of monetary benefits by commercial activities or exchange (money, material or services)
	2.6	Provider of professional services, information and knowledge
3. Regulating services	3.1	Regulation of waste by an urban or industrial process
	3.2	Regulation of the flow of people, vehicles, goods and materials
	3.3	Regulation of conditions for habitability, security, social development, economic interactions and organization
	3.4	Regulation of basic physical and mental health
4. Cultural services	4.1	Physical and experiential interactions, active or passive, for leisure and tourism and/or personal enjoyment and development
	4.2	Intellectual interactions for cognitive development and training
	4.3	Spiritual, religious, symbolic, aesthetic, emblematic or ethic interactions
	4.4	Sociocultural relationships and material or economic exchange
	4.5	Nonuse value (For instance: value by mere existence, bequest value)

Source: authors' own elaboration

4.3 The step-by-step process for Integrated Heritage Assessment (IHA)

The methodological process consists of four stages (see Figure 3):

1. Determine whether the unit is part of a complex system and delineate the socio-ecological system if applicable.
2. Identify and categorize the unit or service providing system.
3. Identify the functions associated with the unit or system, which are responsible for the services.
4. Determine the services associated with the unit or system, both as an individual entity and as part of a larger system.

Firstly, a distinction must be made between simple anthropic systems (e.g., a single building or monument) and complex anthropic systems. Complex systems involve interrelated service provision units, which may consist solely of anthropic units or a combination of anthropic and natural units (1). Secondly, units are identified and categorized based on the origin of their components and processes, classified as natural, mixed or anthropic. Further classification depends on predefined categories (2).

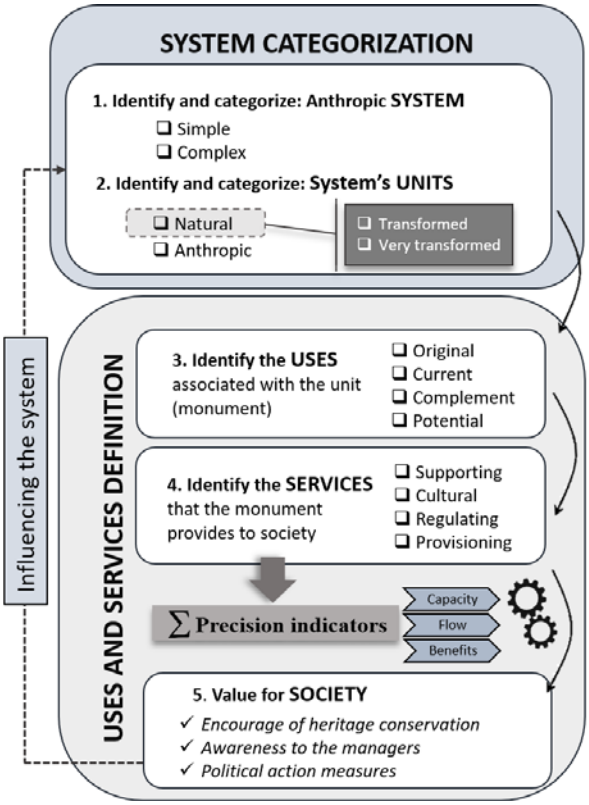
Thirdly, the functions associated with these units or systems are identified, which are responsible for providing services (3, 4). Various levels of detail can be used to assign services to each function(s), including:

- The primary historical function(s) of the unit, along with any potential for reinstatement.
- Current primary function(s) being fulfilled performed by the structure, which are crucial for identifying and categorizing services.
- Additional complementary functions performed by the unit or system, typically secondary in nature.
- Potential new functions to enhance the building's potential, which may lead to the discovery of new benefits or best practices for similar building types. These findings could lead to improvements, or an expansion of the anthropic services provided; or to the renovation of buildings uses that, now, have lost all use and are in a situation of abandonment or degradation.

All of this is controlled through precision indicators classified into indices of capacity, flow, and benefit, which make it possible to monitor the uses and functions of the unit analysed.

Finally, this process facilitates the appropriate allocation of services associated with the unit or system under study (5), facilitating decision-making in this regard to favour the flow and benefit of the services provided by the unit.

Figure 3. Step-by-step process scheme



Source: authors' own elaboration

5 Pilot study: Zarzuela racecourse

Since the 20th century, concrete has been a widely used material in constructing our current heritage, often forming the core of architectural expression. Many countries recognize concrete-based architecture as cultural heritage. Despite being relatively "young" compared to older monuments, these concrete structures are facing decay due to a lack of understanding of their true value and exposure to harsh environmental conditions. Among the unique concrete constructions of the 20th century in Spain, the Zarzuela racecourse stands out, making it an ideal pilot case for study.

Designated as a *Bien de Interés Cultural* in 2009 and considered National Heritage, the racecourse is protected along with its grandstands, paddock, and pelouse. It occupies lands owned by the public entity "Patrimonio Nacional" (National Heritage) within the natural area of "Monte de El Pardo", contributing significantly to an important green corrido (Hipódromo de la Zarzuela, 2018).

Covering an area of 30.2 ha (301.957 m^2), the socio-cultural activity linked to the racecourse occupies approximately 27% of the total extension, as per the *Sede Oficial del Catastro de España* (Figure 4). This space forms a socio-ecosystem comprising various units supplying different

services, including the racecourse, circuit, parking, stables, and other annexed buildings. These units contribute to various functional aspects such as economic, social, cultural, aesthetic, and architectural.

Figure 4. Cadastral polygon of Zarzuela racecourse

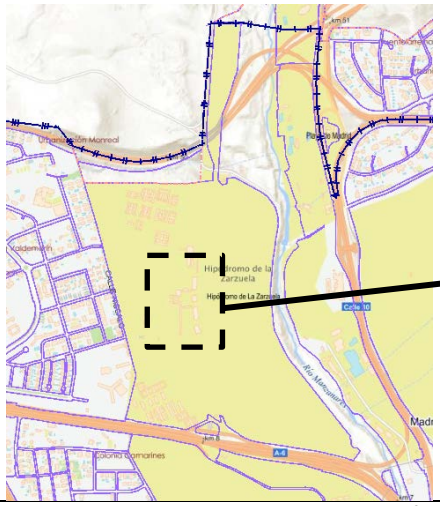


Figure 4 (a). Cadastral polygon of Zarzuela racecourse

Figure 4 (b). Zarzuela racecourse

Source: authors' own elaboration

The socio-ecosystem would be eminently anthropic, since the main functions are associated with components and processes built by man (see Table 3).

Table 3. Units identified of the socio-ecologic system

N°	Sites	Units
1	Tracks	Natural, very transformed
2	Grandstands	Anthropic
	Offices	Anthropic
3	Paddock	Anthropic with natural elements
4	Restaurant	Anthropic
5	Parking	Anthropic with natural elements

Source: authors' own elaboration

While the racecourse occupies a space with natural elements (herbaceous and arboreal vegetation), it is more accurately categorized as a highly transformed ecosystem. The prioritized elements and functions are utilized to generalize and classify services based on the racecourse's functions. Table 4 presents the current array of services associated with the identifies units within the system.

Table 4. Services associated with the Zarzuela racecourse

Units	Services CICES equivalence	Category of the service	Character of the service (Relevance)
Grandstands	Cultural	Relations / Social interactions	Primary
		Aesthetic and landscape (architectural structure)	Secondary
		Identity (part of the historical heritage)	Secondary
Tracks	Cultural	Sports (Physical and experiential interactions)	Primary
	Spatial support	Operational space for the development of human activities	Primary
Betting offices	Cultural	Leisure / Recreation with bets (experiential interactions)	Primary
	Provisioning	Financial income	Primary
Restaurant	Cultural	Leisure / Gastronomic recreation (experiential interactions)	Secondary
	Provisioning	Provisioning food	Secondary
Paddock and the enclosure where horses are saddled	Spatial support	Operational space for the development of human activities	Primary
Stable and riding area	Spatial support	Operational space for the development of human activities	Primary
Museum and library	Cultural	Intellectual interactions for cognitive development and training	Secondary
Stores	Provisioning	Provision of goods and products and provision of economic benefits	Secondary
	Cultural	Leisure and recess (shopping)	Secondary
Parking	Spatial support	Temporary vehicle parking	Secondary
Administration office	Regulating	Racecourse administration and other support functions	Primary

Source: authors' own elaboration

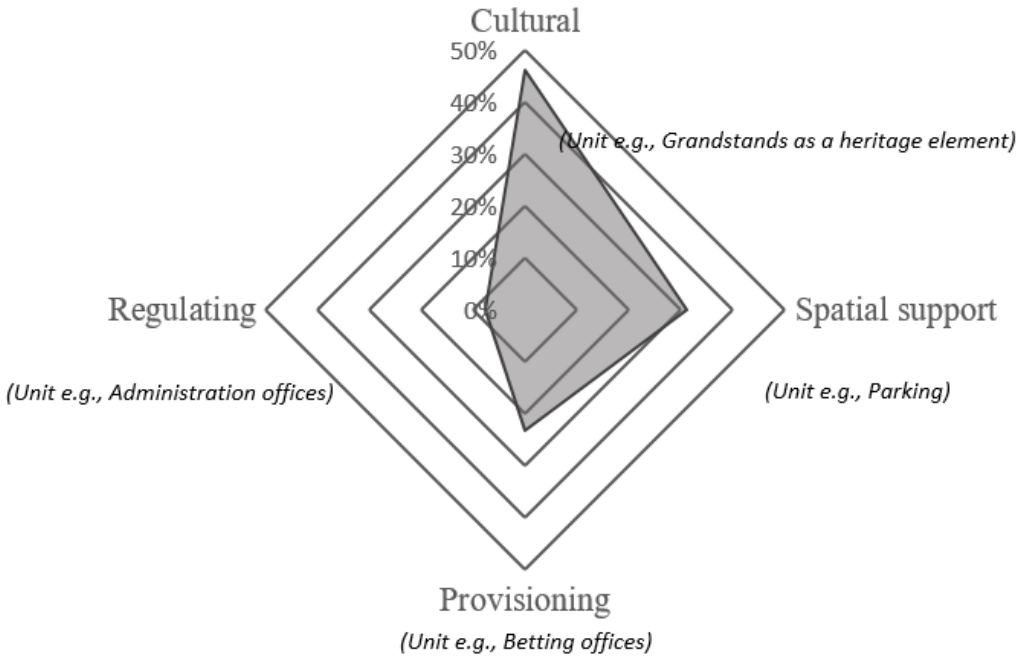
The main functions would be associated with components and processes built by man (anthropic system):

1. Past and current main function: Facilities for horse races and their contemplation, as well as associated betting.
2. Complementary functions: gastronomic experiences, cultural experiences (museums), temporary parking of vehicles, administration.
3. Potential function in the future: unknown.

According to the diversity of services that the racecourse could offer, as has been seen previously (Table 4), 46% of the services offered are classified as cultural services, followed by the services of spatial support (31%), provisioning (23%) and regulating (8%) (Figure 5). Cultural services are

highlighted above the others, the racecourse being a cultural resource of great potential for tourist use (Figure 5).

Figure 5. Total set of services associated with the Zarzuela racecourse



Source: authors' own elaboration

Although cultural services have been emphasized due to their significant tourist potential, the current activities primarily focus on providing economic goods and services. Therefore, the system would be included in the category 2.5, "Provision of monetary benefits for commercial or exchange activities", within the provisioning services.

From this example, several insights can be gleaned. In the first instance, a single unit can serve multiple functions, each offering diverse benefits in terms services provision. Similarly, the same function can have various associated services simultaneously. Therefore, it is possible to distinguish between main services, secondary services and primary or ancillary services, which could also be distinguished (those that support the main services, without which they could not exist, e.g., parking as spatial support).

Building on this application, it's crucial to develop tailored strategies to enhance the value of individual heritage sites and create suitable tourist offerings. Ecosystem services analysis should underpin these proposals. Likewise, the stakeholders involved in this process can apply their value system and prioritize various uses and services based on their objectives.

To this end, it is crucial to consider the specific territorial planning processes in the area under study in future studies. This methodology offers a proposal that could effectively be integrated as an intermediate step in urban territorial planning processes, placing cultural assets as the central axis of planning. By incorporating this methodology, the possibility of a more holistic and sustainable management of cultural heritage is opened up, allowing for a more harmonious integration of cultural, economic, and social aspects into urban development. This can lead to a more balanced urban growth oriented towards the preservation and valorisation of heritage, while promoting economic development and the quality of life of the local community.

5 Conclusions

The methodological framework presented here holds significant potential in bringing to light the considerable benefits of cultural heritage. By rendering these benefits visible, the framework facilitates the allocation of value based on the services they provide, employing methodologies such as quantification/qualification indicators or monetary and non-monetary valuation techniques, which are well-established in the realm of ecosystem services. The outcomes of this approach include the identification of new services, the enhancement of currently undervalued services, and the discovery of services not currently considered in conservation or maintenance prioritization criteria.

Once the service classification system identifies functions for a building or monument, it becomes possible to pinpoint the specific and detailed services associated with their characteristic attributes. Furthermore, when dealing with multiple buildings, the classification system enables constructional, architectural, and contextual comparisons, thus enabling better prioritization and allocation of services among them.

Integration of cultural ecosystem services (CES) can significantly influence the valuation and conservation of cultural heritage. Understanding the links between biodiversity and cultural can promote more integrated and sustainable conservation approaches that recognize the importance of maintaining cultural diversity and traditional knowledge in balance with environmental protection. Likewise, considering CES in cultural heritage management enriches our understanding of the relationship between human communities and ecosystems. This expanded perspective not only promotes the conservation of cultural heritage but also fosters cultural diversity and environmental sustainability by acknowledging the intrinsic value of cultural practices and knowledge in natural resource management.

An additional benefit of the proporsed framework is its capacity to identify heritage management issues, with the potential application the causal framework DAPSI(W)R, (Driver, Activities, Pressures, State, Impact (on Welfare), Responses), widely used in ecosystem services cases (Atkins, 2011; Cooper, 2013; García-Onetti et al., 2018). This associated conceptual framework would facilitate the process of providing criteria to decision makers and thus allowing them to prioritize some units over others – taking into consideration the services that each unit provides and assessing the consequences of urban planning decisions on human well-being. The process also involves determining the anthropic and ecosystem services gained or lost from prioritized units or those replaced by new uses after a decision is made.

The classification system fosters better cooperation between institutions and encourages greater multidisciplinary/interdisciplinary collaboration in science and research. It provides a logical discourse to bridge gaps between science and public management, science and society, and public management and society. Leveraging the theoretical framework of ecosystem services capitalizes on a reliable and extensively discussed methodology in scientific fields, increasingly accepted in management fields and uses as criteria for spatial planning. This means that it can be applied to both elements and systems of natural origin, and to elements of a more anthropic origin.

The following factors are to be considered in the application of this methodology:

- A unit can offer multiple service categories simultaneously, akin to ecosystems.
- Anthropic systems typically comprise diverse units.
- The units within a system may have different primary services, such as a university where the main service could be cultural, despite having a cafeteria, associated with a provisioning service.

The main goal of this study is not to compare the importance of different service categories or to prioritize them, but rather to make them visible, both for decision-makers and for society as a whole.

Acknowledgements: This research was funded by InnovaConcrete Project, funding from the European Union's Horizon 2020 research and innovation program under grant agreement (No. 760858).

Authorship statement: The authors declare no conflict of interest. he participation of the authors in the article is as follows. The article has been coordinated by M. Arcila. The theoretical adaptation of the methodology was developed by J. García and J.A. Chica and the elaboration of the practical approach of the methodology and its validation was carried out by G. Ramírez. The four authors

participated in the literature review, the construction of the conceptual framework and the writing of the article.

References

Ahlhorn, F., Beauchard, O., Boerema, A., Boyes, S., Cox, T., Cutts, N., Van Damme, S., Van Duyse, E., Elliott, M., Franco, A., Geerts, L., Hamer, K., Heiber, W., Hemingway, K., Ides, S., Jacobs, S., Knüppel, J., Liedtke, N., Manson, S., Maris, T., Meire, P., Meyerdirks, J., Plancke, Y., Roose, F., Saathoff, S., Schöl, A., Soetaert, K., Thomson, S., Vandenbruwaene, W., Winn, P., & Wolfstein, K. (2013). *Management of estuaries: The need to understand nature & society* (TIDE Final Summary Report). https://www.tide-toolbox.eu/pdf/reports/TIDE_Summary_Report.pdf

Antuña Bernado, J. (2002). *Las estructuras de edificación de Eduardo Torroja Miret*. ETSAM.

Asmus, M.L., Scherer, M.E.G., García-Onetti, J., & Abrahão, G. (2015). *Metodologia para identificação, com base ecossistêmica, dos aspectos e impactos ambientais significativos do porto de Imbituba* (Relatório Técnico). Laboratório de Transportes e Logística (LabTrans) & Universidade Federal de Santa Catarina (UFSC).

Atkins, J.P., Burdon, D., Elliott, M., & Gregory, A.J. (2011). Management of the marine environment: Integrating ecosystem services and societal benefits with the DPSIR framework in a systems approach. *Marine Pollution Bulletin, 62*(10), 215-226. https://doi.org/10.1016/j.marpolbul.2010.12.012

Azcárate, B., & Fernández, A. (2017). *Geografía de los paisajes culturales*. UNED.

Ballart Hernández, J., & Juan i Tresserras, J. (2008). *Gestión del patrimonio cultural*. Ariel.

Balvanera P., & Cotler, H. (2007). Acercamiento al estudio de los servicios ecosistémicos. *Gaceta ecológica, 84-85*, 8-15. https://www.redalyc.org/articulo.oa?id=53908502

Balvanera, P. (2012). Los servicios ecosistémicos que ofrecen los bosques tropicales. *Ecosistemas, 21*(1-2),136-147. https://www.revistaecosistemas.net/index.php/ecosistemas/article/view/33/29

Bertalanffy, L. (1989). *Teoría General del Sistemas*. FCE.

Bishop, J. (Coord.). (2010). *The economics of ecosystems and biodiversity TEEB for business*. UNEP.

Brown, G., & Weber, D. (2012) Measuring change in place values using public participation GIS (PPGIS). *Applied Geography, 34*, 316-324. https://doi.org/10.1016/j.apgeog.2011.12.007

Choi, A.S., Ritchie, B.W., Papandrea, F., & Bennett, J. (2010). Economic valuation of cultural heritage sites: A choice modelling approach. *Tourism Management, 31*(2), 213-220. https://doi.org/10.1016/J.TOURMAN.2009.02.014

Cooper, P. (2013). Socio-ecological accounting: DPSWR, a modified DPSIR framework, and its application to marine ecosystems. *Ecological Economics, 94,* 106-115. https://doi.org/10.1016/j.ecolecon.2013.07.010

Costanza, R., d'Arge, R., de Groot, R., Farberk, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Suttonkk, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature, 387,* 253-260. https://doi.org/10.1016/S0921-8009(98)00020-2

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S.J., Kubiszewski, I., Farber, S., & Turner, R.K. (2014). Changes in the global value of ecosystem services. *Global Environmental Change, 26,* 152-158. https://doi.org/10.1016/j.gloenvcha.2014.04.002

Costanza, R., de Groot, R., Braat, L., Kubiszewski, I., Fioramontid, L., Suttone, P., Farberf, S., & Grasso, M. (2017). Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosystem Services, 28,* 1-16. https://doi.org/10.1016/j.ecoser.2017.09.008

Daily, G.C., Polasky, S., Goldstein, J., Kareiva, P.M., Mooney, H.A., Pejchar, L., Ricketts, T.H., Salzman, J., & Shallenberger, R. (2009). Ecosystem services in decision making: Time to deliver. *Frontiers in Ecology and the Environment, 7*(1), 21-28. https://doi.org/10.1890/080025

De Groot, R.S., Wilson, M.A., & Boumans, R.M.J. (2002). A Typology for the Classification Description and Valuation of Ecosystem Functions, Goods and Services. *Ecological Economics, 41*(3), 393-408. https://doi.org/10.1016/S0921-8009(02)00089-7

De Groot, R.S., Alkemade, R., Braat, L., Hein, L., & Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity, 7,* 260-272. https://doi.org/10.1016/j.ecocom.2009.10.006

De Groot, R., Brander, L., van der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L., Hussain, S., Kumar, P., McVittie, A., Portela, R., Rodriguez, L.C., ten Brink, P., & van Beukering, P. (2012). Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services, 1,* 50-61. https://doi.org/10.1016/j.ecoser.2012.07.005

Dickey-Collas, M. (2014). Why the complex nature of integrated ecosystem assessments requires a flexible and adaptive approach. ICES Journal of Marine Science, *71*(5), 1174-1182. https://doi.org/10.1093/icesjms/fsu027

Ehrentraut, A. (1993). Heritage authenticity and domestic tourism in Japan. *Annals of Tourism Research*, *20*(2), 262-278. https://doi.org/10.1016/0160-7383(93)90054-7

Fagerholm, N., Oteros-Rozas, E., Raymond, C. M., Torralba, M., & Plieninger, T. (2016). Assessing linkages between ecosystem services, land-use and well-being in an agroforestry landscape using public participation GIS. *Applied Geography*, *74*, 30-46. http://dx.doi.org/10.1016/j.apgeog.2016.06.007

Fisher B., Turner R.K., & Morling P. (2009). Defining and classifying ecosystem services for decision making. *Ecological Economics*, *68*, 643-653. https://doi.org/10.1016/j.ecolecon.2008.09.014

García Onetti, J. (2017). *Servicios ecosistémicos y gobernanza de sistemas portuarios* (Doctoral dissertation, Universidad de Cádiz, Spain). https://dialnet.unirioja.es/servlet/tesis?codigo=136327

García-Onetti, J., Scherer, M.E.G., & Barragán, J. (2018). Integrated and ecosystemic approaches for bridging the gap between environmental management and port management". *Journal of Environmental Management*, *206*, 615-624. https://doi.org/10.1016/j.jenvman.2017.11.004.

Goicochea, Z.I.N. (2011). Valoración económica del patrimonio natural: las áreas naturales protegidas. *Espacio y Desarrollo*, (23), 131-154. https://dialnet.unirioja.es/descarga/articulo/5339526.pdf

Gómez-Baggethun, E., De Groot, R., Lomas, P.L., & Montes C. (2010). The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecological Economics*, *69*, 1209-1218. https://doi.org/10.1016/j.ecolecon.2009.11.007

Haines-Young, R., & Potschin, M.B. (2018). Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the Application of the Revised Structure. www.cices.eu

Haines-Young, R. (2023). Common International Classification of Ecosystem Services (CICES) V5.2 and Guidance on the Application of the Revised Structure. www.cices.eu.

Helliwell, D.R. (1969). Valuation of wildlife resources. *Regional Studies, 3*, 1-7. https://doi.org/10.1080/09595236900185051

Hipódromo de la Zarzuela (2018). Memoria medioambiental del Hipódromo de la Zarzuela. Año 2017. Departamento de Carreras. https://www.hipodromodelazarzuela.es/sites/default/files/resources/Memoria-Medioambiental-2017.pdf

Hueting, R., (1970). Moet de natuur worden gekwantificeerd? (*Should Nature be Quantified*). *Economica Statistische Berichten, 55*(2730), 80-84.

IPBES (2013). *Conceptual framework for the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services* (Decision IPBES-2/4). United Nations. https://www.ipbes.net/resource-file/2763

IPBES (2019). *Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (Edited by E.S. Brondizio, J. Settele, S. Díaz & H.T. Ngo). IPBES secretariat. https://doi.org/10.5281/zenodo.3831673

King, R.T. (1966). Wildlife and man. *NY Conservationist, 20*(6), 8-11. https://nysl.ptfs.com/data/Library1/Library1/pdf/50874345_V20-N6-JUN-JUL-1966.pdf

Kumar, P. (Ed.). (2011). *The Economics of Ecosystems and Biodiversity (TEEB): Ecological and Economic Foundations* (1st ed.). Routledge. https://doi.org/10.4324/9781849775489

Maes, J., Teller, A., Erhard, M., Grizzetti, B., Barredo, J.I., Paracchini, M.L., Condé, S., Somma, F., Orgiazzi, A., Jones, A., Zulian, A., Vallecilo, S., Petersen, J.E., Marquardt, D., Kovacevic, V., Abdul Malak, D., Marin, A.I., Czúcz, B., Mauri, A., Loffler, P., BastrupBirk, A., Biala, K., Christiansen, T., & Werner, B. (2018). *Mapping and Assessment of Ecosystems and their Services: An analytical framework for ecosystem condition*. Publications office of the European Union.

Mackey, B.G., Nix, H.A., Hutchinson, M.F., Macmahon, J.P., & Fleming, P.M. (1988). Assessing representativeness of places for conservation reservation and heritage listing. *Environmental Management, 12*, 501. https://doi.org/10.1007/BF01873263.

Martín Guglielmino, M. (2015). La difusión del patrimonio. Actualización y debate. *Revista electrónica de Patrimonio Histórico,* (1), 195-215. https://revistaseug.ugr.es/index.php/erph/article/view/18190

Martini, Y.A. (2002). *Patrimonio cultural: gestión y difusión como alternativa de integración latinoamericana*. UNRC.

Maynard, S., James, D., & Davidson, A. (2010). The Development of an Ecosystem Services Framework for South East Queensland. *Environmental Management, 45*, 881-895. https://doi.org/10.1007/s00267-010-9428-z.

McGranahan, G., Marcotullio, P., Bai, X., Balk, D., Braga, T., Douglas, I., Elmqvist, T., Rees, W., Satterthwaite, D., Songsore, J., & Zlotnik, H. (2005). Chapter 27. Urban Systems, in: The Millenium

Ecosystems Assessment Series (MEA). *Ecosystems and Human Well-Being: Current Status and Trends, 1,* 795-825. https://doi.org/10.2307/134206.

Muradiana, R., & Rival, L. (2012). Between markets and hierarchies: The challenge of governing ecosystem services, *Ecosystem Services, 1*(1), 93-100.

Murawski, S.A. (2007). Ten myths concerning ecosystem approaches to marine resource management. *Marine Policy, 31,* 681-690. https://doi.org/10.1016/j.marpol.2007.03.011.

Nijkamp, P. (1989). *Quantity and quality: Evaluation Indicators for Our Cultural-Architectural Heritage* (Serie Research Memoranda; No. 1989-46). Faculty of Economics and Business Administration & Vrije Universiteit Amsterdam.

Odum, H.T. (1971). *Environment, Power and Society*. John Wiley.

Ojeda Rivera, J.F. (2013). Lectura transdisciplinar de paisajes cotidianos, hacia una valoración patrimonial. Método de aproximación. *Revista Invi, 28*(78), 25-75. https://revistainvi.uchile.cl/index.php/INVI/article/view/62563

Organización de Estudios Americanos (OEA) (1978). *Metodología de inventario turístico, mimeografiado*. Washington.

Ostrom E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science, 325*(5939), 419-422. https://doi.org/10.1126/science.1172133

Normyle, A., Vardon, M., & Doran, B. (2023). Aligning Indigenous values and cultural ecosystem services for ecosystem accounting: A review. *Ecosystem Services, 59,* 101502. https://doi.org/10.1016/j.ecoser.2022.101502

Peterson, M., Hall, D., Feldpausch-Parker, A., & Rai, P. (2010). Obscuring ecosystem functions with the application of the ecosystem services concept. *Conservation Biology, 24*(1), 113-119. https://doi.org/10.1111/j.1523-1739.2009.01305.x

Pissourios, I.A., & Lagopoulos, A.P. (2017). The Classification of Urban Uses. *Urban Science, 1*(26). https://doi.org/10.3390/urbansci1030026.

Piwowarczyk, J., Kronenberg, J. & Dereniowska, M.A. (2013). Marine ecosystem services in urban areas: Do the strategic documents of Polish coastal municipalities reflect their importance? *Landscape Urban Planning*, 109, 85–93. https://doi.org/10.1016/j.landurbplan.2012.10.009.

Poiraud, A., Chevalier, M., Claeyssen, B., Biron P-E., & Joly, B. (2016). From geoheritage inventory to territorial planning tool in the Vercors massif (French Alps): Contribution of statistical and expert

cross approaches. *Applied Geography, 71*, 69-82. http://dx.doi.org/10.1016/j.apgeog.2016.04.012

Portman, M.E. (2013). Ecosystem services in practice: Challenges to real world implementation of ecosystem services across multiple landscapes – A critical review. *Applied Geography, 45*, 185-192. http://dx.doi.org/10.1016/j.apgeog.2013.09.011.

Ramírez-Guerrero, G., García-Onetti, J., Chica-Ruiz, J.A. and Arcila-Garrido, M. (2020). Concrete as heritage: the social perception from heritage criteria perspective. The Eduardo Torroja's work. *International Journal of Design & Nature and Ecodynamics, 15*(6), 785-791. https://doi.org/10.18280/ijdne.150603

Ramírez-Guerrero, G., García-Onetti, J., Chica-Ruiz, J.A., & Arcila-Garrido, M. (2021a). Social appreciation for the improvement of tourism management of 20th-century heritage: a methodological proposal. *International Journal of Culture, Tourism and Hospitality Research, 15*(4), 522-546. https://doi.org/10.1108/IJCTHR-10-2020-0230

Ramírez-Guerrero, G., García-Onetti, J., Arcila-Garrido, M., & Chica-Ruiz, J.A. (2021b). A tourism potential index for cultural heritage management through the ecosystem services approach. *Sustainability, 13*(11), 6415. https://doi.org/10.3390/su13116415

Rojas, J.H., & Pérez, M.A. (2013). Capítulo 1. Servicios ecosistémicos: ¿Un enfoque promisorio para la conservación o un paso más hacia la mercantilización de la naturaleza? In M.A. Pérez, J.H. Rojas & R. Gavis Castaño, *Sociedad y Servicios Ecosistémicos: perspectivas desde la minería, los megaproyectos y la educación ambiental* (pp. 29-59). Programa Editorial Universidad del Valle.

Serageldin, I. (1999). Cultural heritage as public good: Economic Analysis Applied to Historic Cities. *Global Public Goods, 240*, 1-24. https://doi.org/10.1093/0195130529.003.0012

Smith, M., & Ram, Y. (2017). Tourism, landscapes and cultural ecosystem services: a new research tool. *Tourism recreation research, 42*(1), 113-119. http://dx.doi.org/10.1080/02508281.2016.1253206

UN (United Nations) (2005). *Ecosystems and Human Well-being. Synthesis. Millennium Ecosystem Assessment Board*. Island Press.

UN (2008). *The International Standard Industrial Classification of All Economic Activities* (ISIC) (Revision 4. Statistical papers. Series M. N° 4. Rev. 4). Department of Economic and Social Affairs & United Nations Statistics Division (UNSD). https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

UNESCO (United Nations Educational, Scientific and Cultural Organization) (1972). *Convention Concerning the Protection of the World Cultural and Natural Heritage*. Adopted by the General Conference at its seventeenth session Paris, 16. (http://whc.unesco.org/en/conventiontext/).

UNESCO (2002). *Universal Declaration on Cultural Diversity*. Adopted by the 31st session of the General Conference of UNESCO, Paris. https://unesdoc.unesco.org/ark:/48223/pf0000127160.page=17

Van der Meulen, E.S., Braat, L.C., & Brils, J.M. (2016): Abiotic flows should be an inherent part of ecosystem services classification. *Ecosystem Services, 19*, 1-5. https://doi.org/10.1016/j.ecoser.2016.03.007

Viñals Blasco, M. J., Morant González, M., & Quintana, R. (2011). Análisis de los criterios para la valoración turística del patrimonio natural. *Revista Investigaciones Turísticas, 1,* 37-50. https://doi.org/10.14198/inturi2011.1.03.

Willis, K.G., & Garrod, G.D. (1993). Valuing landscape: a contingent valuation approach. *Journal of Environmental Management*, 37(1), 1-22. https://doi.org/10.1006/jema.1993.1001

Xia, Z., Wang, Y., Lu, Q., Shen, Z., Liu, K., Wei, X., Yuan, C., Gao, Y., & Liu, L. (2024). Understanding residents' perspectives on cultural ecosystem service supply, demand and subjective well-being in rapidly urbanizing landscapes: a case study of peri-urban Shanghai. *Landscape Ecology, 39*(22). https://doi.org/10.1007/s10980-024-01820-4

Annex I. Service category and type

Category	Type	Definition	Examples
Spatial support service	Necessary space for resting and/or housing	To allow for habitable space for the adequate development of basic human needs and for people's housing.	Block or group of buildings; hotels; residences; houses; villages; orphanages.
	Operative space for the development of human activities	To allow for space and/or essential physical support for the development of specific activities (some primary, secondary and tertiary activities need specific physical support or exceptionally large space). It also allows for a buffer of adaptable space for multiple activities, including exhibitions, meetings, activities for the development of human relationships and sports.	Office blocks; multipurpose rooms; meeting centres; social-cultural centres; centres or pavilions for exhibitions; convention palaces; swimming pools; tennis clubs; racetracks
	Space for storage, deposit and/or reception	Based on the need for space to properly store goods, materials, certain types of vehicles, equipment, etc. An example, at a personal level, would be the allowance for the allocation of appropriate space for the ''rest'' of our loved ones and, in general terms, for any deceased person.	Storage installations; sheds; garages; water towers; libraries; museums; zoos; cemeteries
	Necessary support to allow movement and transport	The main service is to adapt railroads and other infrastructure in order to allow the necessary physical support for the transit of vehicles (e.g., cars, tramways, trains, ships) or people. Therefore, it refers to infrastructures such as highways, roads, navigation channels, railway tracks, and bridges. These infrastructures offer the "trafficability, pedestrianization and navigability'' necessary for human movement.	Bridges, highways, roads, navigation channels, railroads and other infrastructures.
Supply and provi-sioning service	Human mobility to allow for other anthropic activities	To allow for the movement of people from one place to another through several transport systems (e.g., bus, train, ship, on foot). This displacement "provides'' people with other anthropic unities/systems (urban areas, industrial parks, seaports...) needed to develop their activities (e.g., tourists, workers, customers).	Bus stations; train stations; airports and other support units for transport systems.
	Provider of goods and products to allow other anthropic activities	To allow for citizens to obtain supplies of raw and processed materials needed for the development of anthropic activities (e.g., seaports or industries). Using multiple transport systems (including highway, trains, ships, roads) and through other changing unities and distribution.	Marketplace; grocery stores; stores; street markets and facilitative infrastructure (e.g., roads, railway tracks.
	Provider of basic urban services	To allow for the supply of basic urban services (such as water, energy, telecommunication), for the development of society's general activities. Using multiple transport systems (e.g., gas pipelines, pipelines, wiring and associated support).	Energy plants, power transformers, pipeline systems, gas pipelines, wiring.
	Provider of goods and products through transformation, processing and handling of the materials	To allow for the provision of materials; to access and use specially adapted equipment to handle and transform raw material, process materials and produce a supply. The purpose is to increase economic benefits and improve the enjoyment and quality of life for society. For example, it allows for the distribution of conveniently prepared food.	Industries; factories; processing centres; pubs; cafeteria; restaurants.
	Provider of monetary benefits by commercial activities or exchange (money, material or services)	To allow for improved payment methods through spaces and anthropic units that enable the purchase of products and goods, and the exchange of services.	Shops, shopping malls, marketplaces, markets, concert halls, cinemas, theatres, pubs, nightclubs, racecourses. In addition, infrastructures with important commercial interests, including hotels, health resorts and spa centres
	Provider of professional services, information and knowledge	To allow for the supply and distribution of information and the improvement of specialized knowledge. In addition, the provision of technical and professional services (e.g., consulting), to support other requirements and social activities.	Provision of information (e.g., radio stations); of knowledge (e.g., research centres, innovations, technologic centres); professional services (e.g. consulting, repair shops).

Anex I. Continuation

Category	Type	Definition	Examples
Regula-ting services	Regulation of waste by an urban or industrial process	To allow for the elimination or reduction of negative effects of waste on humans and nature (toxic residues, which cause odours, noise, and visual impact.). This regulation is achieved by means of general urban processes (solid waste disposal, urban effluent treatment, and other urban cleaning services). Also through industrial processes (e.g., control and management of industrial discharge or emissions of liquid or gaseous pollutants; filtration; storage; accumulation of pollutants).	Treatment plants, dumps, waste storage.
	Regulation of the flow of people, vehicles, goods and materials	To allow for the correct, orderly and safe distribution, movement and transit of vehicles (traffic regulation and management, and maintenance of transport routes on roads, railways, navigation channels). Similarly, the movement of people (access control, influx through authorizations, specific controls and others, for operative or security reasons). Lastly, of goods and materials (flux control and commercial goods circulation for operative, control and security reasons).	Customs, tolls, control zones to building or infrastructure access, border areas, control towers, observation towers.
	Regulation of conditions for habitability, security, social development, economic interactions and organization	To allow for the maintenance of a general balance of society or a specific activity, through order, control and administration tasks (offices, public administrations); general security (military centres, bunkers, naval bases, firefighters, civil protection, prisons); intervention in the relations and interactions among countries (embassies) and individuals; via legal support and/or regulating said interactions (court of justice, police, security services).	Prisons, fire brigade buildings, police buildings and military structures, offices, public administrations (e.g., town halls or ministries), courts and tribunals, embassies
	Regulation of basic physical and mental health	To allow for the maintenance, protection and recovery of health and basic physical and mental well-being of society.	Health centres or hospitals and any living being in general (veterinarian center).
Cultural services	Physical and experiential interactions, active or passive, for leisure and tourism and/or personal enjoyment and development	To allow for leisure and enjoyment through physical and experiential use of structures, elements and anthropic landscapes both actively (e.g., practicing sports in pavilions, tourism on urban routes or with gastronomy in restaurants) and in more passive forms (e.g., reading in libraries, entertainment at the cinema, aesthetic pleasure at a museum, attending a football match, listening to music in concert halls, observing an urban landscape, etc.)	Active activities: sports facilities (e.g., swimming pools, pavilions, athletic centres, etc.), bars, restaurants, nightclubs; Passive activities: museums, cinemas, concert halls, theatres
	Intellectual interactions for cognitive development and training	To allow for personal or social growth through intellectual and representative interactions with and within structures, their surrounding elements and anthropic landscapes. Cognitive development and training are attained by means of different processes related to social sciences, cultural and human questions. For example, knowledge production (research and science, innovation, technology development) and intellectual growth (education and training, including cognitive development resulting from sensorial stimulus (e.g., visiting a museum, contemplating heritage, appreciating history, intellectual entertainment…).	Schools, universities, technology development centres, research, innovation and development centres, libraries, museums
	Spiritual, religious, symbolic, aesthetic, emblematic or ethic interactions	Facilitates the mental/moral well-being of a person or a society, through the preservation of its faiths, rituals and spiritual symbology (e.g., churches, monasteries, other religious centres or spiritual elements). Included is the preservation of its moral and/or ethical identity, as well as its cultural identity (sense of place and local identity, artistic representations, emblematic and/or symbolic elements or constructions, preservation of history and heritage, elements that allow greater social cohesion.) A spiritual connection can be made between senses and emotions to landscapes, structures and anthropic elements (including aesthetic design) – resulting in feelings ranging from general well-being to exultation.	Churches, convents, monasteries, cathedrals, burial grounds, monuments, memorials.

Anex I. Continuation

Category	Type	Definition	Examples
Cultural services	Sociocultural relationships and material or economic exchange	To allow for a space or place for social meeting, development of relationships and social interactions; to further intellectual expression, commercial interactions (exchange and sell/purchase) and cultural interactions (e.g., a big square in a city, local culture centre.). Additionally, to improve social cohesion and cohabitation.	Public squares, urban beaches, marketplaces
	Nonuse value (e.g. value by mere existence, legacy value)	To allow for society to have spaces, structures, among others, at their disposal. Entities which, regardless of their actual interest, can have realized or unrealized advantages for future generations. Furthermore, even if the entities are not producing specific or important benefit(s) in and of themselves, society has reason to invest in their preservation. (e.g., a cultural representation, identity symbol or a unique or limited technique).	Heritage buildings, libraries, urban areas without a specific purpose

Source: authors' own elaboration