

A systematic review of cultural ecosystem services and valuation methods

Una revisión sistemática de los servicios ecosistémicos culturales y métodos de valoración

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ABSTRACT

This work aimed to investigate the amount of scientific productions in relation to cultural ecosystem services and valuation methods. An analytical-documentary perspective was used to describe the state of the art of these valuation methods, their operational complexity and forms of application. A systematic review of the literature was carried out, in the quantitative, descriptive and analytical research section, we used the ISI Web of Science and Scopus databases, generating 1332 articles from which the following were extracted: year of publication, type of publication, number number of citations, language, author, journal name, publisher, number of authors of each publication and impact factor. An increase in studies on cultural ecosystem services was verified over the years, since this quantity is associated with a greater number of citations and, consequently, with a high impact factor of the journals. Finally, cultural ecosystem services constitute a growing research field characterized by a growing number of publications from various academic disciplines.

Keywords: Intangible benefits; Non-material services, Ecosystems; Subjectivity; Operational complexity

RESUMEN

Este trabajo tuvo como objetivo indagar la cantidad de producciones científicas con relación a los servicios ecosistémicos culturales y métodos de valoración. Se hizo uso de una perspectiva analítico-documental, para describir el estado de arte de esos métodos de valoración, su complejidad operativa y formas de aplicación. Se realizó una revisión sistemática de la literatura, en la sección de investigación cuantitativa, descriptiva y analítica, utilizando las bases de datos ISI Web of Science y Scopus, generando 1332 artículos de los que se extrajo: año de publicación, tipo de publicación, número de citas, idioma, autor, nombre de la revista, editorial, número de autores de cada publicación y factor de impacto. Se verificó un aumento de los estudios sobre los servicios ecosistémicos culturales a lo largo de los años, ya que esta cantidad está asociada a un mayor número de citas y, en consecuencia, a un alto factor de impacto de las revistas. Finalmente, los servicios ecosistémicos culturales constituyen un campo de investigación en progreso, que se caracteriza por un número creciente de publicaciones de diversas disciplinas académicas.

Palabras clave: Beneficios intangibles; Servicios no materiales, Ecosistemas; Subjetividad; Complejidad operativa.

1. INTRODUCTION

The concept of ecosystem services (ES) has been developed to provide a holistic assessment of the benefits that humans derive from ecosystems. It is based on the idea that goods and services are ultimately generated by ecological functions (or processes), which give rise to benefits or aspects that are of value to people (Alexander, 1998).

The economic valuation of ecosystem services is often used as an argument to promote conservation issues and solve problems of environmental degradation (Castro et al., 2011). Certain aspects of ecosystem services may be inherently difficult to recognize through monetary approaches, not only because of ethical concerns, but also because their concrete, place-based nature may mesh poorly with the hypothetical or abstract counterfactuals typical of ecosystem services. declared preference methods (Cooper et al., 2016).

Consequently, cultural ecosystem services (CES) have proven resistant to monetary valuation, as many aspects of ecosystems, such as their aesthetic or spiritual qualities, are valued precisely for the non-commercial benefits they provide (Scholte et al., 2015). Consequently, a growing group of scholars have developed sociocultural valuation methods to capture the value of SEs (e.g., Agbenyega et al., 2009; Casado-Arzuaga et al., 2013; Hartter, 2010; Martin-Lopez et al., 2012). Because the valuation of cultural ecosystem services remains one of the most difficult and least accomplished tasks in ecosystem services research.

Cultural ecosystem services have been relatively neglected by researchers and policymakers compared to provision, support and regulation services (Schaich et al., 2010). However, the purpose of distinguishing a category of services designated as cultural is to highlight that there are non-material products of ecosystems that are important to people, mostly non-consumptive products that affect people's physical and mental states. Nevertheless, presents conceptual and methodological difficulties in its application (La Rosa et al., 2016). It remains mired in innumerable criticisms, when specifying the nature of intangible values, but more significantly when it comes to relating intangible values to ecosystem functions (Gee and Burkhard, 2010).

This work aims to investigate the amount of scientific productions present in relation to cultural ecosystem services and valuation methods through scientometrics.

Making use of an analytical-documentary perspective, to describe the state of the art of these valuation methods, their operational complexity and forms of application.

The document is structured as follows: in the first section, a conceptualization of cultural ecosystem services, typology, operational complexity and valuation methods. In the second section we present the results from scientometrics. The searches originated in the titles, abstracts and keywords of documents published in relation to cultural ecosystem services. Emphasizing aspects such as: year of publication, unpublished publications or bibliographic reviews, number of citations, language, author, name of the journal, publisher, number of authors of each publication and impact factor.

2. Conceptualization of cultural ecosystem services

CES are the result of dynamic, complex, physical or spiritual relationships between ecosystems and humans, across landscapes and often over long periods of time (Fagerholm et al., 2012; Plieninger et al., 2013). They arise through human-ecosystem interactions (Chan et al., 2012a) and can be associated with all ecosystems, from uninhabited wilderness and coastal ecosystems to urban green spaces.

Once degraded, it is unlikely that they can be replaced by technical or other means (Hernández et al., 2013; Reid et al., 2005). They are also, due to their intuitive and largely subjective nature, non-generalizable: different people perceive CES in heterogeneous ways, depending on their backgrounds, experiences, cultural heritage, age, and gender (Plieninger et al., 2013; Suckall et al., 2009).

Assessments of cultural ecosystem services are quite subjective and value laden, as each individual or each group of individuals has different value systems and demands. Several factors must be considered such as experience, habits, belief systems, behavioral traditions and judgment, as well as lifestyles (MA, 2005).

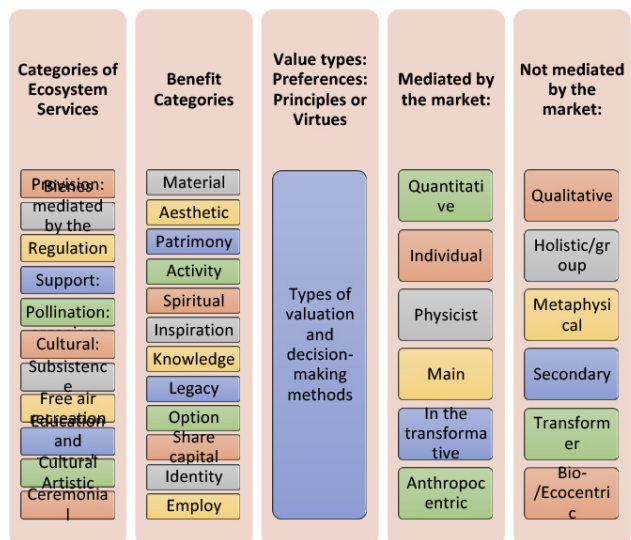
There are several characteristics of CES that make its evaluation different from the evaluation of other SEs (Figure 1). First, the general dependence of CES on an individual's value systems makes their evaluations less quantitative than other services (i.e., provision services) that can be quantified independently of the presence of humans (Nahuelhual et al., 2014). Another important issue is the difficult use of spatial geographic units for the evaluation of CES (Burkhard et

al., 2012). Explicitly space-based evaluation presents many challenges, and studies have primarily focused on mapping the benefits rather than the provision of CES (Milcu et al., 2013). For such reasons, interdisciplinary and transdisciplinary cooperation in CES evaluation better supports the evaluation process (Cheng et al., 2019).

CES are important because they are critical to well-being. Russell et al. (2013) identifies 10 key components of well-being: physical and mental health, spirituality, certainty, sense of control, security, learning/capacity, inspiration/realization of imagination, sense of place, identity/autonomy, connection/belonging, and subjectivity (in general). Although there are a variety of approaches to human well-being and the environment, he concludes that the evidence shows that knowing and experiencing nature makes us happier and healthier. Perhaps these ecological contributions of nonmaterial or extramaterial benefits, including experiences and capabilities, are some of the most prominent and compelling reasons for people to conserve or restore natural systems (Chan et al., 2012a).

Finally, the attractiveness of CES as a concept is rooted in both the diversity of applications and the recognition that sociocultural values underpin all other ecosystem services, and thus can be seen as a window into broader socioecological interactions (Chan and Satterfield, 2015; Pröpper and Haupts, 2014).

Figure 1. The interconnected nature of services, benefits and values



Source: Chan et al. (2012b). Modified by authors.

2.1 Typologies of cultural ecosystem services.

Cultural ecosystem services are defined by the Evaluation of Millennium Ecosystems (MA) as the “non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences” (MA, 2005, p. 40). The MA still provides the most comprehensive overview and categorization to date, with the following suggested categories:

- Cultural diversity (in the sense that the diversity of ecosystems is a factor that contributes to the diversity of cultures).
- Spiritual services (recognizing that many religions attach spiritual and religious values to ecosystems or their components).
- Knowledge systems (traditional and formal) (appreciate that ecosystems influence the types of knowledge systems developed by different cultures).
- Educational values (Understand that ecosystems, their components and processes provide the foundation for both formal and informal education in many societies).
- Inspiration (in the sense that ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture and advertising).
- Aesthetic values (Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in support for parks, scenic drives, and selection of housing locations.)
- Social relationships (In the sense that ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies).
- Sense of place and identity (ecosystems as a central pillar of the “sense of place” that is associated with recognized characteristics of its environment).
- Cultural heritage values (Understanding that many societies place a high value on the maintenance of historically important landscapes (“cultural landscapes”) or culturally significant species).
- Recreation and ecotourism (recognizing that people often choose where to spend their free time based in part on the characteristics of natural or cultivated landscapes in a particular area).

Despite mounting research over the last decade, the assessment of cultural services remains arbitrary and lar-

gely limited to marketable services such as tourism. The evident difficulties in standardizing definitions and measurements have challenged the accounting of cultural services in decision-making processes (Hernández et al., 2013). Despite the intuitive logic of the above categories, working with the concept of cultural ecosystem services presents a number of problems. The M.A. (2005) and the RUBICODE project (Vandewalle et al., 2009) acknowledge that, so far, spiritual, religious, recreational, and educational services have only been evaluated in small local studies, mainly because the data needed for these evaluations are not widely available.

2.2 Operational complexity of the concept

As with other CES, working with cultural ecosystem services requires identifying 'operating units' to which functions, benefits and values can be assigned (Haines-Young et al., 2007). When appreciating a panorama or nature, one is observing the (real physical landscape) the knowledge of the object and the satisfaction that people obtain by visiting or simply knowing that it exists, which refers to one of the value categories (Farber et al., 2002).

For this reason and due to their immaterial quality, cultural services are often much more difficult to assess than support, provision or regulation services. There is a bias towards CES leisure concepts such as recreation, tourism, aesthetics, and educational values (Pröpper & Haupt, 2014). Here are some operational complexities of the concept, including: inherent difficulty of establishing a clear relationship between the intangible values that can be assigned to certain elements of the ecosystem and the functions or benefits of the ecosystem (Vejre et al., 2010).

The main drawback of cultural ecosystem services, is that the value is not a calculable result. Awareness of the formal qualities of a place, for example, is just one element of many dimensions that come together in an aesthetic experience (Hansen-Möller, 2009). Factors related to the observer also come into play, social and cultural experience, habits, belief systems, behavioral traditions, judgment and lifestyles, factors in other words that are related to the observer and, at best, of the cases, indirectly with the ecosystem (Kumar and Kumar, 2008). Therefore, work with cultural ecosystem services it must consider the values in the ecosystem as well as the relationship between the observer and the environment, including the personal and social driving forces that influence the demand side.

Currently, there are numerous indicators for most ecosystem services, but very few for cultural services (Feld et al., 2009). In general, reflect poorly on economic indicators and are rarely tradable (Martín-López et al., 2009). The main reason why researchers propose that the real evaluation of CES is not possible, is inadequate or inappropriate (Hernández et al., 2013).

However, and the concept is used more and more in theoretical and practical contexts (Milcu et al., 2013). The growth of interest in the CES has been accompanied and further stimulated by significant debate related to the integration of the CES into decision-making and governance processes. To make them comparable with other SEs in compensation and management plans, many have tried to develop ways of assigning monetary values (Coscieme, 2015; Van Berkel and Verburg, 2014).

Thus, the increasing attention on CES is not simply a recognition of the technical shortcomings of existing ecosystem service assessments, but because CES assessments emphasize non-monetary valuations and deliberate valuation methods, they also provide a scenario to challenge existing modes of environmental resource assessment or governance and the values that underpin them (Hirons et al., 2016).

Finally, existing research that addresses the effects of cultural ecosystem services on human well-being has been carried out in the Global North, that is, high-income countries, especially in North America and Europe. Still, gaps in knowledge are evident, especially with regard to Africa, Central Asia, East Asia, and Latin America (Kosanic and Petzold, 2020). A new challenge that should be detailed in future works is interdisciplinarity to better understand the role played by ecosystems (Kumar and Kumar, 2008). In addition, there is growing recognition of the need to unite analytical and participatory methodologies to establish more comprehensive valuations of ESAs and overcome individual conceptions of value (Kenter, 2016).

2.3 Methods for Valuing Cultural Ecosystem Services

They can be characterized along several dimensions: whether they are based on quantitative or qualitative data or a combination, examine people's stated or revealed preferences, result in monetary or non-monetary valuations, involve stakeholders in the valuation process, facilitate deliberations, social learning among stakeholders, and provide spatial analysis.

2.3.1 Methods that prioritize monetary valuation

The hedonic pricing method uses the assumption that people will pay more for houses, which are near a park or lake, because they provide CES. Many aspects of the aesthetic environment significantly impact total view area, as well as some types of land cover (water and grass) positively influence home sales prices (Farber et al., 2002; Sander and Haight, 2012).

The travel cost method is applicable when direct physical access to CES locations is important. The method seeks to quantify the financial resources and/or time needed to travel to an area that provides the cultural ecosystem service, such as a national park or nearby forest, as a means of assessing the total value that area brings (Costanza et al., 1989).

Willingness-to-pay/accept methods are a type of stated preference method whereby participants are invited to express the value of an ecosystem service through the amount of money they say they would be willing to pay to encourage (or prevent) a change in the provision of a given ecosystem service (Barrena et al., 2014). This is also known as contingent valuation: the service demand can be obtained by posing hypothetical scenarios that involve some valuation of alternatives (Carson and Hanemann, 2005).

The advantage of monetary methods is that they can be used to compare and make a trade-off assessment between CES and other SEs (i.e., brokerage services) regulation, services of provisioning and support services). Although cultural diversity, knowledge systems and social relationships are rarely investigated with monetary methods, this is one of the reasons why more and more researchers use non-monetary methods (Cheng et al., 2019).

2.3.2 Methods that give priority to non-monetary values

In contexts where monetary valuation methods are opposed by people, or are not considered appropriate, various non-monetary valuation methods can be used. Scaling methods ask stakeholders to assess the value of ecosystem services using arbitrary scales rather than monetary values. These scales are flexible in that they can be used in many studies and can be symmetrical and balanced Likert scales (eg, a five-point scale: "very good", "good", "neutral",

"poor" and "very good"). Or simple numerical scales from 0 to 5 (Kopperoinen et al., 2014).

Ranking methods ask stakeholders to prioritize a range of CES options in an order and use the order as a measure of value. Some versions of this method use text-based approaches (either with moving cards or flipcharts), while photo-getting approaches use images, which can be manipulated to represent different SE for classification and are particularly useful for overcoming language barriers (Martín-López et al., 2012).

Analysis of social network photographs provides a revealed preference option for the analysis of cultural ecosystem services. Georeferenced and openly collaborative photographic datasets are analyzed for evidence of cultural ecosystem service potential, through photographs of particular charismatic species, aesthetic landscapes, or ecosystem-based recreational activities. The geolocated nature of these images allows us to identify spatial patterns in the CES uptake (Martínez et al., 2016).

CES can also be evaluated using quantitative modeling approaches. Geographic information systems (GIS)-based approaches, for example, have been used to assess numerous SEs by applying expert- or stakeholder-guided values combined with spatial data related to land use and/or ensembles of complementary data, for example, of hedonic pricing methods, to quantify the accessibility of the sites that provide ECS in relation to population centers (Kopperoinen et al., 2014).

Bayesian belief networks (BBN) are used as a means to implement deliberative-analytic approaches in relation to ecosystem service mapping and scenario outcome modeling (Haines-Young, 2011). Modeling approaches are particularly useful as they can be used to predict changes in SE provision as a result of changes in policy or action. The explicit quantification and mapping of ecosystem services is considered as one of the main requirements for the implementation of the concept of ecosystem services in environmental institutions and decision-making (Daily and Matson, 2008).

However, non-monetary methods typically require large, time-consuming databases, trained enumerators, highly trained facilitators, and advanced processing skills to avoid the dominance of individual influences in focus groups (Cheng et al., 2019).

2.3.3 Methods that prioritize stakeholder understanding, social learning, and co-production of knowledge

There are various narrative and artistic methods by which the experiences of individuals' interactions with nature can be expressed directly by stakeholders (Satterfield, 2001). These methods include a variety of techniques including interviewing, oral histories, voice or video recording of events, storytelling, obtaining photographs, and artistic expression. Allowing stakeholders freedom of expression, these inventions allow their complex, multiple and varied experiences with ecosystems to be presented with little influence from the evaluator, often in very creative ways. However, the analysis of the results still requires an external interpretation.

Scenario building provides a descriptive way to explore the future development of ecosystem services. Scenario-based approaches can draw on expert opinion and/or public participation to develop a "story line" for how the future may unfold and use these story lines to explore the implications of changing service provision (Plieninger et al. al., 2013). In addition, there are numerous anthropological methods such as participant observation whereby the evaluator develops his or her own understanding of the associations between people and the environment through lived experience with the stakeholders in question (Calvet-Mir et al., 2012).

Deliberative group discussions (Wilson and Howarth, 2002), citizen juries (Spash, 2007), and the Q methodology (Pike et al., 2015) use group activities and participatory and deliberative approaches to obtain detailed information on the relationship of people with the natural environment and the socio-cultural values that they give it. Another resource to be used is participatory GIS, a common approach that uses spatial information as a baseline to facilitate discussion among stakeholders. Geoinformation tools used in these applications include collaborative spatial data collection using remote sensing methods, participatory maps, aerial photography and imagery; analysis and representations (McCall, 2003).

Participatory modeling is another approach that deliberately attempts to break the power asymmetry inherent in expert-based modeling of local contexts. Based on the premise that the different actors involved in resource management operate with different reference areas and time scales in mind, the approach focuses on the representa-

tion of this diversity in its tools and in the form of coordination workshops (Étienne, 2013).

2.3.4 Integrated Methods

Although it is convenient to separate the approaches as stated above, multiple, combined or hybrid approaches integrating these methods and assessment frameworks can be developed to customize an approach for a given problem (Kopperoinen et al., 2014). The use of multiple methods, for example, can allow users to understand a given service from different angles: a modeling approach can provide an overview of the services provided by an area based on land use, and a mapping exercise participatory mapping can complement this by providing experience of the same space.

In addition, there are numerous techniques for evaluating decisions. Multi-criteria decision analysis (MCDA), for example, provides a means of evaluating how well different decisions affect outcomes by specifying the relationship between the amount of a given indicator (for example, available open space) and its importance for a given outcome (for example, recreation) (Satterfield et al., 2013). MCDA has the advantage of being able to take any kind of quantified values (e.g., cultural and/or biophysical, monetary and/or non-monetary, quantified and/or expert-based) and, specifying the relationships, convert them (either deliberately or expertly directed) into a common arbitrary unit that can be compared (Adamowicz et al., 1998).

Although integrated and mixed methods approaches may generate better insights, the findings are strongly influenced by the choice of methods and their implementation (Hattam et al., 2015).

It should be anticipated that culture itself is a complicated issue, including both tangible assets and intangible qualities that are lived or experienced rather than easily articulated in response to the direct question-and-answer formats that characterize preference surveys and similar instruments. research. Alternative methods that encourage narrative expressions of experience and meaning are therefore likely to be more productive (Satterfield et al., 2013).

Perhaps the biggest challenge in the valuation of ecosystem services lies in giving value to services that have no direct or indirect material benefits, referring here to bene-

fits that are conceptual rather than physical (Chan et al., 2011; Oleson et al., 2015). Examples include spiritual enrichment, cognitive development, recreation, and aesthetic experiences.

As such, expressions of astonishment and all their parallels are probably not compatible with the kinds of direct question-and-answer formats used, for example, by contingent valuation, preference surveys favored by economists. However, they may be amenable to measures based on narratives or descriptions, which decision analysts and the psychologists usually call constructed scale (Keeney and McDaniel, 1992) or constructed value (Lichtenstein and Slovic, 2006) in which different degrees of wonder (eg, "a little" or "a lot") can be tied directly to the narratives.

Neglected services such as social relationships, cultural diversity, and knowledge systems are mostly assessed using stated preference methods, such as interviews, questionnaires, and GIS, as those services are more abstract and rely heavily on public perception (Cheng et al., 2019).

More research is needed on developing non-monetary methods to value cultural ecosystem services and incorporate them into easy-to-use tools (Daily et al., 2009). Therefore, interdisciplinary approaches are needed to improve understanding of cultural ecosystem services that take into account the dynamic nature of human-environment interactions and potential synergies and trade-offs between cultural, supporting, provisioning and regulation (Tengberg et al., 2012).

An assessment of cultural ecosystem services must also include a historical perspective, as well as the different perspectives and perceptions of different stakeholder groups that are not easily translated into quantitative indicators (Milcu et al., 2013). Because spiritual, inspirational, and place values are not products of single experiences, but products of all kinds of experiences associated with ecosystems. Therefore, they recommend more inclusive valuation approaches and integration with biophysical and economic service models (Chan et al., 2011).

3. MATERIALS AND METHODS

We carried out a systematic review of the literature, in the quantitative, descriptive and analytical research section we used the ISI Web of Science databases (<http://www.isiknowledge.ez163.periodicos.capes.gov.br>) and

Scopus (<http://scopus.com.ez163.periodicos.capes.gov.br>) to perform an exhaustive search based on the terms described in (Table 1). The research was carried out on titles, abstracts and keywords of scientific articles, including the publication periods from 2007 to 2022 (Table 2).

Table 1. Keywords for searching academic databases.

Search terms
P1: "cultural ecosystem services"
P2: "cultural ecosystem services" and "valuation methods".

Table 2. Number of articles consulted

Font	Number of papers
Articles searched in Web of Science	1379
Documents searched in Scopus	1082
Elimination of duplicates, gray literature	1129
Included in the review	1332

Some information on the selected studies was identified and recorded, such as: year of publication, original articles or bibliographic reviews, number of citations, language, author, name of the journal, publisher, number of authors of each publication and impact factor. For the impact factor of each journal, the 'JCRImpactFactor' package was used (Faisal, 2021). Thus, once the data had been collected and organized in spreadsheets, they were tabulated and then evaluated using descriptive statistics and Pearson's correlation tests to classify the probable relationships between the variables studied: I. The number of publications per year; II. The number of citations per year; III. Impact factor and number of authors; IV. Impact factor and year; V. Impact factor and number of citations.

4. RESULTS AND DISCUSSION

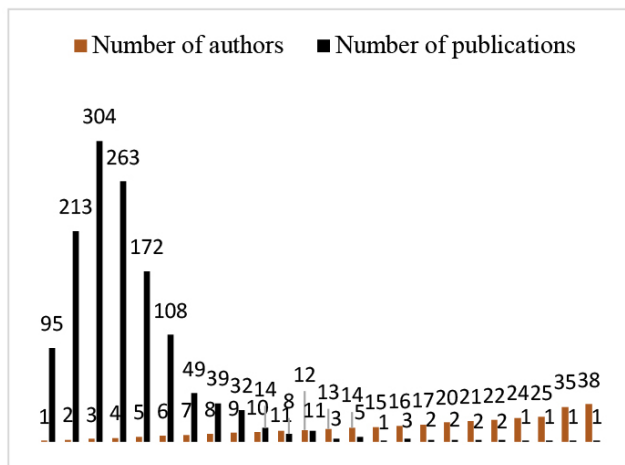
A total of 1,332 documents were entered in the databases, which were structured as follows: Environmental Sciences - 839 documents (33%) and Agricultural and Biological Sciences - 506 documents (20%) which stood out in the areas of publication knowledge. The same publication often had broad areas of knowledge, because Cultural ecosystem services are one of the four main categories of services. However, cultural services cannot be treated independently and depend on provision, regulation and support services, at the same time that the expression of cultural ecosystem services influences the way ecosystems are viewed and managed (Tengberg et al., 2012).

The journals that stood out in publications with a multidisciplinary approach were: *Ecosystem Services* with 161 publications (12%) and *Ecological Indicators* with 62 publications (5%) in relation to the publishers that stood out were Elsevier BV with 290 publications (23%) Mdpi with 127 (10%) and Elsevier Ltd with 108 (8%). Regarding the type of work, the majority (85%) of the documents found were original articles and only 6% were review articles, among the other 9% there were notes, errata, book chapters, letters, conference papers and others.

The most recurrent original language of publication was English (96%) followed by Spanish (1%). Mastery of the English language in science has become paramount and the importance of having a unifying language will continue to grow because language is essential in the scientific environment, in the publication of scientific works and discoveries, which allow the communication of scientific knowledge in the international context between teaching and learning institutions. Thus, a concern arises about the mastery of the English language in the academic field in which it is sought to optimize reading, comprehension, and writing (Zambonato, 2019). For this reason, there are financing agencies that direct economic resources to Postgraduate Programs that have international inclusion, that is,

The article with the highest number of citations (1194) addresses the provision of multiple ecosystem services in landscapes and empirically demonstrates ecosystem services, the title is: "Ecosystem service bundles for analyzing tradeoffs in diverse landscapes" from 2010.

Figure 2. Number of published documents and their respective number of authors, years 2007 – 2022



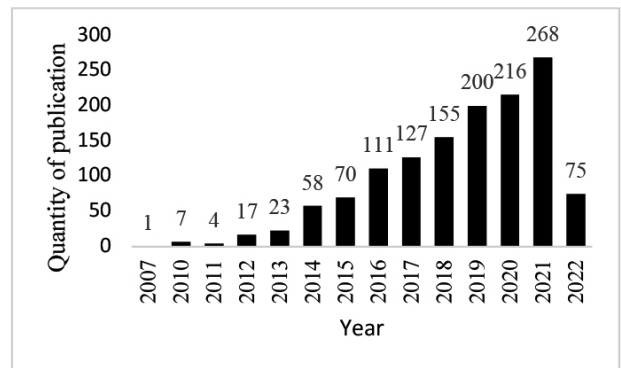
Source: self made.

Most of the publications obtained a low number of citations, that is, from 20 to 1194 citations, 402 (35%); the average number of citations of the 1132 publications is 30. The impact factor of a journal or newspaper is related to the frequency with which the articles are cited, revealing the quality of that journal. Very few studies on CES have been carried out in Latin America where the historical, social and economic conditions are different from those of Europe or North America (Kosanic and Petzold, 2020).

On average, the selected articles had 4 authors. Most of the articles (69%) have six or fewer authors (Figure 2). Likewise, there has been a significant increase in the literature published on this topic in the last 20 years, apparently growing exponentially from 2005 when the MA was published (Hernández et al., 2013). As shown in Figure 3, there was a significant increase in scientific production over the years, in 2021 there was a production peak with 268 articles published.

In addition, an association is verified between the impact factors related to the number of authors and a propensity to increase the citation in relation to the number of authors (Table 3). The research by Mattedi and Spiess (2017) showed a significant association between the impact factor and the number of authors per article, since publications with a greater number of authors tend to receive more citations, corroborating this study (Table 3). Therefore, there is a tendency to increase the number of citations according to a considerably significant impact factor. The notion of cultural ecosystem services has generated a variety of ideas and, most likely, we will witness the rapid evolution of this field of research in the coming years (Milcu et al., 2013)

Figure 3. Number of publications throughout the years 2007-2022.



Source: self made.

Furthermore, the study showed that, over the years, there was a significant approval with the impact factor of published journals and the number of citations. The Impact Factor is used to measure the quality of a given journal, those with a higher Impact Factor are considered more important. Thus, they represent the relationship between the number of citations of a journal with its number of published articles, that is, it considers the journal as a whole and includes all the citations and title of the journal (Miglioli, 2017). Therefore, in the academic field it is important to publish in high-impact journals with the intention of attesting to performance (Goldenberg, 2019). Therefore, the impact factor will continue to be used in Brazilian scientific evaluations, but its limitations can be overcome through aggregation with other methodologies, since this method should not be the only one applied to help in scientific evaluation, because it can cause erroneous and inconsistent conclusions (Almeida and Gracio, 2020). With this, we observe the importance of relating the impact factor as other variables as in this study that we perform correlations.

Table 3. Associations between the number of citations, the number of authors, the year and the impact factor of the journals that have published on cultural ecosystem services.

Associations	r	p*
Number of citations x Year	-0.5174	< 0.0001
Number of citations x Impact Factor	0.2312	< 0.0001
Number of authors X Number of citations	0.1017	0.0016
Number of authors X Year	0.0415	0.1919
Number of authors X Impact factor	0.1085	0.0008
Impact Factor X Year	-0.0981	0.0023

Source: Own elaboration, 2022.

5. CONCLUSIONS

Ecosystems provide goods and services that are necessary for the survival of humanity and the development of society and cultures. The loss of these ecosystem services also has negative impacts on human well-being in terms of loss of access to safe food and water, and traditional medicine, which affects health.

There are various valuation methodologies to find an estimate of the value of the goods and services provided by ecosystems. The most appropriate for each case will depend on both the characteristics of the good or service to be valued (whether or not it has a

market, whether it is a cultural or provision service, etc.) Therefore, more holistic CES assessment methods are needed, particularly in the Global South, to identify the role that CES play in the lives of communities, while improving the incorporation of CES in environmental planning.

This study verified an increase in studies on cultural ecosystem services over the years, since this quantity is associated with a greater number of citations and, consequently, with a high impact factor of the journals. Cultural ecosystem services constitute a growing field of research characterized by a growing number of publications from various academic disciplines.

Finally, cultural ecosystem services have attracted attention in a wide variety of publications, originating from multiple academic disciplines and employing heterogeneous approaches. The heterogeneity in approaches to cultural ecosystem services research may be due to three interacting circumstances. First, the diversity of approaches and apparent lack of cohesion rightfully correspond to the eclectic nature of cultural ecosystem services. Second, within all groups, cultural ecosystem services tended not to be the priority focus of research projects. In third place, The multitude of perspectives on cultural ecosystem services reflects the development of a relatively new field of research that lacks a well-established and replicable research framework. The diversity of research on cultural ecosystem services indicates scientific dynamism, but, at the same time, the lack of a strong common terminology and understanding

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