Article

Evaluation methods for cultural ecosystem services: A systematic review

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Abstract

Cultural ecosystem services (CES) are intangible and non-material benefits provided by ecosystems that have been ignored by stakeholders and policymakers in comparison to provisioning, supporting, and regulating services. The ecosystem services concept was designed to define and evaluate the benefits humans derived from ecosystems. The present study conducts a systematic literature review of CES evaluation methods. Our aims are: to provide an overview of the current state of CES research, to describe the geographic distribution of research, to classify and evaluate CES categories and evaluation methods, to highlight and discuss the overall review of the literature and some important challenges in CES research. In this review, we reviewed 127 case studies and extracted 22 evaluation methods. Based upon findings from literature synthesis, we conclude that (1) a consistent classification and description of CES categories are highly required; (2) we have taken into account all the CES categories during evaluation; (3) the majority of studies tend to focus on recreation and ecotourism services followed by aesthetic values and educational values; (4) we employed various methods extracted from literature and find non-monetary methods mainly were used to evaluate CES; (5) we recommend that an in-depth analysis of CES evaluation methods is a need to improve the importance of CES for local people, stakeholders and policymakers. The present information can potentially act as a fruitful conceptual multidisciplinary research into a human-dominated environment.

1 Introduction

The world's population is expected to reach nine billion people by 2050, with 70% living in urban areas (Zhang, 2008). The population density of developing countries may increase dramatically. So, securing and improving the quality of life of urban citizens is itself a significant challenge. In the last 20 years, ecosystem services valuation has become a well-known tool for deciding on various ecological and social issues (Cheng et al., 2019). Ecosystem services are defined as the benefits that people obtained from the ecosystem and are

commonly classified into provisioning, regulating, supporting and cultural services (MEA, 2005). Cultural ecosystem services (CES) refer to non-material benefits that play an essential role in improving the quality of human life in terms of mental and physical health and also helps in enhancing environmental sustainability (Plieninger et al., 2013). All four types of ecosystem services reflect what people obtain from the natural Environment, which ultimately increases people's awareness of environmental protection (Orenstein, 2013; Plieninger et al., 2015). Besides these benefits from nature, ecosystem services evaluation can also sustain many practical applications in an urban ecosystem like urban planning, policy-making, landscape design (Lautenbach et al., 2011; Willemen et al., 2008).

Meaning of evaluation is the process of assessing the value of something. Valuation, assessment, accounting, mapping, quantifying, and other terminology have been given in the scientific literature to identify various methodologies that are commonly used interchangeably. These different types of terms usually represent different theoretical concepts but the common thing is they are all used to assess the value of ecosystem services. For example, the 'economic valuation' seeks to attach a monetary amount to the ecosystem services and give an assigned value to something. Economists have developed various ways of understanding and quantifying the value of goods and services that can moreover be used for ecosystem services valuation (Sharma et al., 2021). The 'Social valuation' refers to an object's relative importance or value to an individual or group in a given social context (Scholte et al., 2015). And, the 'ecological valuation' can be done at any ecological level. At species level ecological valuation, it can be done by observing the importance of the species role in the ecosystem. The most common way of assessment is done through risk assessment (Critically endangered, endangered, and vulnerable). The ecological valuation is assessed at the ecosystem level by measuring resilience against external disturbances, and biodiversity plays a key role.

Because CES are "intangible,""non-material," and "invisible" in comparison to other material services, their assessment is often ignored and misunderstood (Tilliger et al., 2015). Consequently, valuing CES poses several conceptual and methodological difficulties, but this service has immense interest and importance because it acts as a linkage between nature, cultural values, physical and mental health, and collective decision-making that influences ecosystem and human well-being (Hirons et al., 2016). Although data scarcity is a major barrier to assessing all ecosystem services, it is particularly true for CES evaluation for both quantitative and qualitative data (Brown et al., 2016). Furthermore, the distinction between different CES categories is not always apparent, leading to double counting issues. For example, recreational benefits are related to other services like aesthetic, educational, and spiritual and religious values. It's challenging to evaluate and determine the actual value of each service (Daniel et al., 2012).

With the upsurge of ecosystem services in policy-making and its drastically increasing integration into land and resource management approaches, many techniques have been developed and implemented to assess cultural services provision. These techniques can be characterized across various dimensions, whether qualitative or quantitative, examine people's stated or revealed preferences, monetary or non-monetary, involve stakeholders in the valuation process, or facilitate social learning between stakeholders. Nonetheless, researchers have studied CES and their evaluation methods for years (Katz-Gerro and Orenstein, 2015). In the past few decades, a growing number of researchers started to use economic terms to address ecological issues and evaluated ecosystem services from a financial perspective (Gomez-Baggethun et al., 2010). Addition to these, many international initiatives, such as the Millennium Ecosystem Assessment (MEA), The Economics of Ecosystems and Biodiversity (TEEB), and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), have classified evaluation methods in a multidisciplinary framework in which ecosystem benefits society and makes the ecosystem service concept operational (Carpenter et al., 2009;Seppelt et al., 2011).

This paper aims to conduct a systematic literature review on evaluation methods of CES. We mainly focus on: a) How many different types of CES have been evaluated? b) Which category of CES is most frequently studied? c) How many methods have been proposed to evaluate CES? d) What are the conceptual difficulties for the valuation of CES? Thus, the paper has been divided into four main sections. Firstly, we describe the overview of reviewed articles, including the geographic location of studies and the number of papers published per year. Secondly, we classify and reviewed CES categories. After that, we organiseand review CES evaluation methods based on monetary and non-monetary methods. Then we discuss the overall review and describe some conceptual challenges on the way of CES evaluation.

2 Materials and Methods

A systematic literature review process is used in this research (Pickering and Byrne, 2014; Tranfield et al., 2003). A systematic review was conducted from May to June 2021, based on two databases, i.e., ISI web of science and Scopus database. We performa comprehensive search based on the search term "Cultural ecosystem service", "Cultural ecosystem service AND classification", "Cultural ecosystem service AND evaluation"in titles, abstracts and keywords. Then the results obtained were combined to define our final research object. We set the period from 2010 to June 2021, because 'TEEB released the Economics of Ecosystem and Biodiversity Report' in 2010. This report defines and classifies CES and highlights CES's role to understand the functioning of the ecosystem and supporting human well-being. The European Commission took this initiative and the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety, responding to a proposal of environment ministers from the G8+5 countries meeting in Potsdam, Germany, in March 2007. TEEB 2010 has slightly modified the 'Millennium Ecosystem Assessment report'. Also, the report explained evaluation methods for ecosystem services. Since then, this concept has gained attention.

Besides, the review resulted in 371 references from Scopus and 89 references from the ISI Web of Science. It is followed by the elimination of duplicates and grey literature. Then, inclusion and exclusion of articles for further analysis were performed with intensive screening based on the relativity of the review topic. This was done by checking the title, abstracts, keywords and full text to mainly select the publications about evaluation methods for CES, which resulted in 127 publications that we read in detail for review synthesis (Fig. 1).
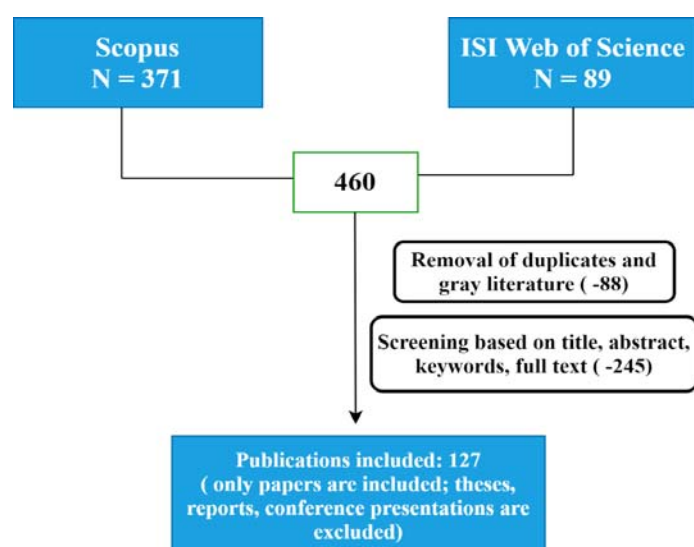

Fig. 1 Overview of search strategy for the literature selection process for our systematic review.

3 Results

3.1 Overview of reviewed papers from 2010-2021

Publications on CES evaluation methods appeared in the past decade and have kept increasing (Fig. 2). Off the total127 papers published between 2010 to 2021, two articles were published in 2010 and 2011 each, while three in 2012, four in 2013, nine in 2014, ten in 2015 and 2016 each, while seventeen in 2017, sixteen in 2018, seventeen in 2019, ninteen in 2020 and eighteen in 2021, respectively (more are expected to come). As for locations of the case study is concerned, these are unevenly distributed globally (Fig. 3). There were two studies screened as global-scale or cross-continental studies, and three were located in the European continent.To find out country-wise location of the study, four were located among two to threeEuropean countries. However, country-wise, China has the highest study which reaches tops the ranking with 46 papers followed by Italy (12), Spain (11), Germany and USA (7 each). However, few countries such as Japan and Slovakia (3 each), while UK, Taiwan, India, Australia and Portugal represented two papers of each. Many other countries, including France, had one case in the publications (Fig. 4).
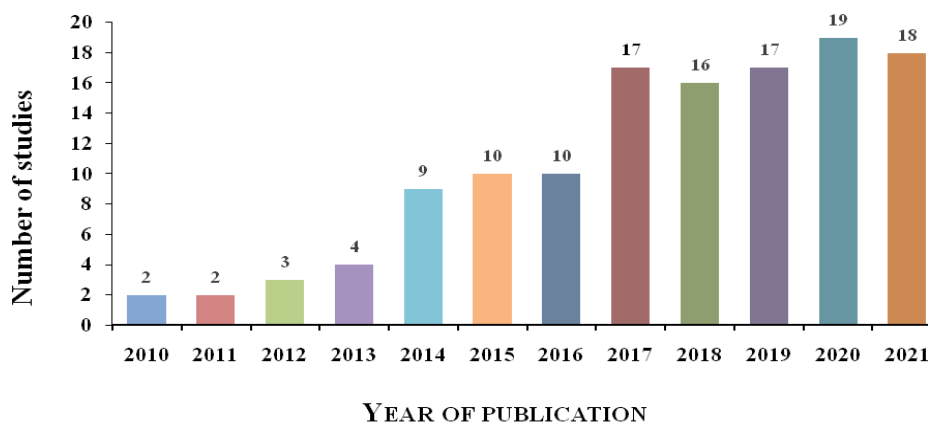

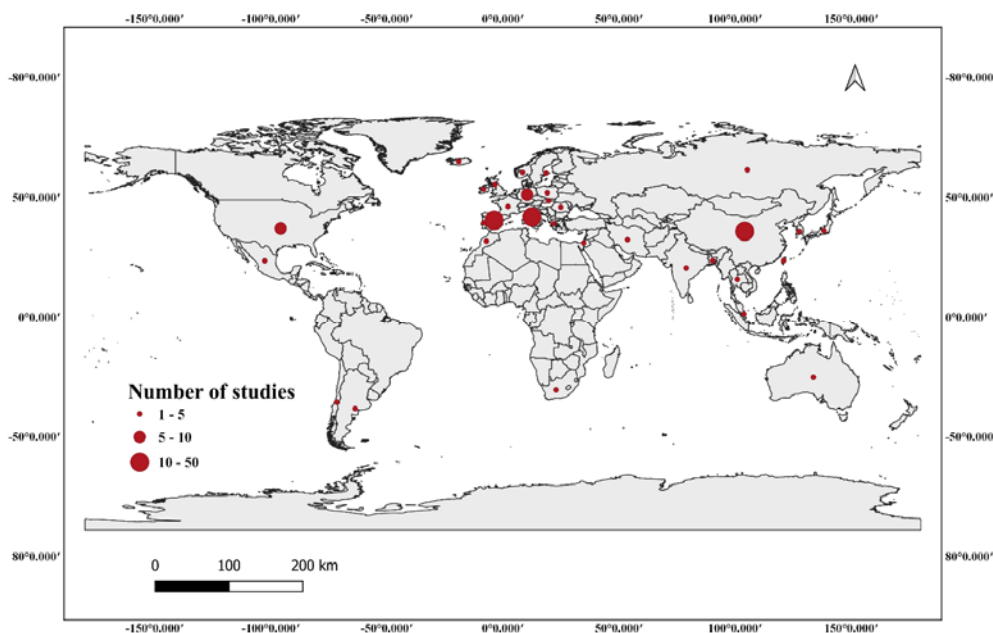Fig. 2 The number of studies per year from 2010 to 2021 (N=127).

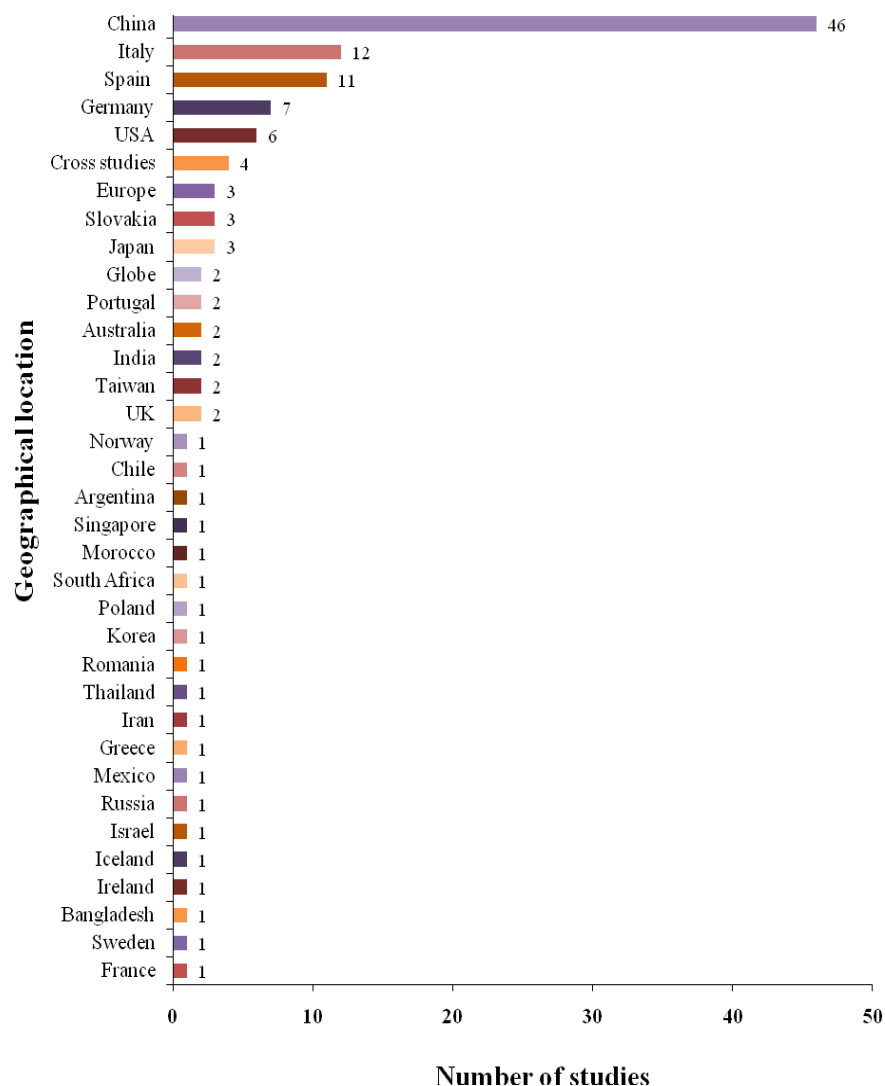Fig. 3 Geographic distribution of various case studies (127) aboutthe cultural ecosystem services.

Fig. 4 The number of case studies in different geographical locations across the world.

3.2 Classification and review of CES categories

MEA initiative classifies ecosystem services into four main categories: provisioning services, regulating services, supporting services and cultural services (Fig. 5). The difference between CES and other services is that CES are primarily driven by human experience. The close relation between CES and the people reflected a valuable opportunitiesto increase awareness of the multifunctionality and interrelatedness of different ecosystems. So, this section reviews the classification of CES categories addressed in this review and highlights the importance of CES for their role in human well-being. There are many typologies of CES, but (MEA, 2005) and (TEEB, 2010) classify the CES mainly into ten valuable categories. They are Cultural diversity, spiritual and religious values (information and cognitive development), knowledge systems, educational values (inspiration for culture, art and design, aesthetic information), inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation and ecotourism (recreation and tourism) (Table 1). Services in brackets are those which TEEB named. It's worth noting that "recreation and ecotourism" include both individual services like recreation and tourism, as well as combinations of the two.

It's important to note that only the categories with the in-depth study were listed, not those that were "mentioned," since they were of little use. Those categories were not recorded, which were not applicable to our classification like symbolic species (Egarter Vigl et al., 2021), leisure and entertainment (Zhang et al., 2021), nature experience (Tachibana et al., 2021), mental and physical health (Sitko and Scheer, 2019) and sports (Dai et al., 2019).

Furthermore, some authors used different terms such as sense of identity instead of sense of place (Giedych and Maksymiuk, 2017). Also, we placed culture research (Wang et al., 2017), research and education (Li and Mang, 2012), scientific research culture (Zhang et al., 2021) in the educational values category. Some authors referred to CES as a broad entity and evaluated all the CES categories, so we recorded CES as a separate category.
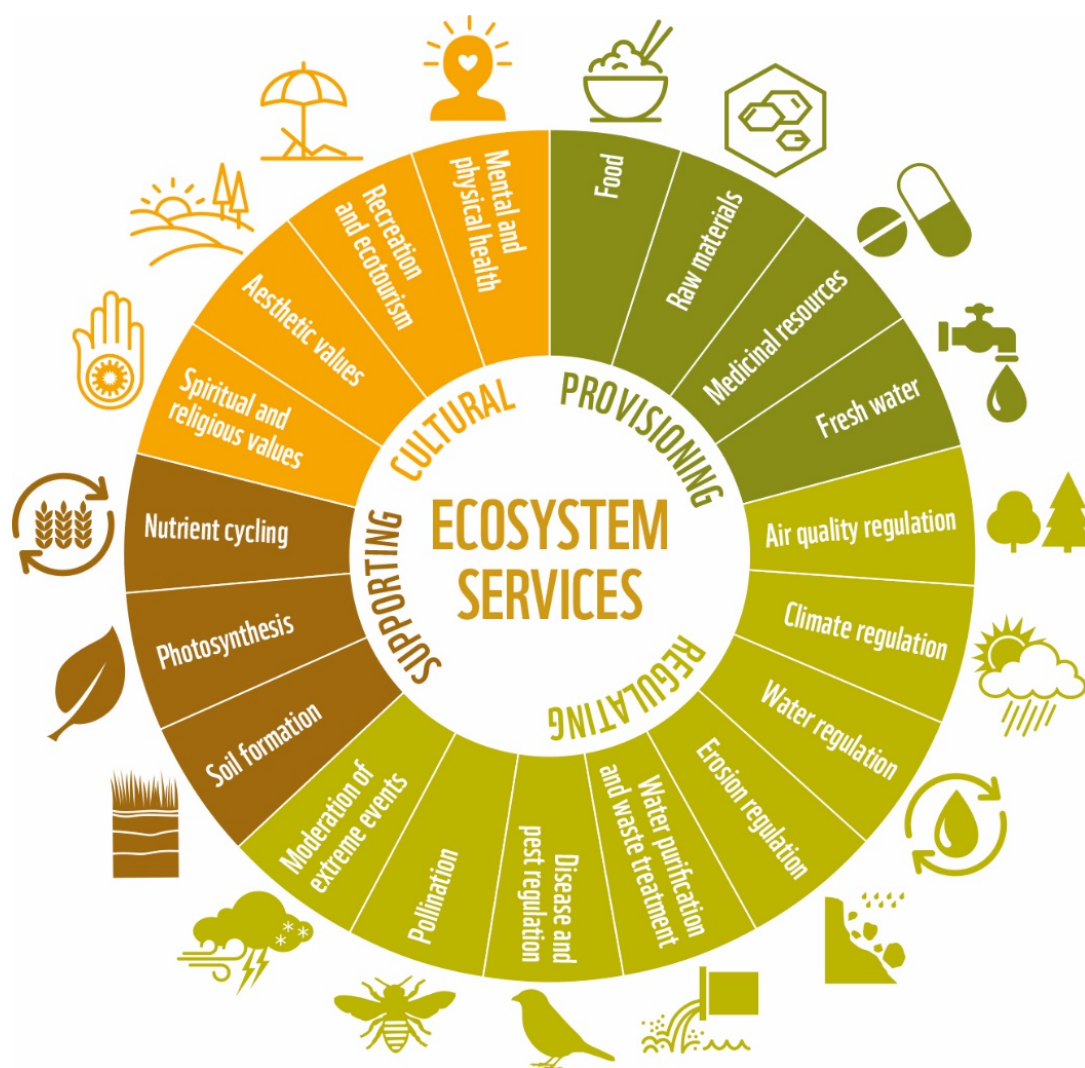

Fig. 5 Classification of ecosystem services (Source: WWF Living planet report 2016, adapted from MEA 2005).

Table 1 Classification and definition of CES categories (adapted from MEA 2005 and TEEB 2010).

Category	Definition
Cultural diversity	One aspect that influences the diversity of cultures is the diversity of ecosystems.
Spiritual and religious values	Many religions attach spiritual and religious significance to ecosystems and their constituents.
Educational values	In many societies, ecosystems and their components and processes serve as the foundation for formal and informal education.
Knowledge systems	Ecosystems have a significant impact on the types of knowledge systems that different cultures might develop.
Inspiration	Ecosystems deliver a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
Aesthetic values	Many people consider beauty or aesthetic value in many ecosystems, as seen by support for parks, 'scenic drives', and housing location choices.
Social relations	Ecosystems have an impact on the types of social relationships that develop in different cultures. Fishing communities, for example, differ in many ways from nomadic herding or agricultural societies in terms of social relations.
Cultural heritage	Many societies emphasise the preservation of historically significant landscapes or culturally valuable species.
Sense of place	Many people cherish the 'sense of place' associated with recognised qualities of their area, such as ecosystem components.
Recreation and ecotourism	People usually choose where to spend their relaxation time based on the characteristics of the natural or cultivated landscapesin a particular area.

The evaluation of CES categories was highly irregular. Most cases evaluated services like recreation and ecotourism. They accounted for a substantial number (51), followed by aesthetic values (28) and 24 by general CES, 18 by educational values, ten by spiritual and religious, and seven by cultural heritage. Inspiration, cultural diversity, sense of place, knowledge system, social relations received the least attention (Fig. 6). In addition, 38 studiesjust focused on a single CES category, while 31 have on multiple CES categories,and 24 studies broadly focused on CES as a separate category. Some studies (34) have been conducted on reviews and theoretical form (Fig. 7).

3.3 Classification and review of CES evaluation methods

Various methods were used to evaluate the CES. We classified the CES evaluation methods into monetary and non-monetary techniques based on CES classification studies (Cheng et al., 2019; Christie et al., 2012). Then, based on classification, we screened the evaluation methods employed in each review paper and obtain a final set of procedures. Finally, we counted all the methods applied in review papers. If several methods were employed in a single article, it was scored multiple times, once for each approach.

This study included twenty-two evaluation methods that used different procedures and applied various techniques. Among these respective techniques, eight were monetary, twelve as non-monetary, one was an integrative method, and the remaining was a biophysical method (Table 2). Hence, monetary methods received more attention (online supplementary material A).
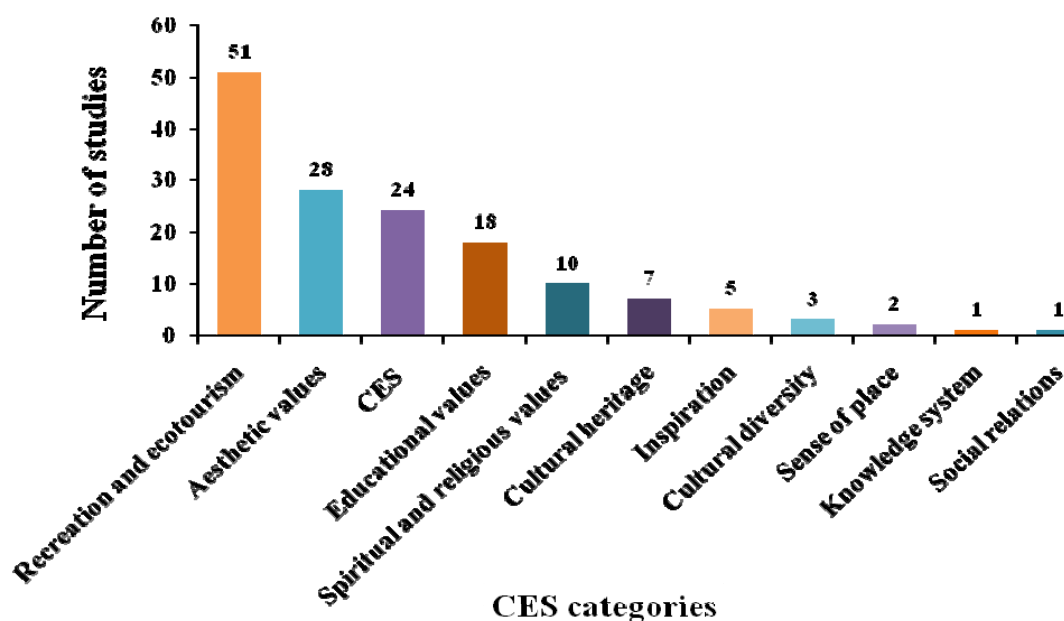
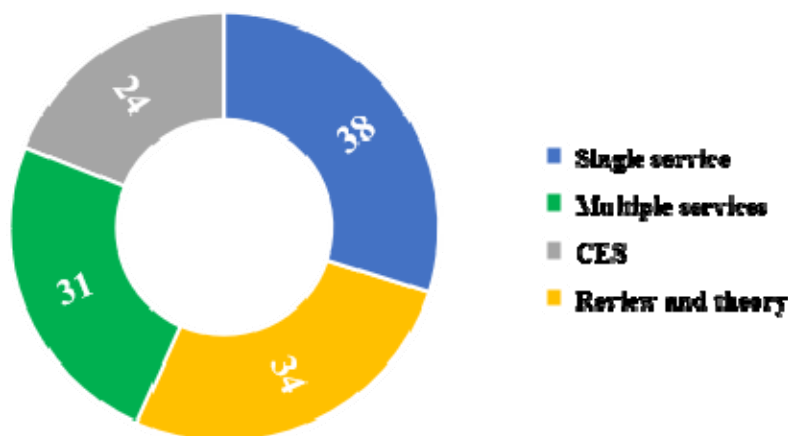**Fig. 6** The number of case studies evaluating different categories of CES.

Fig. 7 The number of case studies showing single or multiple services.

Table 2 Summary of different evaluation methods used in 127 case studies.

MONETARY METHODS		
Methods	**Description**	**References**
Market price	Estimates the economic value of CES using market prices for items that can be purchased and sold. For example, it calculates recreation and ecotourism values using park entry fees.	Li et al., 2016; Jiang et al., 2017
Travel cost	They are estimating the economic value of CES based on travel cost. This technique uses the travel cost to places where recreational activities such as animal watching, hunting, and fishing are accessible to value recreation and ecotourism in ecosystems.	Wang et al., 2010; Pang et al., 2014

Hedonic pricing	They are estimating the economic value of changes in CES based on similar property selling prices. Hedonic methods, in essence, may assess values that are capitalized into the asset value of property; moreover, buyers and sellers are aware of the impact of relevant CES on home prices.	Cook et al., 2020
Benefit/value transfer	Transfers current benefits to CES evaluation to estimate economic values. For example, the cost per trip per person in an existing study is modified and transferred to new research to calculate recreation and ecotourism services.	Brown et al., 2016; Hu et al., 2020
Contingent valuation	People are asked to express their willingness to pay for certain CES directly. Unlike other approaches, the contingency valuation method may measure passive use values individuals may have even if they do not intend to use a CES explicitly.	Cao et al., 2017; Gerner et al., 2018; Zhang and Zhou, 2018
Choice experiment	Respondents are asked to pick amongst several CES bundles based on their qualities and attribute levels.	Sacchelli, 2018; Lin et al., 2020
Damage cost avoided	Services that allow the human society to avoid the cost that would have occurred in the absence of those services.	Gerner et al., 2018
Replacement cost	Services could be replaced by the artificial human-made ecosystem that might be costly. In such conditions, the replacement cost of the ecosystem services can be calculated.	Jiang et al., 2017
NON-MONETARY METHODS		
Observation	Directly looks at human activity and behavior to represent the social value of CES. For instance, it monitors the number of visits to a park to determine the recreational significance of the place.	Weyland and Laterra, 2014; Bujnovsky, 2015; Giacche et al., 2021,
Scenario simulation	Simulates future scenarios with various CES capacities to give guidance for policy-making and planning.	Attardi et al., 2014; D'Auria et al., 2018
Document	Looks at texts, images, or other forms of materials to obtain information about human preferences on CES. For instance, analyses the number of photos taken by the public and in advertisements to indicate the aesthetic value.	Giedych and Maksymiuk, 2017; Giacche et al., 2021
Social-media based	To evaluate CES, we used social media data from a variety of sources. For example, calculating the recreation and ecotourism values utilizes the number of wildlife photos uploaded on a photo-sharing website like Flickr as a proxy.	Cabana et al., 2020; Tachibana et al., 2021
Interview	Through face-to-face conversation or other ways, directly obtains a detailed understanding of how and why consumers appreciate CES. People are free to express their emotions and opinions better to understand services like the sense of place or inspiration.	Bouahim et al., 2015; Vojinovic et al., 2017;Teff-Seker and Orenstein, 2019
Questionnaire	Includes a series of questions designed to get information about CES from responders. For example, researchers might use a Likert scale to allow participants to choose from a collection of CESs, indicating significant advantages.	Bernues, 2014, Kovacs et al., 2020; Yang et al., 2021
Focus group	Respondents are given the option to acquire further information and time for evaluation or group discussion. Facilitators assist participants in discussing their views on CES in a group conversation. The purpose of the focus group is to observe how people interact and how a group develops conversation on the topic of CES, rather than to collect individual ideas or thoughts.	Fleming et al., 2014; Subiza-Perez et al., 2019
Expert-based	To evaluating CES, experts' professional knowledge and extensive experience are used. Experts skilled in language and ways to express what they believe are the essential aspects of CES concerns.	Li and meng, 2012; Karstens et al., 2019; Song et al., 2021
Q-method	Written statements are used to divide stakeholders into categories based	Lee et al., 2017

	on their value orientations. Respondents' different values about CES are revealed through the Q-sorts and post-sort interviews, which analyses individual beliefs, interests, and attitudes.	
Participatory mapping	Via mapping of the CES, this project combines current mapping techniques with participatory methodologies. For example, it invites participants to indicate or mark where they think the CES is on a map.	Beichler, 2015
Participatory GIS (PGIS)	GIS and participative mapping technologies are combined in this project.	Cabana et al., 2020
Public participatory GIS (PPGIS)	Promotes knowledge production by local and nongovernmental organizations by focusing on the local level.	Peng et al., 2019
INTEGRATIVE METHOD		
Multicriteria decision analysis	MCDA is an umbrella term for a collection of formal methods that explicitly account for numerous criteria in assisting people or groups in making important choices. GIS is used to carry out spatial MCDA to visualize the various standards.	Peng and Wang, 2020
BIOPHYSICAL METHOD		
Ecosystem service modelling method	Ecosystem service models use specialized GIS-like tools to determine the supply (and sometimes demand) of different ecosystem services. InVEST is a series of models for mapping and evaluating numerous ecosystem services' ecological or economic value at a local to regional scale.	Scorza et al., 2019

In this series, market price and expert-based ranked first and second with 13 and 12 studies, respectively. This is followed by contingent valuation, travel cost, questionnaire, social-media-based, observation, PPGIS, interview, and participatory mapping with 11, 10, 10, 9, 7, 6, 5, 5 studies, respectively. Four studies used choice experiment and PGIS, followed by scenario simulation, benefit transfer, MCDA with three studies each (Fig. 8). The use of the remaining categories ranged from 1 to 2 studies. In addition, 47 studies used only one method, 33 studies used more than one method and five studies combined monetary and no-monetary methods. Figure 9 depicts the distribution of each CES subcategory subsequent for various evaluation. In this figure, 22 bars have shown with 22 evaluation methods. Where in each method shows the CES subcategory evaluated by them. However, all the methods evaluate only the recreational and ecotourism service.
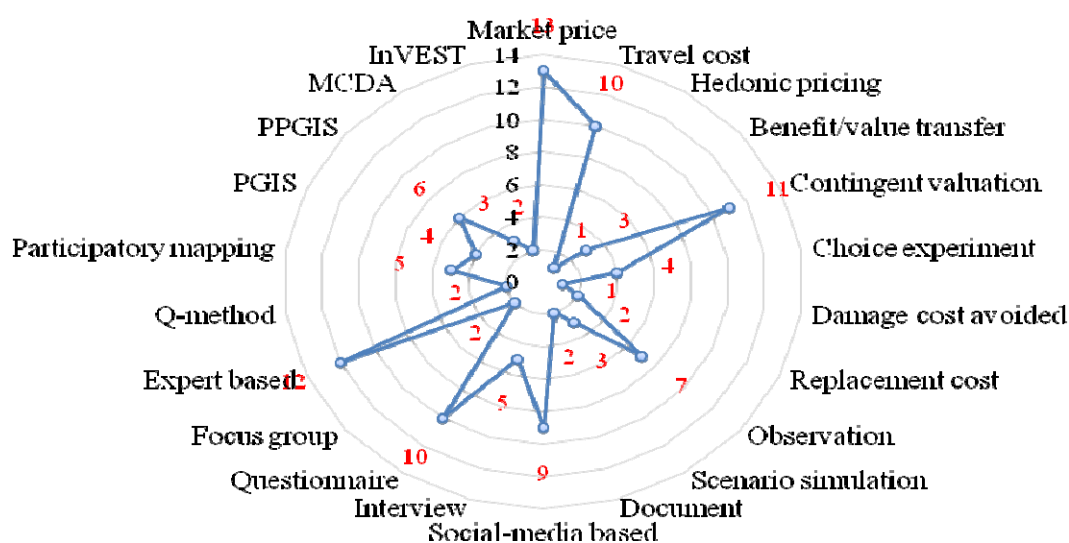

Fig. 8 The number of case studies using different methods to evaluate CES.
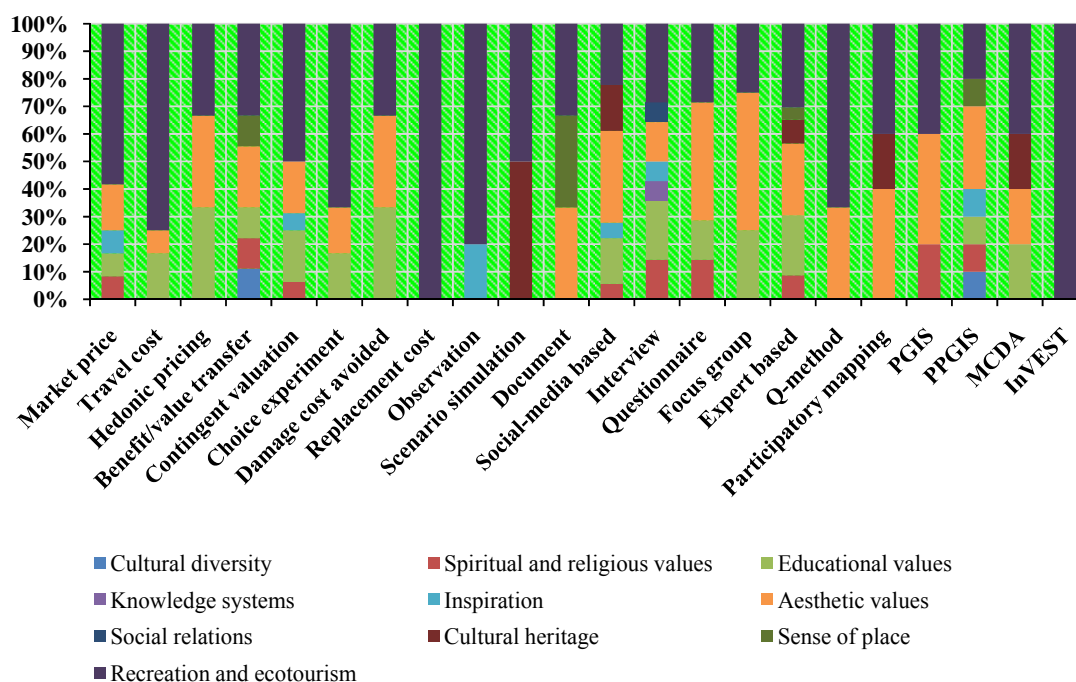
Fig. 9 Representation of CES subcategories evaluated by their corresponding evaluation method.

4 Discussion

CES valuation has displayed vital importance in various parts of the world. The study of cultural services in more than 30 countries (Fig. 2) validates their significance in science and arguably has been successfully linked with human well-being. The link with human well-being can be assessed through the studies conducted on various cultural ecosystem services. It is clearly seen that recreational and ecotourism ecosystem service is more apparent and prominent among cultural ecosystem services, as it is more attached to human sentiments and well-being(Yang et al., 2021; Lin et al., 2020; Hu et al., 2020; Sacchelli, 2018). Moreover, from the earlier studies, it can be easily depicted that the studies on cultural services are more inclined toward services values that correspond to human preferences. Although there are no significant differences in the studies conducted individually or in multiple services, twenty-four studies have considered overall cultural services for valuation (Fig. 7)(Cheng et al., 2021; Dushkova et al., 2020; Cabana et al., 2020; Rosario et al., 2019). However, most of the studies in different regions have considered recreational, aesthetic, educational and religious and spiritual values for assessment (Moore and Hunt, 2012; Li and Meng, 2012; Richards and Friess, 2015). These cultural ecosystem services can be easily identified and assessed through local stakeholders irrespective of the areas or regions.

The CES has been evaluated through different means and methods. The implementation of monetary and non-monetary valuation methods has an almost equal contribution for assessment. As many as eight monetary and twelve non-monetary methods with some modeling tools were applied for mapping by the various experts (Wang et al., 2010; Pang et al., 2014; Fleming et al., 2014; Subiza-Perez et al., 2019). While valuing the cultural services indicates a robust analysis of cultural services valuation based on different sets of ideas, measurements and interpretation of regional or global CES. This could potentially provide a multiple-choice assessment tool for others in the future.

Furthermore, the use of monetary valuation for cultural services evaluation might highlight the neglected features associated with the ecosystems, and the value can be used to specify and visualize the region's significances for non-materials benefits for human welfare in economic terms. On the other hand, the non-monetary valuations relatively provide an understanding of experts, stakeholders, indigenous people, and other respondents' perceptions and preferences regarding various cultural ecosystem services. Although monetary and non-monetary valuation is quite different, both can be used as a primary platform for environmental sustainability and an essential tool for policymakers and decision-makers.

5 Some KEY CHALLENGES in CES Research

5.1 In the context of geographic location
Studies on CES evaluation are insufficient, as only 127 studies were found from hundreds of articles. The majority of 127 research took place in Europe and China. Until recently, other countries appeared to be unfamiliar with this development. Chinese scholars have been particularly paying attention to CES research since 2010, and the number of studies is consequently increasing in 2021. Because people's perceptions and preferences are known to have a significant role in CES evaluation (Milcu et al., 2013), their different interests and preferences about CES make it challenging to evaluate CES. Furthermore, geographical bias might be because research on ecosystem services and CES has its origin in European countries and China. So, unawareness about CES research globally might be one of the challenges in this direction.

5.2 In the context of environment and human well being
The increasing research and policy focus on CES reflects a greater understanding of their significance. But there are some challenges for the evaluation of CES. This includes interaction between the Environment and human well-being. In evaluating CES, it is essential to review two critical points around which conceptualization of human well-being is oriented. First, is human well-being having both subjective and objective elements. For example, subjectively, someone may be satisfied with their knowledge while being illiterate objectively. In context to CES, a recreational experience of mountaineering in the heavy rain might be what life is all about for one person, but for someone else, the same experience makes them think they seemed to be dead. So, this type of subjective knowledge has inherent within ecosystems and makes CES evaluation more difficult (MacDonald, 1998; Hirons et al., 2016).

The second is the services and disservices of CES about human well-being. The CES literature mainly focuses on the positive role of the ecosystem. In the CES literature, the concept of ecosystem disservices, the ecosystem's functions that consider harmful for human well-being, are neglected (Jorgensen and Anthopoulou, 2007; Doherty and Clayton, 2011; Tschakertet al., 2013). So, highlighting these points raises questions in the decision-making process and the evaluation of CES research.

5.3 In the context of CES evaluation methods
Recent studies on ES evaluation methods have increased significantly, and they have primarily classified CES evaluation methods into monetary and non-monetary categories. Monetary methods increase the suitability of assessment for policymakers and stakeholders and make it easier to incorporate the CES evaluation results into the ecosystem service framework for better decisions about environmental management and conservation (Spangenberg and Settele, 2010). Besides these advantages of monetary methods, some researchers have pointed out that the actual monetary value of CES is often inefficient (Kumar and Kumar, 2008). Because there are some services like cultural heritage, social relations, knowledge systems are poorly evaluated by monetary methods. There is also a reason behind this because these services are depending upon human perception. That's why some researchers pointed out that the actual value of monetary methods is sometimes inadequate. Some (Voigt and Wurster, 2015) also figure out that during the evaluation of CES, the focus

should be more on people than on ecosystems because people with different cultures and values show other CES demands.

Additionally, many studies tend to focus on more than one method in our review. This can create difficulties for the policymakers because while using more than one method, only skilled researchers are needed who are familiar with all the methods and techniques. So, these are some challenges that might arise during evaluation by monetary and non-monetary methods.

6 Conclusion

Our review reveals that literature on CES deals with a variety of topics and addresses CES in various ways. The concept of cultural ecosystem services has created multipleideas, and we will almost certainly see the rapid expansion of this research topic in the future years.Based on our findings, we recommend that: 1) recreation and ecotourism service is more examined so studies should also focus more on other CES subcategories, especially those that are significantly less evaluated; 2) more evaluation methods should be developed to address CES that would be helpful in ecosystem service framework in policy-making research; 3) more combination of methods should be used in the evaluation process,especially in the urban ecosystem, the CES concept can prove an ideal factor for making good health of people if they are appropriately managed. In conclusion, according to our views, CES act as a binding element between social and ecological pillars to fulfil the central idea of sustainability; therefore, more emphasis should be drawn on their evaluation procedures in future research.

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