

REVIEW

Integrating Aesthetic Value into Ecosystem Services Assessment: A Conceptual Framework for Sustainable Landscape Management

Weimo Wang

College of Applied Technology, Dalian Ocean University, Dalian 116300, China

ABSTRACT

The concept of aesthetic value as a part of ecosystem services (ES) assessment is needed to manage the landscape sustainably, although it is still conceptually limited and methodologically divided. This review brings together progress in defining, measuring, and integrating aesthetic value into ES frameworks, and specifically how it can be viewed as a cultural ecosystem service, and how it mediates between ecological conditions and human well-being and behavior. We look at qualitative and participatory methods, which can capture contextual and culturally ingrained perceptions, quantitative measures, and metrics of the landscape that can be compared, and spatially explicit approaches that can be used in planning and scenario analysis. We also evaluate the emerging computational methods, the crowdsourced and image-based information, and point out the possibilities of mapping on a large scale and the difficulties of representativeness, bias, and validation. Based on this synthesis, we suggest a conceptual integration pathway that considers aesthetic value as a joint product between landscape qualities and human senses, expressly showing their interactions, synergies, and trade-offs with other ecosystem services on different scales. It finds significant standardization gaps, dynamics of time, and plural valuation identified and describes the next directions of research on mixed-methods designs, uncertainty management, and more robust science-policy interfaces. Landscape planning can be used to create ecological sustainability and multifunctional landscapes by incorporating aesthetic value in more explicit ES assessment, which can be used to support resilient and multifunctional landscapes.

Keywords: Ecosystem Services; Aesthetic Value; Cultural Ecosystem Services; Landscape Planning; Multifunctional Landscapes

*CORRESPONDING AUTHOR:

Weimo Wang, College of Applied Technology, Dalian Ocean University, Dalian 116300, China; Email: 13700116659@163.com

ARTICLE INFO

Received: 7 January 2026 | Revised: 25 February 2026 | Accepted: 13 March 2026 | Published Online: 6 May 2026

DOI: <https://doi.org/10.30564/jees.v8i5.13231>

CITATION

Wang, W., 2026. Integrating Aesthetic Value into Ecosystem Services Assessment: A Conceptual Framework for Sustainable Landscape Management. *Journal of Environmental & Earth Sciences*. 8(5): 1–17. DOI: <https://doi.org/10.30564/jees.v8i5.13231>

COPYRIGHT

Copyright © 2026 by the author(s). Published by Bilingual Publishing Group. This is an open access article under the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License (<https://creativecommons.org/licenses/by-nc/4.0/>).

1. Introduction

The issue of sustainable landscape management has become a priority issue in light of the rising rate of environmental change, the loss of biodiversity and increasing human burden and pressure on natural and semi-natural systems^[1]. Landscapes are not merely a biophysical system that offers material resources and ecological control but a socio-ecological system that influences human experience, identity and well-being^[2,3]. Within the last 20 years, the ecosystem services (ES) conceptualization has become a leading paradigm in the conceptualization, measurement, and even valuation of the various benefits that humans gain through ecosystems. The ES framework has been broadly used to describe land-use planning, a conservation focus, and policy decisions by translating ecological processes into what has become known as a service of implication to society. Nonetheless, the evaluation of ecosystem services has been unequal even though it has been an integrative activity with cultural and non-material aspects, especially aesthetic value, being either underrepresented or simplified.

One of the most basic perspectives by which humans view, experience, and judge the landscapes is aesthetic value^[4]. Scenic beauty, visual quality and aesthetic experience have an impact on recreational preferences, residential preferences, mental health, cultural identity and social approval of environmental policies. The landscapes that are seen to be aesthetically attractive would be more likely to be safeguarded, restored, or managed in a sustainable way and the degraded or aesthetically displeasing landscapes might receive no attention or be exploited in an unsustainable manner. Consequently, aesthetic value is a vital mediator of ecological aspects and human activities, and thus very useful in the management of sustainable landscapes. However, aesthetic value is difficult to conceptualize and operationalize in ecosystem services evaluation because of a subjective, context-specific, and culturally inherent character^[5].

In the ecosystem services paradigm, aesthetic value is usually grouped, with recreation, spiritual enrichment, and sense of place, as cultural ecosystem services^[6]. It is generally accepted that cultural ecosystem services contribute significantly to the well-being of humans, but they are also known as the most understudied type of ecosystem services. Existing ES measures are more likely to focus on provision-

ing and controlling services, which are easier to measure and monetize by means of biophysical indicators and economic value systems. By contrast, aesthetic value is more frequently dealt with qualitatively, proxied away, or left out because it is difficult to measure. This bias has the risk of underestimating culturally and aesthetically significant landscapes, which may result in the making of management decisions that do not take into account key social aspects of sustainability.

The more recent developments in research on landscapes, environmental psychology, and geospatial analysis have revived the interest in incorporating aesthetic value into the assessment of ecosystem services^[7,8]. Methods like participatory mapping, landscape preference survey, visual landscape measure, and use of crowdsourced data on social media platforms have broadened the methodological shelf of aesthetic perception capturing methods at various spatial and temporal scales. Simultaneously, conceptual arguments have also revealed the necessity of further comprehension of the relationship between aesthetic value and ecological integrity, land-use patterns, and other ecosystem services. Regardless of these changes, no consistent conceptual frameworks are currently available that explicitly incorporate aesthetic value in ecosystem services assessment in a manner that is theoretically well-founded, methodologically sound, and useful in practical terms towards sustainable landscape management.

It is one of the most important problems with the duality of aesthetic value. On one hand, aesthetic appreciation is determined by objective landscape features, including the diversity of land covers, the naturalness of the land cover, the presence of water bodies, and the spatial arrangement. Conversely, it is influenced by personal aspects such as personal preferences, culture, previous experiences, and social ethics. Such a relationship between biophysical characteristics and human senses makes it difficult to standardize the assessment procedures and relate the results among regions or scales. Moreover, the aesthetic value is dynamic, which varies with time due to the ecology, land-use change, and changing societal values. To cope with such complexities, an integrative approach that cuts across natural and social sciences and recognizes aesthetic value as an emergent feature of coupled human-environment systems is needed^[9-11].

Aesthetic value should be incorporated into the ecosys-

tem services assessment as part of management, not as an academic endeavor, but as a practical need. Landscape planning and policy choices usually entail a trade-off among rival land uses and ecosystem services. The disregard of aesthetics may produce incompatibility, less acceptance by the stakeholders, and unwanted social impacts. On the contrary, aesthetic value can explicitly be managed to improve the level of participation in decision making, facilitate multifunctional landscape design, and introduce solutions adhering to ecological sustainability and human interest and values. This is especially the case in settings like urban growth, agricultural intensification, renewable energy growth, and ecological restoration, where the visual effects and landscape character serve as determining factors in the perception of the masses and policy implications^[12].

Although it is essential, the awareness of the aesthetic value to the ecosystem services assessment is disjointed in the field and practice. The current literature is diverse in its definition, indicators, and methodology; it is hard to generalize research or to translate it into practical advice to guide landscape management. Besides, most ecosystem services frameworks consider aesthetic value as an additive feature instead of a core element, and this reduces its impact on the decision-making process. There is a gap in a critical review that would bring together the existing knowledge, demonstrate any conceptual and methodological gaps, and suggest a unifying framework to inform future research and practice^[13].

On this backdrop, this review aims at analyzing how aesthetic value has been conceptualized, measured, and embedded in the framework of ecosystem services studies, and also to present a conceptual framework that clearly includes aesthetic value into the scope of the ecosystem services evaluation in the management of sustainable landscapes. In particular, a synthesis of theoretical viewpoints on aesthetic value in landscapes and its applicability within the ecosystem services frameworks will be sought, the current approaches to assessing aesthetic value within the framework of ecosystem services will be reviewed and compared and possible ways of integrating aesthetic value within the ecosystem services assessment models will be examined; and key challenges and future research directions to improve the operationalization of aesthetic value in a landscape planning and policy^[14–16].

This review aims to make its contribution to the current development of the ecosystem services science towards more holistic and social assessments. Aesthetic value in ecological sustainability. The inclusion of aesthetic value in the ecological sustainability assessment system can enhance the connection between ecological sustainability and human well-being, which in turn can support more resilient, inclusive, and sustainable landscape management plans^[17,18].

2. Conceptual Foundations

2.1. Ecosystem Services as a Socio-Ecological Framework

The ecosystem services (ES) concept offers a systematic means of explaining and examining the variety of advantages human beings enjoy because of ecosystems^[19]. Since it was formalized in the field of environmental science and policy, the ES framework has become extensively applied to understand the ecological processes and needs of society, providing the shared language of scientists, planners, and decision-makers. The most common classification of ecosystem services is based on the four categories of provisioning, regulating, supporting, and cultural services that represent various ways in which ecosystems bring benefits to human well-being. Although this classification has helped incorporate ecological knowledge into economic valuation and policy tools, it has had an impact on research priorities, whereby those services that can be more easily quantified and valued are more prevalent.

In this context, landscapes are perceived as multifunctional systems where ecological structures, spatial pattern and human activity interact to generate various services^[17,20]. The ES methodology focuses on the functional dependencies between the ecological elements and human utility, usually on some quantifiable value, such as food production, temperature regulation, or water treatment. But landscapes also produce non-material advantages which are less directly connected with biophysical flows, yet which are core to the way people experience and appreciate their landscape. The socio-ecological system characteristics of landscapes emphasize the necessity to shift away from strictly biophysical analysis and include perceptual, cultural, and experiential aspects in the analysis of ecosystem services.

2.2. Conceptualizing Aesthetic Value in Landscapes

Aesthetic value can be described as the aesthetic sense of beauty in the landscapes and meanings that people and communities place on their appearance^[21,22]. Aesthetic value has been linked to scenic beauty, visual quality, landscape character, and visual amenity in the context of landscape research. Aesthetic value, unlike most of the provisioning or regulating services, does not emanate from a particular ecological action, but occurs through the interplay of the landscape qualities and the perception of humans. Land cover composition, spatial heterogeneity, water availability, vegetation structure, and the extent of naturalness are also elements that combine with the cultural norms, personal experience, and expectation in shaping aesthetic judgments.

The aesthetic value has, in the past, been acknowledged to be a conceptual challenge due to its subjectivity^[23]. Although there are some features of the landscape that are likely to receive widely popular tastes, aesthetic tastes also have an influence on socio-cultural background, education, and personal familiarity with certain settings. Consequently, the aesthetic value cannot quite be taken down to objective landscape measures, nor can it be perceived through the prism of individual taste. Rather, it lies in a middle ground between ecological qualities and social significance, and is a phenomenon of emergent quality of coupled human-

landscape systems. The main disciplinary perspectives that have shaped conceptualizations of aesthetic value and their relevance for ecosystem services assessment are summarized in **Table 1**.

In terms of sustainability, the aesthetic value has a great role to play in shaping new attitudes towards landscapes and behavior modification. Landscapes that are perceived to be aesthetically appealing will most probably be linked to positive feelings, attachment to the place, and desire to advocate conservation or sustainable management programs. On the other hand, aesthetically impaired or dull landscapes can decrease emotional relationships and decrease civic interaction. Theoretically, aesthetic value is thus not just a good in its own right, but also a mediator between ecological situations and social reactions and management consequences^[24].

2.3. Aesthetic Value within Cultural Ecosystem Services

Aesthetic value has most often been categorized within the cultural ecosystem services framework in the ecosystem services framework. Cultural ecosystem services are the non-material goods that people derive through ecosystems, such as recreation, spiritual enrichment, cultural identity, and education. Aesthetic appreciation is also commonly seen as a cornerstone of such services, since visual perception is the basis of much landscape recreation and cultural experience^[25,26].

Table 1. Conceptual definitions and disciplinary perspectives on aesthetic value relevant to landscape and ecosystem services research.

Disciplinary Perspective	Conceptualization of Aesthetic Value	Key Focus	Relevance to Ecosystem Services
Landscape ecology	Emergent property of landscape structure and spatial patterns	Land cover composition, heterogeneity, and naturalness	Links aesthetic value to measurable biophysical attributes
Environmental psychology	Perceived visual quality influences emotional and cognitive responses	Preference, restoration, well-being	Explains pathways between aesthetics and human well-being
Cultural geography	Socially constructed meaning embedded in place and culture	Identity, symbolism, sense of place	Highlights the cultural specificity of aesthetic value
Ecosystem services science	Non-material benefit contributing to cultural ecosystem services	Human–nature interactions	Integrates aesthetics into sustainability-oriented assessments

Although it is recognized to be important, aesthetic value has been a conceptually underdeveloped area in the cultural ecosystem services studies^[27]. More often than not, it is implicitly assumed in most of the assessments, or it is expressed using simplified measures like proximity to natural areas or land cover diversity. This pattern is mirrored by

larger issues to do with cultural ecosystem services, which are often typified by non-tangible payoffs, multifaceted causality, and high context. Because of this, aesthetic value is occasionally relegated or left out in assessments of ecosystem services or implied as auxiliary to other, more readily quantifiable services.

Recent conceptual literature has also emphasized the idea that aesthetic value is not to be considered as a collateral cultural good but should be regarded as a dimension of ecosystem services that overlap with other service categories. As an example, the aesthetics of landscapes can have an effect on how recreational opportunities are perceived, whether renewable energy infrastructure is socially acceptable, or whether agricultural landscapes are desirable. These

interconnections require the acknowledgement of the fact that there have been strict divisions between the categories of ecosystem services and the need to be more integrative in the conceptual understanding of the multi-functional aspects of landscapes^[24,28]. The conceptual positioning of aesthetic value within the ecosystem services framework and its interactions with other service categories are illustrated in **Figure 1**.

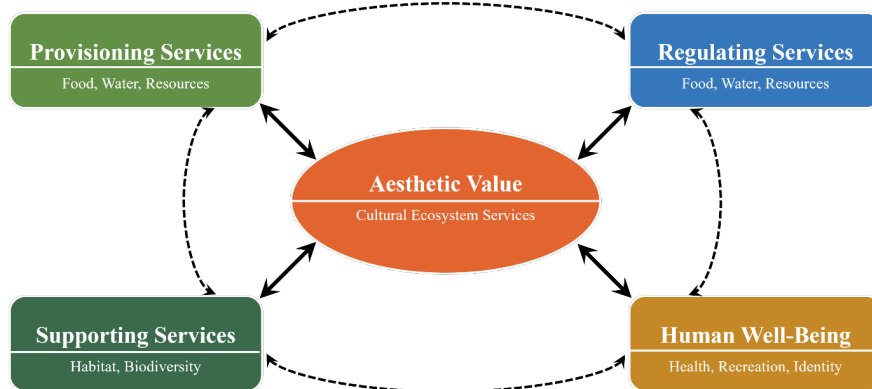


Figure 1. Conceptual positioning of aesthetic value within the ecosystem services framework, highlighting its role as a cross-cutting cultural dimension interacting with other ecosystem service categories.

2.4. Linking Aesthetic Value, Human Well-Being, and Sustainability

The increasing amount of literature indicates that there is a close connection between landscape aesthetics and human well-being. The psychological restoration, reduction of stress, and enhanced mental health associated with exposure to aesthetically pleasing environments have been attributed to urban and peri-urban settings. These advantages do not just affect individual experience but also social cohesion, quality of life, and identity of the community. From this point of view, aesthetic value contributes to various benefits of well-being, such as emotional, cultural, and social^[29].

Aesthetic value can also be an important implication of integrating aesthetic value into ecosystem services assessment in terms of sustainability^[18,30]. Sustainable landscape management aims at striking a balance between ecological integrity, economic viability, and social equity in the long run. The aesthetic factors affect the utilization, appreciation, and regulation of landscapes, and help to determine the popularity of sustainability-based policies and interventions. Landscapes, which effectively integrate ecological and aes-

thetic functionality, are more likely to be seen as desirable and legitimate, and tend to create the chance of continued management actions.

In principle, aesthetic value can be perceived as a product of the landscape structure as well as a source of social processes that influence sustainability pathways^[31]. The implementation of this dual role into the ecology services assessment needs a conceptual framework that recognizes the co-production of aesthetic value by ecology and human senses. This kind of understanding offers the foundation for building assessment frameworks that are more representative of the complexity of human-landscape relationships and enable informed, inclusive, and sustainable landscape management decisions.

3. Methods for Assessing Aesthetic Value in Ecosystem Services

3.1. Qualitative and Perception-Based Approaches

Current attempts to measure aesthetic value in landscapes have mainly depended on qualitative and perception-

based methods, which attempt to define how individuals feel and perceive visual landscapes^[32]. These lies are based on the environmental psychology, landscape architecture, and human geography disciplines, in which aesthetic appreciation can be perceived as a subjective and social phenomenon. Some of the most common methods that have been employed in their quest to understand aesthetic preferences and meanings attached to landscapes include expert-based landscape evaluation, in-depth interviews, focus group discussions, and narrative analyses. The qualitative methods bring detailed information on the influence of the culture, personal history, and societal standards on the formation of aesthetic value by focusing on the lived experience and interpreting it through cultural and personal contexts.

In the context of ecosystem services, participatory approaches have become increasingly popular as a means of encompassing the stakeholder perspectives of the evaluation of cultural ecosystem services, such as aesthetics^[33]. The concepts of participatory mapping, deliberative workshops, and co-design processes enable local communities and other stakeholders to express what they consider to be visually desirable in the landscape and the reasons behind it. These approaches boost the social complacency and relevance of assessments and tend to be restricted in spatial maps and comparability. Also, qualitative results may be challenging to incorporate into decision support systems that demand standardized or spatially explicit indicators; thus, the use of add-on quantitative methods is necessary.

3.2. Quantitative Indicators and Landscape Metrics

In response to the requirement of comparability and scalability, quantitative techniques of aesthetic evaluation have been devised and are typically based on quantifiable landscape features as approximations of visual quality^[9,34]. Such approaches presuppose some systematic interrelation of some biophysical attributes with the aesthetic enjoyment. The most popular indicators are land cover diversity, edge density, vegetation structure, topographic variation, and the existence of water bodies. Spatial data are used to create landscape measures of these qualities and also to determine the connections between landscape pattern and perceived aesthetic value.

Within the context of the ecosystem services assessment, quantitative indicators allow for including aesthetic value into the greater analytical schemes along with other services^[35]. They help to produce scenarios, spatial modeling, and the comparison of trade-offs to the ecosystem services under diverse land-use alternatives. It also presents conceptual and methodological constraints; however, biophysical proxies come with dependence. Quantitative measures might be simplistic of aesthetic experience and may not account for cultural and contextual differences in perception. Moreover, the quality and the orientation of the relationships between landscape measures and aesthetic preference may differ based on regions and social groups, that positively concern for the transferability and generalization.

3.3. Spatially Explicit and Visual-Based Methods

The spatial explicit techniques are key in the association of glacial beauty with the evaluation of ecosystem services in the landscape and regional dimensions^[36,37]. The mapping of aesthetic value is extensively carried out using geographic information systems (GIS) that consist of integrating landscape indicators with spatial analysis methods. Viewshed analysis is used to determine visibility and visual exposure, where areas that add most value to scenic quality are identified. These techniques are especially applicable in the landscape planning situations where aesthetic effect and spatial layout affect managerial judgments.

Improvements in visual-based assessment have also increased methodological possibilities. Researchers can test aesthetic reaction to existing or hypothetical landscapes with the use of photographs, simulative photorealistic, and virtual environments in controlled conditions. These methods are being employed more to evaluate human response to change in land-use, infrastructure development, or ecological restoration situations^[38]. Although visual-based techniques provide a more direct connection between the landscape appearance and perception, they should be designed with care to ensure that bias is not created around image choice, framing, and representation. To incorporate these approaches in the assessment of ecosystem services, a compromise between the visual realism and analytical rigor and transparency is necessary.

3.4. Emerging Data Sources and Computational Approaches

Over the past years, new sources of data and new methods of calculation have appeared that provide new prospects for measuring the aesthetic value on a large scale. Data collected by crowdsourcing social media sites, geotagged photographs, and online image-sharing services give enormous quantities of user-generated data on where and how people interact with the landscapes on a visual basis. The researchers have started to conclude aesthetic preferences and scenic value of different landscapes by examining image density patterns, content, and user interactions. The methods allow measuring both spatial and temporal scales, which could not be easily attained via conventional survey techniques^[39,40].

The ability to analyze visual information has also been increased through machine learning and computer vision approaches^[41]. Landscape features that can be identified using automated image classification and feature extractions are related to aesthetic appreciation, and predictive models can estimate the perceived scenic value on a large scale. Combined with spatial ecosystem services models, these methods provide potentially viable paths to the inclusion of aesthetic

value into the decision support system. However, there are still questions about the representativeness of data, and certain ethical issues are still present, as well as online behavior as a measure of aesthetic appreciation. The critical reflection and methodological validation should always be done thoroughly to make sure that the emerging approaches do not supersede the old methods.

3.5. Strengths, Limitations, and Methodological Integration

Both approaches to valuing aesthetic value have their particular advantages and disadvantages, as the aesthetic experience is complex in nature^[42,43]. Participatory and qualitative methods are detailed and contextualized but might not be very scalable. Quantitative and spatial techniques provide comparability and analytical unification, but run a risk of simplifying the subjective perceptions. New calculational methods increase the spatial and temporal scope at the expense of adding a novel uncertainty and bias. An overview of the main methodological approaches used to assess aesthetic value within ecosystem services research, along with their respective strengths and limitations, is provided in **Table 2**.

Table 2. Overview of methods used to assess aesthetic value in ecosystem services studies, including data sources, spatial scales, strengths, and limitations.

Method Category	Typical Data Sources	Spatial Scale	Key Strengths	Main Limitations
Qualitative and participatory	Interviews, focus groups, participatory mapping	Local to regional	Context-sensitive, inclusive of stakeholder values	Limited comparability and scalability
Quantitative indicators	Land cover data, landscape metrics	Regional to national	Standardized, suitable for modeling	Risk of oversimplifying perception
Visual-based assessments	Photographs, simulations, virtual landscapes	Site-specific to regional	Directly captures visual perception	Sensitive to design and framing bias
Computational and crowdsourced	Social media images, geotagged data	Regional to global	Large-scale, high temporal resolution	Representativeness and ethical concerns

In the case of ecosystem services assessment, no one method can be adequate to define the entire range of aesthetic value. There is growing support among researchers to adopt mixed-methodological approaches, which integrate the processes of qualitative and quantitative analysis and space.

The latter can be integrated more deeply into the aes-

thetic value through the perspective of human perception and ecological and spatial information. Such an integrative view is indispensable conceptually and methodologically to integrating aesthetic value into the frameworks of ecosystem services in a manner that will be scientifically sound and useful in managing the landscape sustainably^[24].

4. Integrating Aesthetic Value into Ecosystem Services Assessment Frameworks

4.1. Ecosystem Services Assessment Frameworks and Their Limitations

To assist in systematic examination of the interconnections among the ecosystems, the services they furnish, and human well-being, frameworks of assessment of ecosystem services have been established^[44]. The most commonly used models promote causal pathways between biophysical structures and processes and service flows and benefits to society. These structures have played a major role in the development of combined environmental studies, as well as supporting land-use planning and policy. The existing methods, however, were largely intended to capture what can be defined in terms of material outputs or quantifiable ecological functions, which reduced their capacity to accept aesthetic and other cultural values.

In most of the ecosystem services models, aesthetic value is implicitly captured in the wider cultural ecosystem services or simplified indicators that fail to capture the complexity of aesthetic value^[27]. This therapy usually leads to a divisive mode of representation of aesthetic value, detached from the biophysical and social processes that create it. In addition, aesthetic appreciation, human behavior, and landscape change may be confused due to the linear structure of certain frameworks. Such shortcomings demonstrate the necessity of conceptual improvements that would enable the introduction of aesthetic value in the ecosystem services assessment explicitly and logically.

4.2. Conceptual Pathways for Integration

When we find the means of incorporating aesthetic value in the evaluation of ecosystem services, we must find straightforward conceptual frameworks that can connect landscape characteristics, human perception, and decision outcomes^[45]. One way is to expressly acknowledge aesthetic value as a co-created service, which comes out of interactions amongst ecological structures and human interpretation. Following this perspective, aesthetic value is not purely a product of the ecosystem, but a relational value, which is based on ecological features and social background. When

this view is integrated into systems of ecosystem services, aesthetics can be placed on a par with the other services, yet the different mechanisms involved in the generation of aesthetic value can still be considered.

Conceptual integration also entails the explication of the interaction of aesthetic value with other ecosystem services^[27,46]. The aesthetic value can increase the value of recreational services, have an effect on the demand for residential or tourism-related benefits, or even the social approval of land-use actions. Meanwhile, the management activities that strive to maximize some of the provisioning or controlling services can change the look of the landscapes, hence the aesthetic value. These interactions need to be explicitly presented in assessment frameworks, as they can help identify the possible synergies and conflicts and make more informed decisions.

4.3. Trade-Offs and Synergies with Other Ecosystem Services

Key considerations in the ecosystem services assessment are trade-offs and synergies, especially in multifunctional landscapes where many services are produced at any given time^[47,48]. These dynamics are closely connected with aesthetic value. In other instances, aesthetic value is very high, and the ecological integrity is high, like in the diverse semi-natural landscapes that sustain not only the biodiversity but also the scenic value. Elsewhere, the trade-offs can arise, such as when the agricultural production or the development of infrastructure can improve the provisioning services, while reducing the visual quality. By considering aesthetic value in systems of ecosystem services, a more intensive examination of these trade-offs and synergies can be conducted. Analyzing the impact of various land-use situations on the visual and experience, as well as ecological and economic results, can be done by introducing aesthetic indicators into the multi-service assessment procedures. The broadened approach is especially relevant to sustainability-based planning, in which a choice has to be made between conflicting goals and long-term social acceptability.

Quantifying trade-offs between aesthetic value and provisioning or regulating ecosystem services requires integrative analytical approaches that combine biophysical, spatial, and perceptual data. Multi-criteria decision analysis

(MCDA) provides a structured framework for comparing services with different units and value dimensions by incorporating stakeholder-defined weights. Spatially explicit modeling approaches, including GIS-based overlay analysis and scenario simulations, enable the identification of areas where high aesthetic value coincides with or conflicts with provisioning or regulating services. In addition, composite indices that integrate landscape metrics with perception-based indicators can be used to approximate aesthetic value in quantitative terms. While these approaches involve uncertainty and methodological assumptions, they offer practical tools for systematically evaluating trade-offs and informing balanced landscape management decisions.

4.4. Scale and Context Considerations

Scale and context have a powerful role in the incorporation of aesthetic value in the assessment of ecosystem services^[49]. The difference between local site-specific experiences and landscape regional character can be extremely high in terms of aesthetic preferences and perceptions. Likewise, aesthetic value can vary with the level of governance, planning, and cultural context in terms of relevance in decision-making. The ecosystem services frameworks should then be adaptable enough in order to accept scale-sensitive differences in aesthetic value and how it interrelates with other

services. Aesthetic appreciation is also influenced by contextual aspects like cultural practices, historical land use, and socio-economic conditions. To incorporate aesthetic value into the assessment of ecosystem services, it is necessary to be sensitive to these contextual dimensions to avoid general indicators or assumptions. Models that enable context-based adaptation and still retain conceptual stability are more appropriate in being able to capture the differences in aesthetic values between landscapes and societies.

4.5. Toward an Integrated Conceptual Framework for Landscape Management

Based on these reflections, aesthetic value as a component of sustainable landscape management should be explicitly developed within an integrated conceptual framework of ecosystem services assessment. This framework would establish a connection between biophysical landscape features and aesthetic perception, placing aesthetic value in the larger network of ecosystem services and human well-being. **Table 3** summarizes the main avenues by which aesthetic value can be incorporated into ecosystem services assessment systems. It would also consider feedback among aesthetic appreciation, human behavior, and landscape change, as it is known that perceptions may affect the management decisions that result in restructuring the landscape structure^[31,50].

Table 3. Conceptual pathways for integrating aesthetic value into ecosystem services assessment frameworks and their implications for analysis and decision-making.

Integration Pathway	Description	Interaction with Other Ecosystem Services	Implications for Assessment
Biophysical–perceptual linkage	Aesthetic value derived from landscape attributes and visibility	Synergies with recreation and biodiversity	Enables spatial modeling and scenario analysis
Co-production approach	Aesthetic value produced through human–landscape interaction	Influences demand for multiple services	Requires social data integration
Trade-off analysis	Explicit evaluation of gains and losses across services	Conflicts with intensive land uses	Supports balanced decision-making
Feedback mechanisms	Aesthetic perception influencing management choices	Alters future service provision	Highlights dynamic socio-ecological processes

With the insertion of aesthetic value into the strategies of ecosystem services assessment, landscape management could shift to more holistic and socially accountable strategies^[6,51]. A coordinated structure gives the basis to the implementation of aesthetic concerns in planning and policy to

facilitate the decisions that would correspond to ecological sustainability with cultural and experiential values. By doing so, aesthetic value addition can serve to provide more holistic ecosystem services measurements, as well as to more inclusive and robust sustainable landscape management tactics.

5. Implications for Sustainable Landscape Management

5.1. Aesthetic Value in Landscape Planning and Policy

The significance of intertwining aesthetic value in the assessment of ecosystem services is significant to landscape planning and policy development^[45,52]. Planning decisions themselves tend to influence the landscape in ways that are manifested in land/use zoning, infrastructure building, conservation, and restoration projects. When the aesthetic considerations are clearly taken into consideration in the measurement of ecosystem services, the planners and policymakers will have a more comprehensive view of how alternative management choices impact ecological and economic performance in addition to visual appeal and cultural connotation. This increased view assists in the equal weighting of decisions made and the prediction of social reaction to landscape change.

Policy frameworks are also putting more stress on participatory and place-based sustainability, as these approaches have realized that public endorsement and acceptability are the key to successful implementation^[53]. The aesthetic value is vital to forming such social dynamics because more appealing landscapes will be more likely to be supported by local people and stakeholders. With the consideration of aesthetic value in the evaluation of ecosystem services, the policy instruments will better respond to the social preferences and help create policies that are viewed as just, context-sensitive, and sensitive to local values.

5.2. Enhancing Stakeholder Engagement and Social Acceptance

Aesthetic issues provide a strong point of entry into the landscape management processes in terms of stakeholder involvement^[54,55]. The visual features of landscapes are also perceptible and emotionally charged to make them effective in communication and deliberation. By directly measuring aesthetic value in the ecological services assessment, a dialogue between different stakeholder groups may be encouraged since they can have a point of reference that leads to a conversation regarding the goals of landscape change and management.

The integration of aesthetics in the evaluation systems will also assist in exposing variation in perception and preference between stakeholders^[33]. Such differences can be based on different livelihoods, cultures, or similarities in attachment to specific landscapes. Such diversity should be acknowledged and managed to have an inclusive and equitable landscape management. When the aesthetic value is demonstrated in the measurement of ecosystem services, it becomes possible to find the conflicts earlier, and management policies can be adjusted to the needs of various views to facilitate social acceptance and decrease opposition to change.

5.3. Applications across Landscape Types

The aesthetic value is not always relevant in the context of various landscapes; however, its incorporation into the ecosystem services assessment is generally applicable. Aesthetic values have a strong connection with the quality of life, recreational, and mental health in urban and peri-urban settings. Green areas, waterfronts, and urban forests are not only effective in balancing services like managing temperatures but also provide visual rest and aesthetic pleasure. Incorporating these dimensions in the evaluation of ecosystem services would assist in city planning practices that facilitate livelihood and resiliency^[56,57].

Real-world applications increasingly demonstrate the practical integration of aesthetic value into landscape management. For example, urban green infrastructure planning in European cities has incorporated visual quality indicators alongside ecological metrics to enhance both livability and public acceptance of nature-based solutions. In agricultural landscapes, agri-environmental schemes in countries such as the United Kingdom and Switzerland have explicitly considered landscape aesthetics by maintaining hedgerows, field patterns, and traditional land-use mosaics, thereby supporting both biodiversity and cultural identity. Similarly, in protected areas, scenic quality assessments have informed zoning and tourism management strategies, as seen in national parks in the United States and China, where visual landscape integrity is a key criterion for conservation planning. These cases highlight how integrating aesthetic value can support more socially acceptable and multifunctional landscape outcomes^[58,59].

The aesthetic value has an effect on the landscape per-

ception of character and cultural heritage in rural and agricultural sceneries. Mosaic systems of farming or terraced fields are examples of traditional land-use patterns, which often have high aesthetic value, biodiversity conservation, and cultural identity. The aesthetic dimension of ecosystem services assessment can emphasize the multifunctionality of such landscapes and help to sustain management practices that will ensure that production is not at the expense of aesthetic value. Aesthetic value is often driven by tourism and conservation in natural and cultural landscapes, where aesthetic value is an important factor in conservation and sustainable management strategies.

5.4. Supporting Multifunctional Landscapes and Nature-Based Solutions

Sustainable landscape management is placing more emphasis on multifunctionality as it tries to maximize the provision of a variety of ecosystem services in a single spatial setting. This multifunctionality is also characterized by aesthetic value as it interacts with ecological, economic, and social functioning. Landscapes that effectively combine aesthetic qualities and ecological performance will be more likely to generate a wide scope of benefits and endure social and environmental transformation^[60].

The nature-based solutions offer a rather topical framework for incorporating aesthetic value into ecosystem services assessment. Other interventions like reforestation, green infrastructure development, and wetlands regeneration are usually explained as regulating and supporting services, yet their aesthetic effects also determine the opinion of the people and the success in the long term. The evalua-

tion of aesthetic value, along with other ecosystem services, would help to make the argument of the nature-based solution stronger and would inform the design decisions that would lead to the increase of both ecological efficiency and aesthetics^[61,62].

5.5. Challenges in Operationalizing Aesthetic Value for Decision Support

Although it is important, aesthetic value is difficult to operationalize in the management of a sustainable landscape. The translation of complicated and contextual perceptions to the indicators that may be used to inform planning and policy necessitates methodological decisions and clear assumptions. The problem is that simplified portrayals of aesthetic value can be inaccurate in terms of reflecting the preferences of the stakeholders or distorting key social processes^[31,63].

Also, the addition of aesthetic value in decision-support tools casts doubt in the areas of weighting, comparability, and uncertainty^[13]. The decision-makers have to manage the trade-offs between the services of the ecosystem and the various and even opposing aesthetic tastes. The solution to these issues involves iterative and adaptable mechanisms incorporating powerful evaluation techniques with participatory decision making. The pathway through which aesthetic value assessment informs sustainable landscape management outcomes is summarized in **Figure 2**. By acknowledging both the potential and the limitations of aesthetic value assessment, sustainable landscape management can more effectively incorporate visual and cultural dimensions into ecosystem services-based decision-making.

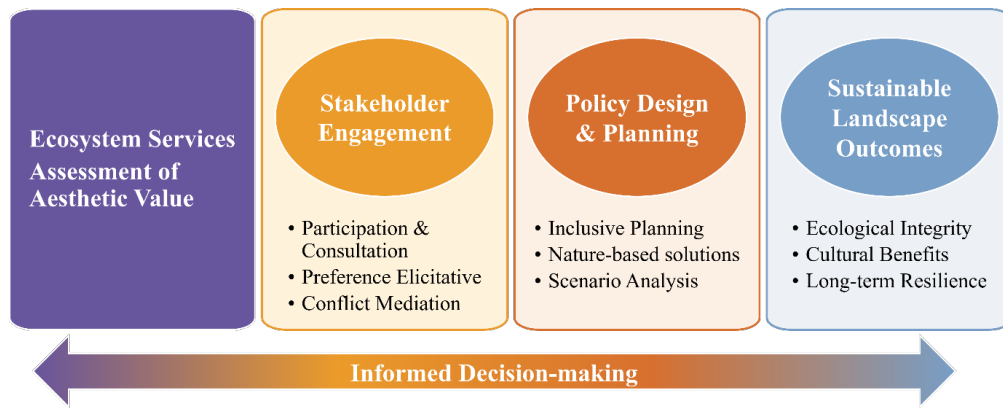


Figure 2. Pathway linking aesthetic value assessment to stakeholder engagement, policy design, and sustainable landscape management outcomes.

6. Research Gaps and Future Directions

6.1. Conceptual and Theoretical Gaps

Although there is an increasing appreciation of the significance of aesthetic value in ecosystem services research, the conceptual and theoretical gaps are still wide. The common problem is that no single conceptualization of aesthetic value can be applied uniformly in other fields of assessment and across the contexts of different disciplines. Research frequently follows divergent definitions and theoretical approaches and relies on landscape ecology, environmental psychology, cultural geography, or design theory, which may restrict the ability to compare and synthesize. A deeper conceptual understanding is required to explain the relationship between aesthetic value and other cultural ecosystem services, but also how aesthetic value operates as a component of coupled human-environment systems^[6,64].

The other gap that exists in theoretical terms concerns the dynamic aspect of aesthetic value. The majority of ecological services appraisals take aesthetic value as a fixed value, though it has been indicated that aesthetic perceptions can change over time based on ecological change, land-use actions, and changes in social norms. Future studies ought to be more explicit in terms of time dynamics and feedbacks and how the variation in the landscape structure would change aesthetic satisfaction over time, and how the variation in turn would affect management decisions and sustainability^[25,31].

6.2. Methodological Challenges and Standardization

Methodological diversity has served as both an advantage and a disadvantage in the evaluation of aesthetic value. Although a diverse set of qualitative, quantitative, and computational methods has contributed to a better understanding, the lack of standardized methods makes it difficult to compare and combine them. Intended indicators of the aesthetic value vary in many aspects (including scale, data needs, and assumptions), and so it is hard to pool results or inter-regionally transfer methods^[9,65].

The proposal of the research in the future research should be to come up with flexible and similar evaluation methods that are non-standardized but more context-

sensitive. This encompasses the refinement of proxy indicators, legitimizing the relationship between landscape measures and aesthetic perception, and the effects of the best practices to integrate participatory data with spatial models. Openness in methodology decisions and analysis of uncertainties will be fundamental in increasing the usability and accuracy of aesthetic value measures in the frameworks of ecosystem services^[66].

6.3. Data Limitations and Representativeness

A limitation that is also of great concern is the availability and representativeness of data, especially for large-scale and comparative research. Older techniques that rely on survey data can be resource-intensive and cannot cover space in the same manner as new sources of data, like social media, which could contain biased samples of the population. Such biases may affect the derived aesthetic preferences and might contribute to the further reinforcement of existing inequalities whose values are portrayed^[67].

To solve these limitations, it is necessary to combine several sources of data and consider them thoroughly in terms of representativeness. Further studies ought to be conducted on how to combine conventional surveys, participatory, and digital data in a manner that complements the other and reduces bias. The use of new sources of data in aesthetic value evaluation should also be grounded in ethical considerations, such as data privacy and informed consent^[68].

6.4. Cultural Diversity and Context-Specific Perceptions

The aesthetic value is closely connected with cultural and historical backgrounds, and the field of ecosystem services research has tended to make generalizations regarding landscape preferences^[69,70]. This way would jeopardize the awareness of cultural diversity and disregard the values specific to a location. Further research ought to emphasize more on the perception of aesthetics among people of different cultures, regions, and socio-economic backgrounds and the effects of such diversities on the landscape management preferences.

The inclusion of cultural diversity in ecosystem services evaluation also brings the issue of how various, and even conflicting, aesthetic values can be compromised in

the process of making decisions. Studies are required to come up with strategies that can support plural values but not generalize them to a particular quantitative scale. This work would help towards a more welcoming and fair landscape management and enhance the social significance of ecosystem services assessments^[71].

6.5. Bridging Science, Policy, and Practice

Another ultimate and general research gap would be the translation of the aesthetic value assessment into policy and

practice^[72]. Although the conceptual and methodological development has increased the possible space of incorporating aesthetic value into the framework of ecosystem services, the application is still limited. This is because decision-makers are usually constrained in terms of the availability of data, technical capacity, and institutional priorities, which make it difficult to pursue aesthetic concerns in planning and management. The major conceptual, methodological, and practical challenges identified in this review, together with corresponding future research priorities, are summarized in **Table 4**.

Table 4. Challenges and future research priorities for integrating aesthetic value into ecosystem services assessment.

Dimension	Current Challenge	Research Need	Expected Contribution
Conceptual clarity	Inconsistent definitions and frameworks	Unified, flexible conceptual models	Improved comparability and synthesis
Methodological integration	Fragmented assessment approaches	Mixed-methods frameworks	Robust and context-sensitive evaluations
Data and scale	Limited representativeness and temporal coverage	Multi-source, longitudinal data	Scalable and dynamic assessments
Policy relevance	Weak translation into planning tools	Co-produced decision-support systems	Greater uptake in landscape management

The future research needs to then be concerned with the co-production of knowledge with practitioners and policy makers so that the assessment frameworks and tools are set in line with the real-world context of decision-making. The integration of aesthetic value in sustainable landscape management can be achieved through the development of user-friendly decision-support tools, case-based guidance, and policy-relevant indicators. The future work can assist in making the aesthetic value a working and operational element of ecosystem services assessment by enhancing the interface between science, policy, and practice.

7. Conclusion

This review has discussed the importance of aesthetic value in the assessment of ecosystem services and how it can be important in sustainable landscape management. Although the ecosystem services concept has contributed significantly to the evolution of incorporating ecological factors into the process of decision-making, aesthetic value has been poorly defined and evaluated in an inconsistent manner. The synthesis of theoretical approaches, method-

ological perspectives, and practical frameworks emphasizes the significance of aesthetic value as a fundamental element of human-landscape relationships, as well as the issues of implementing aesthetic value in the framework of ecosystem services evaluation, as pointed out in the article.

One of the lessons gained during this review is that the aesthetic value must be perceived as a co-production and emergent quality of socio-ecological systems as opposed to a side effect or a purely subjective advantage. Aesthetic appreciation: Due to cultural, historical, and contextual influences, the interactions between biophysical landscape features and human perception lead to aesthetic appreciation. It is important to appreciate this relational quality in order to come up with assessment frameworks that bring to the table all the benefits the landscape offers. By applying the aesthetic value to ecosystem services assessment explicitly, the multifunctionality of landscapes can be represented more broadly, and the connection between ecological integrity, the well-being of people, and the results of sustainability can be established with greater strength.

The methodology of the review shows that there is no one method that can be used to measure aesthetic value

across scales and contexts. All computational approaches (qualitative, quantitative, spatial, and emerging) have their own pluses and minuses. Their conceptual rationality in mixing the strategies creates the most promising avenue of sound and socially pertinent evaluation. Mixed-methods approaches would also be more integrative and enable greater comparability with the sensitivity to local perceptions and cultural diversity, and thus, increase the relevance of ecosystem services assessment in planning and policy-making.

Management-wise, the implication of introducing aesthetic value in ecosystem services systems is far-reaching. Aesthetic factors also affect the stakeholder involvement, social acceptance, and viability of long-term landscape interventions. The aesthetic value can be explicit in a way that facilitates a more inclusive decision-making process, trade-offs and synergies between ecosystem services, and improves the design and implementation of multifunctional landscapes and nature-based solutions. Aesthetic value in this regard is not merely a result of sustainable landscape management but also a precursor to the success of sustainable landscape management.

Although improvements have been made lately, there are still major gaps in research. The inherent ambiguities of concepts, methodological piecemeal, limitations of data, and lack of focus on cultural diversity have still limited the successful incorporation of aesthetic value in the assessment of ecosystem services. The interdisciplinary cooperation, methodological innovations, and closer contact between scientific work and policy imperatives are the approaches that will be needed to handle these issues. Further work should be directed towards the creation of adaptable and consistent conceptual frameworks, better assessment instruments, and co-producing knowledge along with stakeholders and decision-makers.

To summarize, the inclusion of aesthetic value in ecosystem services assessment is an important milestone towards more holistic and socially accountable sustainable landscape management approaches. Through the realization of the complexity of aesthetic value and integrating it into the frameworks of ecosystem services, researchers and practitioners will have a greater opportunity to capture how people perceive, appreciate, and construct landscapes. This type of integration can make the scientific strength and practical applicability of ecosystem services evaluations, which in

the end lead to ecologically sound, culturally relevant, and ecologically resilient landscapes.

Funding

This work received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

No new data were created or generated in this study. All data were presented in this work.

Conflicts of Interest

The author declares no conflict of interest.

AI Use Statement

The author declares that no artificial intelligence (AI) tools were used in the preparation of this manuscript.

References

- [1] Mohamed, A., DeClerck, F., Verburg, P.H., et al., 2024. Securing Nature's Contributions to People Requires at Least 20%–25% (Semi-) Natural Habitat in Human-Modified Landscapes. *One Earth*. 7(1), 59–71.
- [2] Butler, E.P., Bliss-Ketchum, L.L., de Rivera, C.E., et al., 2022. Habitat, Geophysical, and Eco-Social Connectivity: Benefits of Resilient Socio-Ecological Landscapes. *Landscape Ecology*. 37(1), 1–29.
- [3] Delgado, L.E., Rojo Negrete, I.A., Torres-Gómez, M., et al., 2019. Social-Ecological Systems and Human Well-Being. In *Social-Ecological Systems of Latin America: Complexities and Challenges*. Springer: Cham, Switzerland. pp. 53–69.
- [4] Parsons, R., Daniel, T.C., 2002. Good Looking: In Defense of Scenic Landscape Aesthetics. *Landscape and Urban Planning*. 60(1), 43–56.
- [5] Hirons, M., Comberti, C., Dunford, R., 2016. Valu-

- ing Cultural Ecosystem Services. *Annual Review of Environment and Resources*. 41(1), 545–574.
- [6] Cooper, N., Brady, E., Steen, H., et al., 2016. Aesthetic and Spiritual Values of Ecosystems: Recognising the Ontological and Axiological Plurality of Cultural Ecosystem Services. *Ecosystem Services*. 21, 218–229.
- [7] Williams, D.R., Patterson, M.E., 1999. *Environmental Psychology: Mapping Landscape Meanings for Ecosystem Management*. In: Cordell, H.K., Bergstrom, J.C. (Eds.). *Integrating Social Sciences and Ecosystem Management: Human Dimensions in Assessment, Policy and Management*. Sagamore Press: Champaign, IL, USA. pp. 141–160.
- [8] Giné, D.S., Albert, M.Y.P., Buendía, A.V.P., 2021. Aesthetic Assessment of the Landscape Using Psychophysical and Psychological Models: Comparative Analysis in a Protected Natural Area. *Landscape and Urban Planning*. 214, 104197.
- [9] Frank, S., Fürst, C., Koschke, L., et al., 2013. Assessment of Landscape Aesthetics—Validation of a Landscape Metrics-Based Assessment by Visual Estimation of the Scenic Beauty. *Ecological Indicators*. 32, 222–231.
- [10] Jacobsen, T., 2010. Beauty and the Brain: Culture, History and Individual Differences in Aesthetic Appreciation. *Journal of Anatomy*. 216(2), 184–191.
- [11] Schirpke, U., Altzinger, A., Leitinger, G., et al., 2019. Change from Agricultural to Touristic Use: Effects on the Aesthetic Value of Landscapes over the Last 150 Years. *Landscape and Urban Planning*. 187, 23–35.
- [12] Bell, S., 2019. *Elements of Visual Design in the Landscape*. Routledge: London, UK.
- [13] Booth, P.N., Law, S.A., Ma, J., et al., 2017. Modeling Aesthetics to Support an Ecosystem Services Approach for Natural Resource Management Decision Making. *Integrated Environmental Assessment and Management*. 13(5), 926–938.
- [14] Englund, O., Berndes, G., Cederberg, C., 2017. How to Analyse Ecosystem Services in Landscapes—A Systematic Review. *Ecological Indicators*. 73, 492–504.
- [15] Schirpke, U., Timmermann, F., Tappeiner, U., et al., 2016. Cultural Ecosystem Services of Mountain Regions: Modelling the Aesthetic Value. *Ecological Indicators*. 69, 78–90.
- [16] Cheng, X., Van Damme, S., Li, L., et al., 2019. Evaluation of Cultural Ecosystem Services: A Review of Methods. *Ecosystem Services*. 37, 100925.
- [17] Wu, J., 2013. Landscape Sustainability Science: Ecosystem Services and Human Well-Being in Changing Landscapes. *Landscape Ecology*. 28(6), 999–1023.
- [18] Panagopoulos, T., 2009. Linking Forestry, Sustainability and Aesthetics. *Ecological Economics*. 68(10), 2485–2489.
- [19] Grunewald, K., Bastian, O., 2015. *Ecosystem Services—Concept, Methods and Case Studies*. Springer: Berlin, Germany.
- [20] Mastrangelo, M.E., Weyland, F., Villarino, S.H., et al., 2014. Concepts and Methods for Landscape Multifunctionality and a Unifying Framework Based on Ecosystem Services. *Landscape Ecology*. 29(2), 345–358.
- [21] Brady, E., 2006. Aesthetics in Practice: Valuing the Natural World. *Environmental Values*. 15(3), 277–291.
- [22] Brady, E., 2016. Aesthetic Value, Nature, and Environment. In *The Oxford Handbook of Environmental Ethics*. Oxford University Press: Oxford, UK. pp. 186–198.
- [23] Buchecker, M., Kianicka, S., Junker, B., 2007. Value Systems: Drivers of Human-Landscape Interactions. In *A Changing World: Challenges for Landscape Research*. Springer: Dordrecht, The Netherlands. pp. 7–26.
- [24] Gobster, P.H., Nassauer, J.I., Daniel, T.C., et al., 2007. The Shared Landscape: What Does Aesthetics Have to Do with Ecology? *Landscape Ecology*. 22(7), 959–972.
- [25] López-Santiago, C.A., Oteros-Rozas, E., Martín-López, B., et al., 2014. Using Visual Stimuli to Explore the Social Perceptions of Ecosystem Services in Cultural Landscapes: The Case of Transhumance in Mediterranean Spain. *Ecology and Society*. 19(2).
- [26] Lin, I.Y., 2016. Effects of Visual Servicescape Aesthetics Comprehension and Appreciation on Consumer Experience. *Journal of Services Marketing*. 30(7), 692–712.
- [27] Daniel, T.C., Muhar, A., Arnberger, A., et al., 2012. Contributions of Cultural Services to the Ecosystem Services Agenda. *Proceedings of the National Academy of Sciences*. 109(23), 8812–8819.
- [28] Li, J., Huang, Z., Zhu, Z., et al., 2024. Coexistence Perspectives: Exploring the Impact of Landscape Features on Aesthetic and Recreational Values in Urban Parks. *Ecological Indicators*. 162, 112043.
- [29] Vanderheiden, E., 2025. The Emotional Impact of Aesthetic Appreciation on Individual and Collective Well-Being. In *International Handbook of Emotions: Resourceful Cultural Perspectives*, Vol. 1. Springer: Cham, Switzerland. pp. 211–224.
- [30] Yang, D., Luo, T., Lin, T., et al., 2014. Combining Aesthetic with Ecological Values for Landscape Sustainability. *PLoS One*. 9(7), e102437.
- [31] Nohl, W., 2001. Sustainable Landscape Use and Aesthetic Perception—Preliminary Reflections on Future Landscape Aesthetics. *Landscape and Urban Planning*. 54(1–4), 223–237.
- [32] Steen Jacobsen, J.K., 2007. Use of Landscape Perception Methods in Tourism Studies: A Review of Photo-Based Research Approaches. *Tourism Geographies*. 9(3), 234–253.
- [33] Villamor, G.B., Palomo, I., Santiago, C.A.L., et al., 2014. Assessing Stakeholders’ Perceptions and Values

- towards Social-Ecological Systems Using Participatory Methods. *Ecological Processes*. 3(1), 22.
- [34] Wang, Q., Mohd Ariffin, N.F., Abdul Aziz, F., et al., 2025. Theoretical Foundations and Methodological Frameworks for Visual Quality Assessment in Cultural Landscapes. *International Journal of Academic Research in Business and Social Sciences*. 15(1).
- [35] Haase, D., Larondelle, N., Andersson, E., et al., 2014. A Quantitative Review of Urban Ecosystem Service Assessments: Concepts, Models, and Implementation. *Ambio*. 43(4), 413–433.
- [36] Tenerelli, P., Püffel, C., Luque, S., 2017. Spatial Assessment of Aesthetic Services in a Complex Mountain Region: Combining Visual Landscape Properties with Crowdsourced Geographic Information. *Landscape Ecology*. 32(5), 1097–1115.
- [37] Bishop, I.D., Hulse, D.W., 1994. Prediction of Scenic Beauty Using Mapped Data and Geographic Information Systems. *Landscape and Urban Planning*. 30(1–2), 59–70.
- [38] Meade, K., 2018. Assessing the Use of Photorealistic and Computer Simulated Landscapes to Understand the Cumulative Landscape and Visual Impacts of Onshore Wind Turbines [PhD Thesis]. University of Sheffield: Sheffield, UK.
- [39] Lee, H., 2022. A Collective Sense of Place and the Image of the City: Urban Public Spaces—Analysis on People’s Perception of User-Generated Image Content and Hashtags on Instagram [PhD Thesis]. Virginia Polytechnic Institute and State University: Blacksburg, VA, USA.
- [40] Tieskens, K.F., Van Zanten, B.T., Schulp, C.J.E., et al., 2018. Aesthetic Appreciation of the Cultural Landscape through Social Media: An Analysis of Revealed Preference in the Dutch River Landscape. *Landscape and Urban Planning*. 177, 128–137.
- [41] Khan, A.A., Laghari, A.A., Awan, S.A., 2021. Machine Learning in Computer Vision: A Review. *EAI Endorsed Transactions on Scalable Information Systems*. 8(32), 169418.
- [42] Rawluk, A., Ford, R., Anderson, N., et al., 2019. Exploring Multiple Dimensions of Values and Valuing: A Conceptual Framework for Mapping and Translating Values for Social-Ecological Research and Practice. *Sustainability Science*. 14(5), 1187–1200.
- [43] Terkenli, T.S., Gkoltsiou, A., Kavrouidakis, D., 2021. The Interplay of Objectivity and Subjectivity in Landscape Character Assessment: Qualitative and Quantitative Approaches and Challenges. *Land*. 10(1), 53.
- [44] Agarwala, M., Atkinson, G., Fry, B., et al., 2014. Assessing the Relationship between Human Well-Being and Ecosystem Services: A Review of Frameworks. *Conservation and Society*. 12(4), 437–449.
- [45] De Groot, R.S., Alkemade, R., Braat, L., et al., 2010. Challenges in Integrating the Concept of Ecosystem Services and Values in Landscape Planning, Management and Decision Making. *Ecological Complexity*. 7(3), 260–272.
- [46] Kandziora, M., Burkhard, B., Müller, F., 2013. Interactions of Ecosystem Properties, Ecosystem Integrity and Ecosystem Service Indicators—A Theoretical Matrix Exercise. *Ecological Indicators*. 28, 54–78.
- [47] Jafarzadeh, A.A., Mahdavi, A., Shamsi, S.R.F., et al., 2021. Assessing Synergies and Trade-Offs between Ecosystem Services in Forest Landscape Management. *Land Use Policy*. 111, 105741.
- [48] Bartolini, F., Vergamini, D., 2023. Trade-Offs and Synergies between Ecosystem Services Provided by Different Rural Landscape. *Agronomy*. 13(4), 977.
- [49] Hein, L., van Koppen, K., de Groot, R.S., et al., 2006. Spatial Scales, Stakeholders and the Valuation of Ecosystem Services. *Ecological Economics*. 57(2), 209–228.
- [50] Zube, E.H., 1987. Perceived Land Use Patterns and Landscape Values. *Landscape Ecology*. 1(1), 37–45.
- [51] Plieninger, T., Bieling, C., Fagerholm, N., et al., 2015. The Role of Cultural Ecosystem Services in Landscape Management and Planning. *Current Opinion in Environmental Sustainability*. 14, 28–33.
- [52] Casado-Arzuaga, I., Onaindia, M., Madariaga, I., et al., 2014. Mapping Recreation and Aesthetic Value of Ecosystems in the Bilbao Metropolitan Greenbelt (Northern Spain) to Support Landscape Planning. *Landscape Ecology*. 29(8), 1393–1405.
- [53] Bradford, N., 2005. Place-Based Public Policy: Towards a New Urban and Community Agenda for Canada. *Canadian Policy Research Networks*: Ottawa, ON, Canada.
- [54] Selman, P., 2004. Community Participation in the Planning and Management of Cultural Landscapes. *Journal of Environmental Planning and Management*. 47(3), 365–392.
- [55] Reed, M.S., 2008. Stakeholder Participation for Environmental Management: A Literature Review. *Biological Conservation*. 141(10), 2417–2431.
- [56] López-Mosquera, N., Sánchez, M., 2011. The Influence of Personal Values in the Economic-Use Valuation of Peri-Urban Green Spaces: An Application of the Means-End Chain Theory. *Tourism Management*. 32(4), 875–889.
- [57] Nevzati, F., 2024. Evaluating Ecosystem Services and Their Impact on Human Well-Being in the Peri-Urban Landscape of Harku Municipality, Estonia [Master’s Thesis]. Estonian University of Life Sciences: Tartu, Estonia.
- [58] Howley, P., 2011. Landscape Aesthetics: Assessing the General Publics’ Preferences towards Rural Landscapes. *Ecological Economics*. 72, 161–169.
- [59] Van Berkel, D.B., Verburg, P.H., 2014. Spatial Quantification and Valuation of Cultural Ecosystem Services in

- an Agricultural Landscape. *Ecological Indicators*. 37, 163–174.
- [60] Lovell, S.T., Johnston, D.M., 2009. Designing Landscapes for Performance Based on Emerging Principles in Landscape Ecology. *Ecology and Society*. 14(1).
- [61] Herrmann-Pillath, C., Sarkki, S., Maran, T., et al., 2023. Nature-Based Solutions as More-than-Human Art: Co-Evolutionary and Co-Creative Design Approaches. *Nature-Based Solutions*. 4, 100081.
- [62] Stange, E.E., Barton, D.N., Andersson, E., et al., 2022. Comparing the Implicit Valuation of Ecosystem Services from Nature-Based Solutions in Performance-Based Green Area Indicators across Three European Cities. *Landscape and Urban Planning*. 219, 104310.
- [63] Musacchio, L.R., 2009. The Scientific Basis for the Design of Landscape Sustainability: A Conceptual Framework for Translational Landscape Research and Practice of Designed Landscapes and the Six Es of Landscape Sustainability. *Landscape Ecology*. 24(8), 993–1013.
- [64] Casalegno, S., Inger, R., DeSilvey, C., et al., 2013. Spatial Covariance between Aesthetic Value and Other Ecosystem Services. *PLoS One*. 8(6), e68437.
- [65] Ben-Bassat, T., Meyer, J., Tractinsky, N., 2006. Economic and Subjective Measures of the Perceived Value of Aesthetics and Usability. *ACM Transactions on Computer-Human Interaction*. 13(2), 210–234.
- [66] Kerebel, A., Gélinas, N., Déry, S., et al., 2019. Landscape Aesthetic Modelling Using Bayesian Networks: Conceptual Framework and Participatory Indicator Weighting. *Landscape and Urban Planning*. 185, 258–271.
- [67] Palmer, S.E., Schloss, K.B., Sammartino, J., 2013. Visual Aesthetics and Human Preference. *Annual Review of Psychology*. 64(1), 77–107.
- [68] Wiles, R., Prosser, J., Bagnoli, A., et al., 2008. Visual Ethics: Ethical Issues in Visual Research. *National Centre for Research Methods: Southampton, UK*.
- [69] Schaich, H., Bieling, C., Plieninger, T., 2010. Linking Ecosystem Services with Cultural Landscape Research. *Gaia—Ecological Perspectives for Science and Society*. 19(4), 269–277.
- [70] Mavromatidis, L.E., 2012. The Aesthetic Value of Socio-Cultural Identities and the Cultural Dimension of the Landscape. *Human Geographies*. 6(2), 15–21.
- [71] De Vreese, R., Leys, M., Fontaine, C.M., et al., 2016. Social Mapping of Perceived Ecosystem Services Supply—The Role of Social Landscape Metrics and Social Hotspots for Integrated Ecosystem Services Assessment, Landscape Planning and Management. *Ecological Indicators*. 66, 517–533.
- [72] Riggie, N., 2024. Aesthetic Value and the Practice of Aesthetic Valuing. *Philosophical Review*. 133(2), 113–149.