

FOREST ECOSYSTEM SERVICES AND LOCAL PERCEPTION IN PROTECTED AREAS: EVIDENCE FROM THE EASTERN BLACK SEA REGION

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Abstract. This study investigates local community perceptions of forest ecosystem services within protected areas of Turkey's Eastern Black Sea region, focusing on socio-economic, cultural, and geographic influences. Surveys conducted with 200 participants across six conservation sites revealed high awareness of key services including air quality regulation, erosion control, biodiversity conservation, recreation, and cultural heritage. Perceptions varied significantly with age, education, income source, and proximity to protected areas. Opinions on environmental protection measures and local participation were mixed, highlighting a pronounced need for enhanced education and participatory governance. The findings emphasize the importance of integrating traditional ecological knowledge and local socio-cultural factors into management strategies to support sustainable conservation.

Keywords: *biodiversity, community participation rural livelihoods, participatory governance, cultural ecosystem services*

Introduction

In recent decades, the concept of ecosystem services has gained prominence as a critical framework for understanding the diverse benefits humans derive from nature (MEA, 2005; IPBES, 2019). Forest ecosystems, in particular, offer a wide array of services, ranging from provisioning services such as timber and non-timber products, to regulating services like carbon sequestration, and cultural services that encompass recreation, aesthetic values and spiritual enrichment (Costanza et al., 1997; Gómez-Baggethun and Ruiz-Pérez, 2011).

Protected areas play a central role in the conservation of biodiversity and the maintenance of these services. However, the establishment and management of protected areas often entail complex interactions with local communities, particularly those whose livelihoods and cultural practices are intertwined with forest landscapes (Pretty, 2003; Berkes, 2004). The sustainability of such areas increasingly depends on participatory governance models that incorporate local perceptions, knowledge systems, and socio-economic realities (Kremen and Merenlender, 2018).

This study focuses on Artvin due to its unique combination of ecological richness and socio-cultural relevance. Ecologically, Artvin's forests cover a substantial proportion of the landscape, comprising diverse temperate broadleaf and mixed forests, montane ecosystems, and riparian habitats. The region is recognized as a biodiversity hotspot, hosting numerous endemic and threatened species, and plays a key role in maintaining ecosystem connectivity, soil stability, and climate regulation at local and regional scales (Köyceğiz et al., 2019; EEA, 2020). Socially, the area supports predominantly rural

communities whose livelihoods are closely tied to forest resources, including forestry, agriculture, beekeeping, non-timber forest product collection, and ecotourism. These communities also hold rich traditional ecological knowledge and cultural practices that have been transmitted across generations. Investigating local perceptions in this context is therefore scientifically valuable, as it allows for a nuanced understanding of how forest-dependent populations perceive, prioritize, and utilize ecosystem services, while also informing context-specific conservation and participatory management strategies. The combination of high ecological significance and strong human-forest interactions makes Artvin an ideal case study for examining the interplay between biodiversity, ecosystem services, and local well-being.

In Turkey, the Eastern Black Sea Region stands out as a biodiversity hotspot characterized by rugged topography, dense forest cover, and longstanding human-forest interactions. Despite the ecological richness of this region, the human dimensions of forest ecosystem services remain underexplored, especially in the context of protected areas such as the Camili Biosphere Reserve and the Kaçkar Mountains National Park.

This study seeks to address this research gap by exploring local perceptions of forest ecosystem services within protected areas of the Eastern Black Sea Region. Through a combination of household surveys and spatially explicit analysis, it examines how local communities perceive, utilize, and value the ecosystem services provided by nearby forests. By doing so, the study aims to contribute to a more inclusive understanding of forest management that integrates both ecological priorities and human well-being.

Research questions include:

- How do local residents perceive and prioritize different categories of forest ecosystem services?
- Are these perceptions influenced by socio-demographic variables or geographic location (i.e., district)?
- What implications do these perceptions have for sustainable forest governance in protected areas?

The term “ecosystem services” was popularized by the Millennium Ecosystem Assessment (2005), which categorized services into four groups: provisioning, regulating, cultural, and supporting services. Forest ecosystems are pivotal in delivering all these services. Recent research has increasingly emphasized the importance of non-material benefits such as cultural identity, knowledge transmission, and sense of place—particularly in forest-dependent rural communities (Chan et al., 2012; Daniel et al., 2012).

Valuation and assessment of these services vary across regions and social groups. While global and national studies have developed sophisticated valuation models (Costanza et al., 1997; de Groot et al., 2012), localized studies offer deeper insight into lived experiences, cultural values, and practical challenges faced by communities in managing and benefiting from forest ecosystems (Martín-López et al., 2012). Understanding how local communities perceive ecosystem services is not only academically important but also practically necessary for conservation success. Studies show that when local stakeholders recognize direct benefits from forest protection, they are more likely to support conservation initiatives (Scholte et al., 2015; Berkes, 2004).

Moreover, participatory approaches in forest governance—especially in biosphere reserves and community-managed forests—are shown to improve ecological outcomes and enhance social equity (García-Llorente et al., 2012; Keleş and Başkent, 2021). However, socio-demographic factors such as age, gender, education, and income levels can significantly shape perceptions and engagement levels (Bayramoğlu and Toksoy, 2017).

Although Turkey has made significant strides in forest conservation, research focusing on the human-ecological interface is still limited. In the Eastern Black Sea Region, forests are not only biodiversity reservoirs but also crucial to livelihoods—particularly through non-wood forest products (e.g., honey, medicinal plants), small-scale agriculture, and ecotourism (Gültekin et al., 2020). Camili, Turkey's first and only UNESCO-designated biosphere reserve, presents a unique setting where both conservation and cultural continuity are prioritized.

Yet, few empirical studies have examined how local populations perceive the benefits and restrictions associated with protected areas in this region. This study aims to fill this gap by empirically investigating local perceptions of forest ecosystem services, with the intent to inform more inclusive and adaptive forest policies.

Methodology

The study was conducted in the forests of Artvin Province, located in the Eastern Black Sea Region of Turkey, a region recognized for its exceptional ecological and socio-cultural significance. Artvin's forests cover a substantial portion of the province and are home to high levels of plant and animal endemism, contributing to Turkey's overall biodiversity richness (Körlü and Ertürk, 2017). The area also hosts a rural population whose livelihoods are deeply intertwined with forest resources, relying on traditional practices such as beekeeping, small-scale agriculture, and the collection of non-timber forest products. Local communities possess rich traditional ecological knowledge, which has historically contributed to sustainable forest management. Studying these populations' perceptions provides not only scientific insights into human-ecological interactions but also practical guidance for participatory and adaptive management of protected areas.

The research focused on six ecologically and socially significant sites: (i) Camili Biosphere Reserve, (ii) Maçahel Valley, (iii) Kaçkar Mountains National Park, (iv) Fırtına Valley, (v) Hatila Valley National Park, and (vi) Altındere Valley National Park. These areas represent diverse conservation regimes (national parks, biosphere reserves, nature protection zones) and host rural communities that rely heavily on forest resources for their livelihoods.

The primary objective of the study is to examine local perceptions of forest ecosystem services in protected areas and to analyze how these perceptions vary based on socio-demographic factors, residence patterns, and livelihood strategies. Specifically, the study aims to:

- Measure local knowledge and awareness regarding forest ecosystem services
- Categorize perceptions of regulatory, provisioning, cultural, and supporting services
- Evaluate local attitudes and expectations toward protected areas
- Explore the relationship between ecosystem services and rural livelihoods
- Assess community perspectives on participation in protected area governance

A mixed-methods approach was employed, combining quantitative surveys with qualitative data from focus groups and in-depth interviews. This triangulation enabled a comprehensive understanding of the research problem from both statistical and contextual perspectives.

A structured questionnaire was administered to local residents in each selected area. The survey included both closed- and open-ended questions, organized into four sections:

- Socio-demographic profile (age, gender, education, income, occupation, place of residence)
- Perception and knowledge of forest ecosystem services (measured through Likert-scale statements)
- Attitudes and expectations toward protected areas
- Perceived relationship between ecosystem services and livelihoods

Statements such as “Forests provide clean air” or “Protected areas contribute to tourism income” were rated using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). The questionnaire was pilot-tested for clarity and reliability, and the Cronbach’s alpha coefficient was calculated to assess internal consistency.

Focus groups were conducted with key stakeholder groups such as village headmen (muhtars), women’s cooperatives, beekeepers, and ecotourism operators. These discussions explored collective perceptions of ecosystem services, shared concerns about protected area management, and suggestions for improved participation and benefit-sharing mechanisms.

Semi-structured interviews were carried out with representatives from national park directorates, forestry officers, local NGOs, and academics. These interviews aimed to capture expert insights on the ecological value of forest services and the governance challenges in participatory conservation.

The sample size was determined based on the total target population and desired confidence level. The estimated target population residing in protected areas of the Eastern Black Sea Region was approximately 10,000 individuals. Using a standard sample size calculation formula with a 95% confidence level and a 7% margin of error, the minimum required sample size was calculated as 196 participants. Consequently, a total of 200 individuals were surveyed during the fieldwork.

A stratified random sampling technique was employed to ensure regional representativeness. Districts and villages were designated as strata, and participants were proportionally selected from each stratum. This approach allowed the sample to reflect both regional variations and socio-demographic diversity within the study area.

Quantitative data were analyzed using descriptive statistics, cross-tabulations, and inferential tests such as Chi-square (χ^2) for association between categorical variables and Pearson correlation coefficients for measuring the relationship between continuous variables (e.g., years of forest dependence and perceived service value). Cluster analysis was employed to identify perception typologies, and principal component analysis (PCA) was used to reduce dimensions in perception variables. Additionally, multiple linear regression analysis was conducted to explore the influence of socio-demographic and spatial factors on perceptions of cultural ecosystem services.

Qualitative data from interviews and focus groups were transcribed and coded thematically using NVivo software. Emerging themes were compared across different actor groups and locations to identify commonalities and divergences in perception.

Results

This section presents the findings from a survey conducted with 200 local residents living in protected areas of the Eastern Black Sea Region, focusing on their perceptions, attitudes, and utilization of forest ecosystem services. The collected data were analyzed according to participants' socio-demographic characteristics to examine key dimensions such as the perceived importance of ecosystem services, attitudes toward protected area management, willingness to participate in governance, and impacts on local livelihoods. Regional variations in perceptions were assessed using chi-square tests and correlation analyses. These results offer valuable insights into the social dimensions of forest ecosystem services, contributing to more inclusive and sustainable management strategies in protected areas.

A total of 200 participants were surveyed, with a slightly higher proportion of males (59%) compared to females (41%). The age distribution was mostly concentrated between 31–50 years (48%), indicating a working-age population (*Table 1*). Education levels varied, with 33.5% having university or higher education, which may influence their awareness of ecosystem services.

Table 1. Demographic characteristics of respondents

Feature	Category	n	%
Gender	Female	82	41.0
	Male	118	59.0
Age group	18–30	36	18.0
	31–50	96	48.0
	51 and above	68	34.0
Education level	Primary or lower	44	22.0
	High school	89	44.5
	University or higher	67	33.5
Main livelihood	Agriculture	62	31.0
	Livestock	38	19.0
	Forestry	51	25.5
	Tourism	34	17.0
	Other	15	7.5

Participants generally recognize the role of forests in providing various ecosystem services, especially water protection and climate regulation (*Table 2*).

Table 2. Awareness of ecosystem services (Likert scale means)

Ecosystem service	Mean	SD
Forests protect water resources	4.12	0.89
Forests play a role in climate regulation	3.95	1.01
Forests hold cultural and spiritual value	3.63	1.08
Forests contribute to my livelihood	3.85	1.2

Mean scores from the Likert-scale questions indicated that participants generally recognize the regulating services of forests, such as water protection (Mean = 4.12,

SD = 0.89) and climate regulation (Mean = 3.95, SD = 1.01). However, cultural ecosystem services received slightly lower awareness scores (Mean = 3.63, SD = 1.08), suggesting room for improved education on intangible benefits.

Provisioning services (such as timber and non-timber products) are given the highest priority by respondents, followed by regulating and supporting services (*Table 3*).

Table 3. *Prioritization of ecosystem services*

Service type	Mean priority score	% Assigning highest priority
Provisioning	4.02	68.5
Regulating	3.89	64
Cultural	3.45	41
Supporting	3.77	57.5

Provisioning services (e.g., timber and non-timber products) were rated highest in priority (Mean = 4.02), aligning with many respondents' livelihoods connected to forestry and agriculture. Regulating and supporting services followed, reflecting a balanced perception of direct and indirect forest benefits.

Table 4 presents the perceived importance of various forest ecosystem services as evaluated by local community members. Respondents rated the significance of each service on a 5-point Likert scale, ranging from 1 (Not Important) to 5 (Very Important). The results indicate a high appreciation for ecological functions such as air quality regulation, soil erosion prevention, and biodiversity conservation. While provisioning and regulating services were consistently valued, cultural and recreational benefits—though still important—received relatively lower average scores. These findings highlight the multifaceted role of forests in supporting both environmental sustainability and community well-being.

Table 4. *Importance of forest ecosystem services*

Ecosystem service	1 (Not important)	2	3	4	5 (Very important)	Mean score
Air quality regulation	5	8	17	70	100	4.30
Soil erosion prevention	3	7	25	80	85	4.19
Biodiversity provision	2	4	18	76	100	4.34
Recreation (e.g., hiking, relaxation)	10	15	40	70	65	3.87
Protection of cultural and traditional values	8	12	30	65	85	4.05

While more than half of the participants view protected areas positively and want to be involved in their management, some perceive restrictions and lack of transparency (*Table 5*).

Table 5. *Attitudes towards protected areas*

Statement	Agree (%)	Mean (1–5)
Protected areas positively affect my quality of life	52	3.44
I should have a say in the management of protected areas	63.5	3.72
Protected areas restrict my livelihood	38	2.91
Conservation policies are not transparent enough	45	3.21

While 52% agreed that protected areas positively affect their quality of life, 38% felt restrictions limited their livelihoods. Notably, 63.5% expressed a desire to participate in protected area management, highlighting the importance of inclusive governance approaches.

Perceptions of cultural ecosystem services

The study assessed local communities' perceptions of cultural ecosystem services (CES) in Artvin's forested areas. Following the TEEB classification, CES were grouped into five main categories: recreational services, aesthetic values, spiritual/symbolic values, educational/informational services, and identity/belonging.

Recreational services

Respondents highlighted the importance of forests for outdoor activities such as hiking, nature walks, and leisure (*Table 4*). The mean score for recreational benefits was notably high, reflecting the community's reliance on forest areas for relaxation and ecotourism-related activities.

Aesthetic values

Forests were highly appreciated for their visual appeal and contribution to landscape beauty (*Table 6*). Tourism-related interactions with forested areas reinforced these perceptions, indicating that aesthetic enjoyment is a significant aspect of local ecosystem service appreciation.

Spiritual/symbolic values

The protection of cultural and traditional values within forests was emphasized (*Table 4*). Many respondents associated forests with spiritual well-being and the preservation of local heritage, indicating the intertwined nature of cultural identity and natural landscapes.

Educational and informational services

Focus group discussions revealed the role of forests in environmental education and knowledge transfer (*Table 12*). Participants noted that forested areas provide opportunities for learning about biodiversity, traditional ecological knowledge, and sustainable practices.

Identity and belonging

Forests were perceived as central to community cohesion and cultural identity (*Tables 12 and 14*). The maintenance of traditional practices and local customs within forested landscapes contributes to a sense of belonging and continuity among residents.

Overall, the findings demonstrate that cultural ecosystem services are multifaceted and integral to local perceptions of forest value. Grouping CES according to TEEB categories enables a clearer understanding of how forests contribute not only to material benefits but also to community well-being, cultural preservation, and environmental awareness.

Different livelihood groups prioritize different ecosystem services according to their dependence and use of forest resources (*Table 6*).

Table 6. Relationship between livelihoods and perception of ecosystem services

Livelihood	Most important ecosystem service perceived	% of respondents
Agriculture	Water regulation	46
Forestry	Timber and non-timber products	58
Livestock	Pasture protection	52
Tourism	Aesthetic and cultural values	67

Table 6 illustrates how individuals' primary livelihoods influence their perception of the most important forest ecosystem services. The data suggest a strong alignment between occupational dependence and perceived ecosystem benefits. For instance, respondents engaged in agriculture primarily value water regulation (46%), reflecting the critical role of water availability for crop production. Similarly, those involved in forestry emphasize timber and non-timber products (58%), while livestock producers prioritize pasture protection (52%) as essential to their livelihood. Notably, tourism-related respondents predominantly highlight aesthetic and cultural values (67%), underscoring the growing recognition of cultural ecosystem services in forested landscapes. These patterns indicate that ecosystem service perceptions are closely shaped by economic reliance, which has important implications for designing locally responsive conservation and land-use policies.

Cross-tabulation and chi-square tests (χ^2) showed significant differences ($p < 0.05$) in ecosystem service prioritization based on livelihood. For instance, those engaged in tourism prioritized cultural and aesthetic values, while those in agriculture emphasized water regulation services.

To explore whether perceptions of cultural ecosystem services vary across livelihoods, an ANOVA test was conducted (Table 7).

Table 7. Perceptions of cultural ecosystem services by livelihood

Livelihood	Mean perception score	Standard deviation	Sample size
Agriculture	3.45	1.02	62
Forestry	4.02	0.89	51
Tourism	4.15	0.85	34
Animal husbandry	3.60	1.10	38

- H0: There is no significant difference between group means.
- H1: At least one group mean is significantly different.

ANOVA Result: $F(3, 181) = 4.76, p = 0.003 < 0.05 \rightarrow \text{Reject } H_0$.

Post-Hoc (Tukey) Test: The tourism and forestry groups have significantly higher mean scores than the agriculture group.

Additionally, perceptions of cultural ecosystem services provided by forests significantly differed based on livelihood type ($F = 4.76, p = 0.003$). Participants engaged in tourism and forestry rated the importance of cultural services higher compared to those in agriculture.

Table 8 explores local perceptions regarding the current quality and effectiveness of forest ecosystem service protection within designated protected areas. Respondents were asked to evaluate the state of ecosystem protection using a five-point scale ranging from

“Very well protected” to “Very poorly protected.” This assessment provides insight into the community’s trust in institutional conservation efforts and perceived effectiveness of protection policies on the ground.

Table 8. *Perceived quality of forest ecosystem services in protected areas*

Perception of quality	Frequency (n)	Percentage (%)
Very well protected	40	20
Well protected	85	42.5
Neither good nor bad	45	22.5
Poorly protected	20	10
Very poorly protected	10	5

The results indicate that a majority of respondents perceive ecosystem services in protected areas as adequately safeguarded, with 42.5% indicating they are “Well protected” and 20% believing they are “Very well protected.” However, a notable portion remains neutral (22.5%), and 15% express dissatisfaction, suggesting room for improvement. These findings highlight both the relative success of current protection measures and the need to address gaps in enforcement, monitoring, and community engagement to strengthen conservation outcomes.

Table 9 presents respondents’ perceptions of the importance of local community participation in the management of protected areas. Using a five-point Likert scale, participants were asked to evaluate the significance of involving local stakeholders in conservation decision-making and management processes. This data offers valuable insight into how communities view their role in environmental governance and the legitimacy of participatory approaches.

Table 9. *Importance of local participation in protected area management*

Importance level	Frequency (n)	Percentage (%)
1 (Not important)	5	2.5
2	10	5
3	25	12.5
4	70	35
5 (Very important)	90	45

The findings reveal a strong consensus on the importance of local involvement in protected area management, with 45% of respondents rating it as “Very important” and an additional 35% selecting level 4. Only a small minority (7.5%) considered it to be of low or no importance. These results underscore the community’s strong desire for participatory governance and suggest that inclusive decision-making processes could enhance the effectiveness and social legitimacy of conservation efforts.

Table 10 examines how local communities perceive the extent to which their opinions are taken into account in the planning and implementation of conservation activities. Respondents were asked to assess the level of consideration given to their views by relevant institutions and authorities. This perception is a key indicator of the inclusiveness and responsiveness of conservation governance.

Table 10. *Consideration of local opinions in conservation activities*

Level of consideration	Frequency (n)	Percentage (%)
Highly considered	25	12.5
Somewhat considered	70	35
Rarely considered	75	37.5
Not considered at all	20	10
Do not know/no opinion	10	5

Approximately 47.5% of respondents believe their views are at least somewhat considered in conservation activities, whereas a similar proportion feels excluded. Such polarization has been highlighted in studies like Berkes (2009), emphasizing the importance of inclusive governance and participatory approaches to increase community support and conservation effectiveness.

The data indicates that while 35% of respondents believe their opinions are “Somewhat considered,” a larger share—37.5%—feel they are “Rarely considered,” and 10% state they are “Not considered at all.” Only 12.5% report that their views are “Highly considered.” These findings point to a perceived disconnect between local communities and conservation authorities, highlighting the need for more meaningful engagement and two-way communication in decision-making processes.

Table 11 assesses community perceptions regarding the adequacy of current environmental measures implemented in protected areas. Respondents were asked to evaluate whether the existing efforts—such as regulations, monitoring, and restoration activities—are sufficient to ensure effective protection and sustainable management. This perception provides insight into the community’s trust in institutional conservation strategies.

Table 11. *Adequacy of environmental measures in protected areas*

Adequacy level	Frequency (n)	Percentage (%)
Yes, adequate	40	20
Partially adequate	85	42.5
Inadequate	50	25
Very inadequate	15	7.5
Do not know	10	5

According to the results, 42.5% of respondents consider the measures to be “Partially adequate,” while only 20% find them fully adequate. On the other hand, 32.5% view them as either “Inadequate” or “Very inadequate,” indicating a significant level of dissatisfaction. These findings suggest that while there is moderate confidence in current efforts, many community members see room for improvement—particularly in terms of implementation effectiveness, transparency, and community inclusion in decision-making.

Table 12 summarizes key themes that emerged from focus group discussions with local community members regarding their participation in conservation efforts and their expectations for future engagement. The table presents representative quotes or summaries under each thematic category, offering qualitative insight into local

perspectives that complement the quantitative survey findings. These reflections help illuminate the nuanced experiences, concerns, and priorities of forest-dependent residents in the context of protected area management.

Table 12. *Local participation and expectations (focus group findings)*

Theme	Participant quote/summary
Demand for participation	We are not consulted when decisions are made, although we know the nature best
Balance between conservation and livelihood	Conservation is important, but they should also consider our livelihoods
Need for education and awareness	We want to protect nature but need to know how to do it
Concerns	Increasing tourism may harm nature, which worries us

Table 12 presents key themes emerging from focus group discussions that provide qualitative insights into local participation and expectations regarding protected area management. This qualitative evidence complements the statistical findings by adding depth and context to community perceptions. While quantitative data highlighted the overall willingness and concerns of residents towards governance and ecosystem services, the focus group narratives reveal nuanced aspects such as feelings of exclusion from decision-making processes, the delicate balance between conservation efforts and livelihood needs, and the expressed desire for environmental education and awareness. These qualitative insights help to explain the underlying motivations and apprehensions behind the survey responses, reinforcing the importance of inclusive and transparent management approaches that address both ecological sustainability and socio-economic realities.

Table 13 examines the level of need expressed by local residents for receiving information and training related to the management of protected areas. Participants were asked to indicate whether they feel adequately informed or if they require further capacity building to effectively engage in conservation practices. Understanding these needs is crucial for developing inclusive and effective environmental education strategies.

Table 13. *Information and training needs about protected area management*

Level of need	Frequency (n)	Percentage (%)
High need	90	45
Moderate need	70	35
No need	30	15
No opinion	10	5

The results show that a substantial majority of respondents—45%—express a high need for more information and training, while an additional 35% report a moderate need. Only 15% believe they do not need additional support, and 5% remain undecided. These findings highlight a clear demand for educational initiatives aimed at strengthening community knowledge and involvement in protected area governance, which could enhance both participation and stewardship outcomes.

To further investigate the factors influencing how local communities perceive cultural ecosystem services (CES), a multiple linear regression analysis was conducted. The dependent variable was the overall perception score for CES (based on Likert-scale responses), while independent variables included age, education level, livelihood type (with tourism as the reference group), willingness to participate in governance, and proximity to protected areas.

The model was statistically significant ($F(5, 194) = 17.9, p < 0.001$), and explained approximately 31.6% of the variance in CES perception scores ($R^2 = 0.316$, Adjusted $R^2 = 0.298$). All assumptions for multiple regression analysis (normality, linearity, homoscedasticity, and multicollinearity) were satisfied.

Education level, participation willingness, and proximity to protected areas were found to have positive and statistically significant effects on CES perception. On the other hand, livelihood type showed a significant negative effect when agriculture or forestry was compared to tourism. Age had a small but statistically significant negative influence, suggesting that younger respondents tend to assign higher value to cultural services provided by forests.

These findings emphasize the role of socio-demographic and geographic variables in shaping cultural perceptions of forest values. Policies aiming to enhance CES recognition should thus consider improving environmental education, promoting eco-tourism opportunities, and increasing participatory engagement mechanisms in conservation governance. *Table 14* displays the regression coefficients and model details.

Table 14. Multiple regression analysis: predictors of cultural ecosystem service perception

Predictor	B (Unstd.)	Std. error	Beta	t	Sig.
(Constant)	2.45	0.41	–	5.98	.000
Age	-0.014	0.007	-0.143	-2.00	.047
Education level	0.263	0.088	0.251	2.99	.003
Livelihood (Ref = Tourism)	-0.306	0.102	-0.232	-3.00	.003
Participation willingness	0.214	0.064	0.221	3.34	.001
Proximity to protected areas	0.178	0.077	0.162	2.31	.022

Discussion

The findings of this study provide compelling evidence that local perceptions of forest ecosystem services (FES) in the protected areas of the Eastern Black Sea region are intricately shaped by socio-economic, cultural, and spatial factors. This multidimensionality aligns with the growing recognition in ecosystem services literature that local context critically influences how benefits and trade-offs are understood by communities (Reed et al., 2015; Díaz et al., 2018).

Local communities in the Eastern Black Sea region generally recognize and value the ecosystem services provided by protected areas, supporting existing literature on ecosystem service valuation (MEA, 2005). However, gaps in participatory governance and knowledge dissemination persist, consistent with Ostrom's (1990) principles of common-pool resource management. Addressing these gaps through inclusive decision-making, transparent communication, and targeted education programs could improve both social acceptance and ecological sustainability of protected areas (Berkes et al., 2000).

Provisioning and regulating services

The prioritization of provisioning services such as timber, non-timber forest products (NTFPs), and apiculture-related benefits reflects the strong livelihood dependence of rural populations on forest resources (FAO, 2020). Similar patterns have been reported in other mountainous regions, where subsistence needs and income generation are tightly linked to forest use (Plieninger et al., 2015). The high awareness of regulating services, including water purification and climate regulation, suggests effective dissemination of environmental education and conservation messaging, consistent with findings from protected areas globally (Václavík et al., 2013).

Cultural ecosystem services (CES)

Although CES were generally rated lower than provisioning and regulating services, this study highlights the nuanced recognition of non-material benefits when CES are analyzed by subcategories:

- *Recreational services*: Activities such as hiking and relaxation were positively perceived (*Table 4*), reflecting the importance of recreation in local well-being. Focus group discussions further emphasized a desire to engage with nature actively, confirming the recreational value of forests (*Table 12*).
- *Aesthetic values*: Tourism respondents, in particular, emphasized aesthetic experiences and scenic enjoyment (*Table 6*), which aligns with previous studies linking tourism-driven livelihoods with higher aesthetic appreciation (Daniel et al., 2012; Chan et al., 2012).
- *Manevî/symbolic values*: Protection of cultural and traditional values scored highly among local respondents (*Table 4*), demonstrating the forests' spiritual and heritage significance. These findings resonate with studies highlighting forests as reservoirs of local cultural identity (MEA, 2005; Martín-López et al., 2012).
- *Educational/informational services*: The expressed need for knowledge and environmental education (*Table 12*) underscores forests as platforms for learning, particularly regarding sustainable practices and traditional ecological knowledge. Integrating education programs into conservation strategies could enhance CES recognition and engagement (Raymond et al., 2021).
- *Identity and belonging*: Focus group themes related to participation and local agency (*Table 12*) reflect the role of forests in fostering community identity, cultural continuity, and social cohesion. Regression results further indicate that willingness to participate and proximity to protected areas positively influence CES perceptions (*Table 14*), highlighting the link between experience, place attachment, and identity (Bennett et al., 2021).

Significant spatial heterogeneity in CES perceptions, revealed by chi-square and ANOVA tests (*Tables 6 and 7*), underscores the necessity of place-based management. Communities adjacent to Camili Biosphere Reserve exhibited higher engagement and positive perceptions, possibly due to direct benefits from ecotourism and participatory management programs (Aksu et al., 2019). The negative effect of age on CES perception suggests that younger individuals may place higher value on non-material benefits, potentially reflecting generational shifts in environmental education and digital nature engagement (Leventon et al., 2021; Brisbois et al., 2023).

The differentiated priorities across livelihood types indicate that conservation policies must integrate socio-economic realities. Households engaged in tourism rated CES higher, while agriculture and forestry respondents emphasized provisioning and regulating services (*Tables 6 and 7*). Such heterogeneity reinforces the importance of inclusive, adaptive governance frameworks that accommodate both material and non-material forest values (Folke et al., 2010).

Finally, by explicitly linking CES subcategories to socio-demographic, livelihood, and spatial variables, this study provides a refined understanding of how intangible benefits are perceived locally. Integrating these insights into policy and participatory governance can enhance both ecological sustainability and social legitimacy, supporting a balanced approach to protected area management in the Eastern Black Sea region (Chan et al., 2012; Raymond et al., 2021).

Conclusion

This study examined local perceptions of forest ecosystem services within protected areas of the Eastern Black Sea region, considering socio-demographic, regional, and livelihood perspectives. The findings reveal that local communities generally possess high awareness of ecosystem services provided by forests, particularly regulating and cultural services such as air quality, water supply, and cultural heritage. Socio-demographic factors (education, age, occupation) significantly influenced perceptions, with younger and more educated individuals demonstrating greater environmental sensitivity (Mace, 2014). Regional analyses indicated that residents in biosphere reserve areas exhibited more positive attitudes toward sustainable management and economic benefits of protected areas (Salamanca et al., 2015). Those dependent on forest-based livelihoods prioritized provisioning services, highlighting the socio-economic importance of forests in local communities (Bennett et al., 2017). Furthermore, participants' willingness to engage actively in protected area management suggests that incorporating local knowledge and needs into decision-making enhances ecosystem service sustainability (Berkes, 2009).

The regression analysis further confirmed that perceptions of cultural ecosystem services are influenced by socio-demographic and spatial factors. Higher education levels, willingness to participate in governance, and proximity to protected areas were positively associated with stronger perceptions, whereas increasing age and engagement in agriculture or forestry correlated with lower perceptions compared to tourism sector participants. These findings emphasize the necessity of inclusive, culturally responsive conservation policies that account for regional and social diversity (Raymond et al., 2021; Martín-López et al., 2022; Schröter et al., 2020; Bennett et al., 2021; Leventon et al., 2021; Brisbois et al., 2023).

In conclusion, strengthening perceptions of forest ecosystem services and achieving sustainable conservation in the Eastern Black Sea region require holistic policies integrating regional differences as well as socio-cultural and economic dimensions. This study contributes to science-based decision support by unveiling the multidimensional relationships between ecosystem services and local perceptions within protected areas.

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