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Evaluation of biocultural landscapes and associated ecosystem services in the region of Suğla Lake in Turkey

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ABSTRACT

The purpose of this study was to evaluate biocultural landscapes and associated ecosystem services in the region of Suğla Lake located in Konya Province of Turkey. Method of the study includes four stages. In the first stage, the biodiversity function of landscapes was identified by overlapping the maps of flora and fauna and then it was evaluated by using a 1–5 score system. Second, the cultural diversity function of landscapes was evaluated by site survey and literature review. The obtained data were evaluated according to the 11 criteria by using a 1–4 score system. The analysed data were transferred on to the maps. Third, the biocultural landscapes were designated by overlapping the maps of the biodiversity and cultural diversity functions of landscapes. Finally, major ecosystem services provided by the biocultural landscapes were examined by assessing the collected data on the biodiversity and cultural diversity functions of landscapes and review of literature.

KEYWORDS

Biocultural landscapes; biocultural diversity; biodiversity function of landscapes; cultural diversity function of landscapes; ecosystem services

1. Introduction

1.1. Interrelation between nature and culture

Humans have always made use of and modified the natural environment in response to their material and non-material needs. At the same time, human cultures have adapted to the natural environment in which they have been influenced and developed by this adaptation process. Cultural beliefs, values, institutions, knowledge systems, languages and practices manifest this mutual relationship between humans and the environment. The complex system of cultural and biological diversities is interrelated (Maffi & Woodley, 2010). Within this context, landscape is a phenomena and/or place which provides a ground and/or forum for this complex interrelation.

1.1.1. Landscape as a place for the interaction of nature and culture

Landscapes are the by-products of human adaptations of natural settings for the purpose of securing shelter, food and/or for pleasure. Landscape therefore implies tangible physicality (e.g., field and settlement), the product, but also perceptions and cultural valuations attached to this physical setting in the act of production (Makhzoumi, Talhouk, Zurayk, & Sadek, 2012). The term landscape has often been

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debated. Many authors have proposed different meanings for it (Müller, 2008). Scientists, for example, are concerned with the physicality of landscape which they use interchangeably with environment and ecosystem (Naveh & Lieberman, 1990). Social scientists on the other hand see landscape as a medium for interpreting traditions, constructing identities and unfolding cultural heritage (Adams, Hoelscher, & Till, 2001). Within this context, landscape is a phenomenon of how people perceive, memorise and represent history. It leads to the construction of collective memory of a social group (Guo, 2004, p. 193) and a physical manifestation of a culture's knowledge (Kuchler, 1993, p. 85; Spiegel, 2004, p. 8–9). Culture (the set of distinctive spiritual, material, intellectual and emotional features of society or a social group that encompasses, in addition to art and literature, lifestyle, ways of living together, value systems, traditions and beliefs) (UNESCO, 2001) and landscape interact in a feedback loop in which culture structures landscapes and landscapes inculcate culture (Nassauer, 1995). Thus, landscape is a complex socio-ecological system in which biological diversity (diversity within species, between species and of ecosystems) (UN, 1992) and cultural diversity (the manifold ways in which the cultures of groups and societies find expression) (UNESCO, 2001, 2005) interact. This interrelation is well presented in biocultural landscapes.

1.1.2. The concept of biocultural diversity and biocultural landscapes

The newly emerged field of biocultural diversity can be defined as the sum of the diversity of life in all its manifestations. It comprises biological, cultural and linguistic diversity, which are interrelated within a complex socio-ecological adaptive system. Such a link has formed the backbone of community vitality, resilience and well-being and of community ability to freely pursue their endogenous path of development. The breakdown of the perceived link between humans and nature underlies many of the environmental and social problems humanity face today. Thus, there is an ever more pressing need to understand the connections between biodiversity and cultural diversity, and to act on this understanding, in both policy and practice, to support and restore vitality and resilience to biocultural systems (Maffi, 2006; Maffi & Woodley, 2010). Traditionally, researches in the field of biocultural diversity focus on tropic regions, as three core areas of biocultural diversity (The Amazon Basin, Central Africa and Indomalaysia/Melanesia) can be found there. However, even though other regions might not rank among the top diverse countries, they can still be remarkably bioculturally diverse. For example, regions in Europe such the Mediterranean Basin require further research to prevent diversity loss (Davidson-Hunt et al., 2012; Frank, 2011; Laird, 1999; McNeely, 2000; Posey, 1999). In addition, one of the programmes of the Christensen Fund on biocultural diversity is focused on Central Asia and Turkey. The programme aims to re-establish relationships with the land in order to revitalise biocultural diversity and support a variety of livelihoods (Fadili & Grincheva, 2012). Such landscapes are referred to as biocultural landscapes.

Diversity of landscapes that had created biological and cultural diversity is influencing both human tradition and life. Through the landscape, biological diversity can be structured, developed and changed (Hong, 2014). This situation is particularly seen in biocultural landscapes/seascapes. A biocultural landscape/seascape is a geographic area bounded both by its physical features and by a human understanding in which its geologic, topographic, hydrologic, biological, economic and cultural elements are understood as part of a holistic system that has been shaped by human management over long periods of time (The Christensen Fund, 2015, see https://www.christensenfund.org/about/key-concepts/). Biocultural landscapes are the products of ecological processes and human industry in which the linkages of biological and cultural landscapes are presented well. Such landscapes provide a range of valuable ecosystem services (e.g., soil formation and sense of place) for human well-being.

1.1.3. Ecosystem services provided by cultural and/or biocultural landscapes

Ecosystem services (e.g., nutrition, health and pleasure) are the benefits people obtain from ecosystems (Millennium Ecosystem Assessment [MA], 2003; Huntsinger & Oviedo, 2014; Turner & Daily, 2008; Hermann, Schleifer, & Wrbka, 2011; Plieninger, van der Horst,, Schleyer, & Bieling, 2014). People value ecosystem services because services contribute to their lives in terms of poverty reduction, human health and development. The concept of ecosystem services has found increasing attention in

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environmental science, policy-making and practical applications in recent years (Müller, de Groot, & Willemen, 2010). The concept aims to help policy-makers and natural resource users better understand the connections between ecosystem services and human well-being as well as incorporate their values into decision-making and natural resource management strategies (de Groot, Alkemade, Braat, Hein, & Willemen, 2010). Landscapes play an important role in the concept of ecosystem services because they contain many important functions which provide numerous services to society. Major ecosystem services include *provisioning* (e.g., food), *regulating* (e.g., climate regulation), *cultural* (e.g., traditional knowledge) and *supporting* (e.g., soil formation) services (MA, 2005; Müller et al., 2010). These services can be tangible (e.g., plants and buildings) or intangible (e.g., traditions and songs). The relationship between tangible and intangible services is inseparable. The intangible is materialised by the tangible and the intangible plays a vital role in the establishment of tangible (Ito, 2003). Within this context, the concept of ecosystem services should be integrated into landscape planning, natural resource management and decision-making processes to further a better implementation of the Ecosystem Approach, to achieve a more sustainable allocation of resources and to maintain sustainable livelihoods (Vorstius & Spray, 2015; Vrebos et al., 2015). Within this context, the region of Suğla Lake in Turkey can serve as a case study.

1.1.4. Purpose of this study

The studies about landscape planning in Turkey have usually focused on the physical and spatial aspects of landscapes. Thus, the conservation of ecosystem services, biocultural diversity and relevant biocultural landscapes is missing in planning and conservation policies in Turkey. This is the main motivation for this present study. Accordingly, the purpose of this study was to evaluate biocultural landscapes and associated ecosystem services in the region of Suğla Lake located in Konya Province of Turkey. We expect that outcomes of the study can raise awareness of planners and policy-makers in rebuilding the relationship between people and nature by adapting the concepts of biocultural diversity, biocultural landscapes and ecosystem services. This study is a part of the project 'Landscape Management, Protection and Planning Project for Konya Province and Suğla Lake' supported by the Ministry of Environment and Forestry of Turkey between 2008 and 2010.

2. Material and method

2.1. Description of the study area

The study area *Suğla Lake and its surrounding landscapes* are located in Konya Province of Turkey (31°52′43″–32°16′02″ east meridians and 37°10′46″–37°29′46″ north latitudes) and covers a 74.152 ha area (Uzun, Ilke, Çetinkaya, Erduran, & Açıksöz, 2012) (Figure 1).

The study area is located in the transition belt of the Mediterranean and Iran-Turan pytogeographic regions between the Mediterranean and Central Anatolia Regions. The change in its landform in a short distance creates microclimatic areas and enriches landscape diversity housing different ecosystems (e.g., forests, plateaus, wetlands and streams). Suğla Lake is a tectone-karstic lake. Its elevation from sea level is 1040 m; its surface area is 13.50 ha. The surrounding area of Suğla Lake includes productive agricultural landscapes and 30 rural settlements (Uzun et al., 2012). The settlements in the region were established in ancient times and the land has hosted many civilisations. The area is important in terms of its cultural landscape potential, including historical and cultural works (e.g., moorland houses and historic heritage), traditional land uses (e.g., dry and irrigated farming) and rural life style (e.g., transhumance) (Erduran, Uzun, Çetinkaya, Dilek, & Açıksöz, 2012).

2.2. Method of the study

The method of the study includes three stages: identification of the biodiversity function of landscapes, determination of the cultural diversity function of landscapes, designation of the biocultural landscapes

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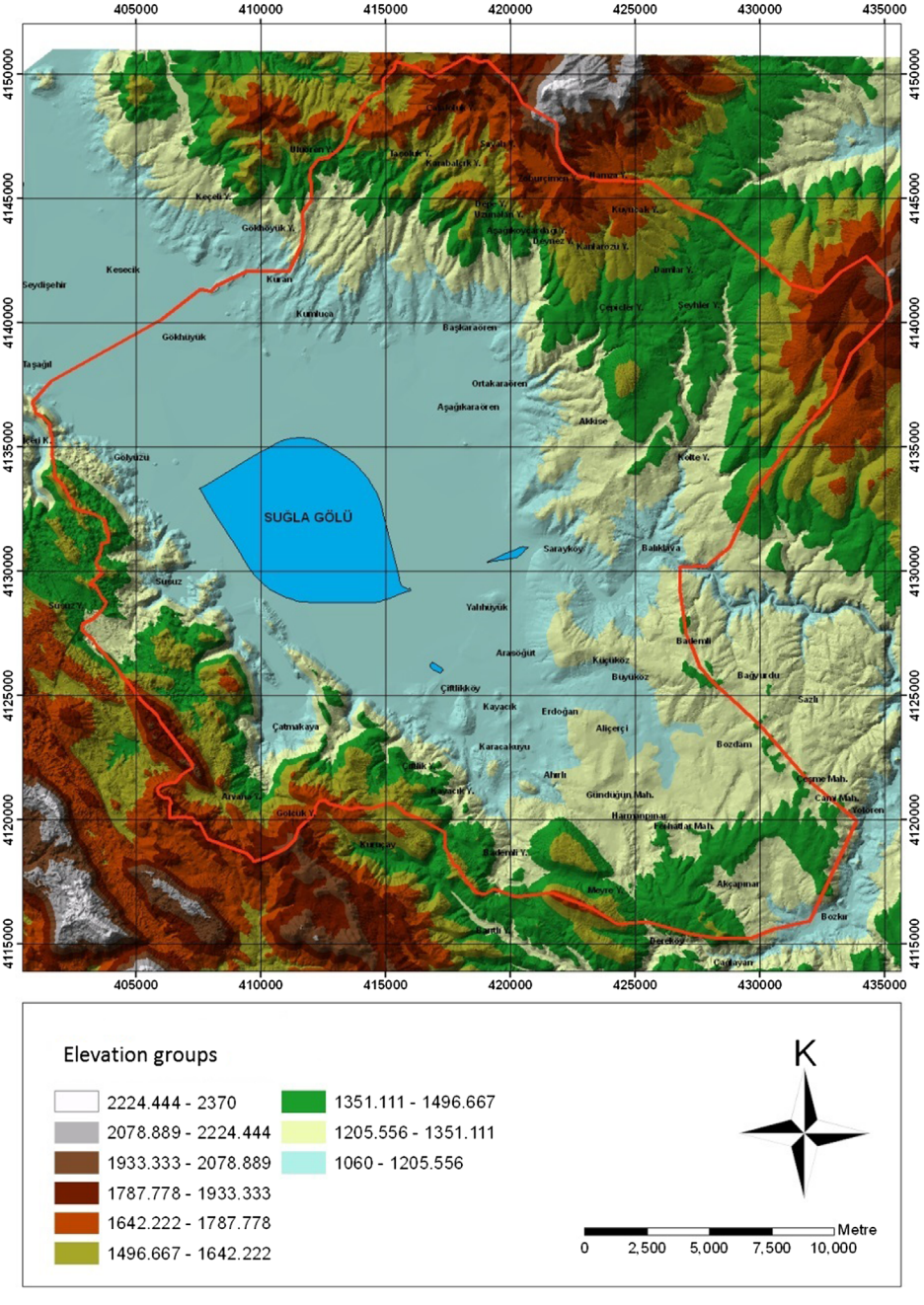


Figure 1. Location of the study area: the region of Suğla Lake (Uzun et al., 2012).

and examination of possible ecosystem services at landscape scale in the region of Suğla Lake (Figure 2). Within this context, field surveys were carried out to collect data on the biodiversity and cultural diversity functions of landscapes and to examine possible ecosystem services in the study area. The field surveys were conducted on the following dates: 31 October–2 November 2008, 11–15 May 2009, 3–7 August 2009.

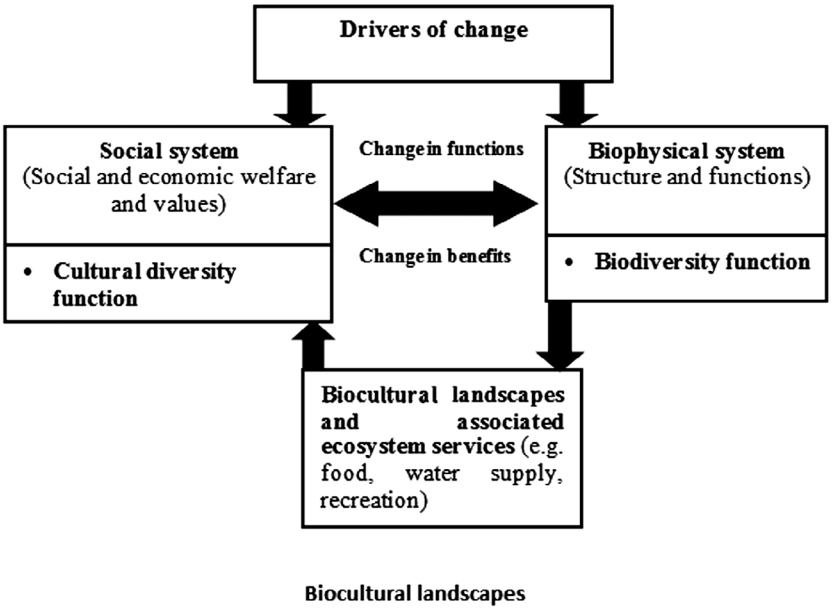


Figure 2. Interaction of the social-ecological systems in the study area: biocultural landscapes and associated ecosystem services.

2.2.1. Examination of the drivers of change by SWOT analysis

The drivers of change—causing changes in the social and biophysical systems—were examined within the framework of the project mentioned. For this reason, a SWOT analysis was conducted on 1 November 2008 by employing a participatory approach. The SWOT analysis was carried out to examine strengths, weaknesses, threats and opportunities for ecological landscape planning. The analysis focused on major biophysical and social landscape components of the study area. However, the drivers of change are not discussed in detail in this paper. We only list major drivers of change that threaten the biocultural landscapes in the region: land use change, overgrazing, stubble burning, illegal logging and hunting in forests, decline in traditional agricultural and fishery systems, drought and migration.

2.2.2. Identification of the biodiversity function of landscapes

The biodiversity function of landscapes in the region of Suğla Lake was determined by using the flora (Ayan, 2010; Duran & Şanda, 2010) and fauna (Mergen, 2010) data and relevant maps developed within the framework of the project by the experts. The maps of the flora and fauna were overlapped by using ArcGIS 9.3 program. As a result of this analysis, the biodiversity function of landscapes (representing diversity in nature) was identified and mapped. The biodiversity function of landscapes was evaluated by using a 1–5 score system (5: very high biodiversity function, 1: very low biodiversity function) based upon landscape attributes (e.g., plant diversity, old natural forest protected and Important Bird and Plant Areas); for example, landscapes hosting endemic plant species were considered as areas with very high biodiversity function and therefore were scored with 5 points (Uzun, Çetinkaya, Dilek, Açıksöz, & Erduran, 2011).

2.2.3. Determination of the cultural diversity function of landscapes

A participatory research approach was applied by participation of a diverse number of stakeholders. The aim of the approach was to establish cooperative dialogue among all relevant stakeholders and to encourage a sense of ownership for all stakeholders in the study area. A set of participatory research tools (e.g., interviews, group discussions, observations and field surveys) was used to collect and evaluate data on the cultural landscape components in the region. For this purpose, an inventory

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Table 1. Evaluation criteria for examination of the cultural diversity function of landscapes in the region of Suğla Lake.

Type of criteria	1–4 score system
Presence of historical and archaeological places	
Presence of traditional architecture	
Important historical monuments	
Handicrafts	
Religious places	
Traditional agriculture and products (e.g., chickpea, viticulture and tahini)	
Transhumance traditional lifestyle	
Traditional festivals and festivities	
Traditional fishing	
Traditional knowledge	
Recreation and aesthetic values	

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form was developed. Major stakeholders participated were the heads of the villages, district mayors, district administrators, key local communities and researchers. Thus, data on the cultural landscape components (e.g., traditional agricultural practices, historical and archaeological places, handicrafts, religious places, transhumance traditional lifestyle and festivals) were collected. As the research is a part of the project supported by the Ministry of Environment and Forestry in Turkey, participation of relevant stakeholders in the interviews and group discussions was encouraged and supported by the local administrative bodies as well.

The cultural diversity function of landscapes in the region of Suğla Lake was determined by adapting a set of criteria reflecting the local conditions (e.g., existence of historical and archaeological sites, local architecture, handicrafts, traditional festivals and transhumance tradition) (Table 1). These criteria were developed by the group of landscape architects engaged in the project. Accordingly, both tangible (e.g., historical and archaeological sites) and intangible (e.g., transhumance traditional lifestyle) cultural landscape components were examined within 30 settlements.

Major stages of the determination of the cultural landscape diversity function included:

- Available cultural, historical, archaeological and other relevant literatures were reviewed.
- An inventory form was developed with the aim of examining and documenting tangible and intangible cultural landscape components in the study area. This form was filled out by all local administrators (mayor and village headman).
- The data obtained from the inventory form were evaluated by the 11 criteria developed. Accordingly, the cultural landscape values in each village were evaluated using a 1–4 scale (1—indicating the lowest and 4—indicating the highest cultural value). The total cultural landscape value for each village was estimated by gathering all scores given for each cultural component.
- The analysed data on the cultural landscape values were transferred onto the map. As a result of this, the map of the cultural diversity function was determined (Erduran et al., 2012).

2.2.4. Designation of the biocultural landscapes and examination of associated ecosystem services

The biocultural landscapes—representing diversity in nature and diversity in culture—were designated by overlapping the maps of the biodiversity function and the cultural diversity function of landscapes. ArcGIS 9.3 GIS program was used within this stage.

Possible ecosystem services provided by the biocultural landscapes in the region of Lake Suğla were examined by assessing the collected data on the biodiversity and cultural diversity functions of landscapes. Value principles (e.g., possible ecosystem service, threat and potential response) for the evaluation of ecosystem services were developed by reviewing the following data: Duran and Şanda (2010), Mergen (2010), WCPA (2000), Harmon (2004), Tengberg et al. (2012), Harmon and Putney (2003), MA (2003, 2005), Conan (2009), de Groot, Wilson, & Boumans (2002), de Groot et al. (2010), Hughes

(2004), Hill, Talbot, McIntyre-Tamwoy, and Cullen (2010), Huntsinger and Oviedo (2014), Turner and Daily (2008), Hermann et al. (2011), Plieninger et al. (2014), Müller et al. (2010), Ito (2003).

3. Results and discussions

3.1. Identification of the biodiversity function of landscapes in the region of Suğla Lake

This part of the study consists of several stages including identification of the Important Plant Areas, determination of the Important Bird and Insect Areas, and designation of the biodiversity functions of the landscapes in the region of Suğla Lake. ArcGIS 9.3 GIS program was used in mapping the Important Plant and, Bird and Insect Areas as well as overlapping both maps. These stages are discussed, respectively, below.

3.1.1. Identification of the Important Plant Areas

The botanist's report was examined to identify the Important Plant Areas in the region (Duran & Şanda, 2010). This assessment revealed that diversity of the plants in the study area includes 438 species. Seventy-two of them are medicinal and aromatic plants and 46 of them are endemic species (two critically endangered and three vulnerable species). In addition, the study area includes the protected area of *Centaurea iconiensis* which is an endemic species. Hydrophytes (plants that have adapted to living in aquatic environments) and agricultural lands are spread to large areas in the surrounding area of Suğla Lake. The results of the forestry research shows that the forests in the study area cover about 34.853,4 ha areas (8.804,6 ha mixed forest, 22.624,5 ha pristine forest and 3.425,3 ha deforested land). Major forest stands in the study area include juniper (*Juniperus oxycedrus*, *Juniperus feoditissima* and *Juniperus excelsa*), fir (*Abies cilicica* Carr.), oak species (*Quercus ilex*, *Quercus coccifera* L., *Quercus cerris* L., *Quercus pubescens*, *Quercus pubescens infectoria*, *Quercus pubescens trojana*) (Ayan, 2010). The most important forest area in the region is the old natural forest of *Quercus cerris* L. and *Pinus nigra*. The relevant data were transferred on the map by using ArcGIS 9.3 (Figure 3).

As seen in Figure 3, the Important Plant Areas particularly extend along the south of the study area.

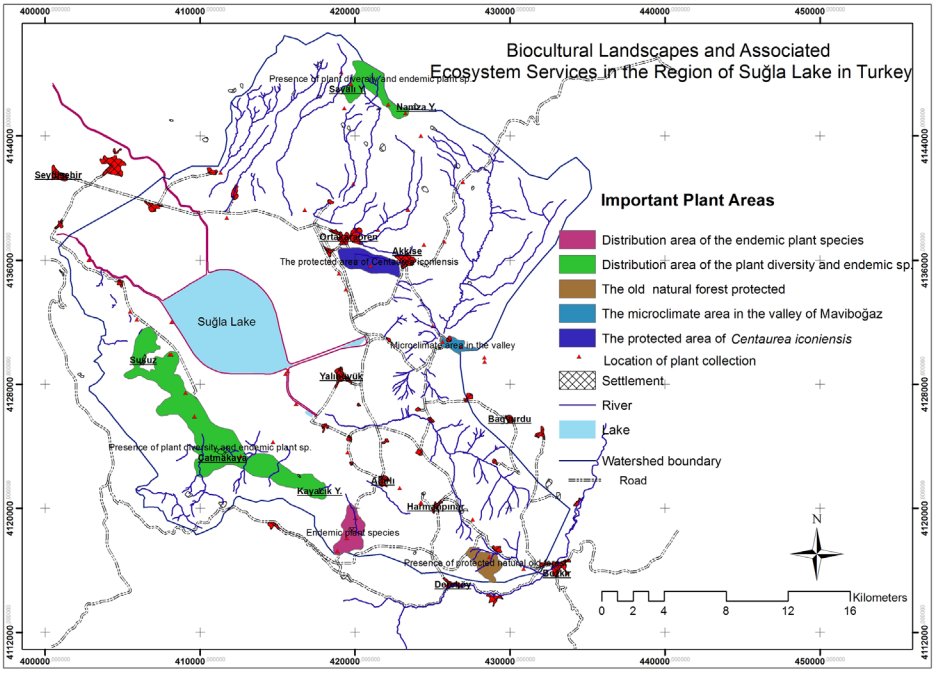


Figure 3. Important Plant Areas in the region of Suğla Lake.

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3.1.2. Determination of the Important Bird and Insect Areas

Assessment of the report of fauna (Mergen, 2010) revealed that the study area hosts 262 fauna species (132 insects, 6 amphibians, 18 reptiles, 29 mammals, 72 birds and 5 fish species). The fish species of *Phoxinellus anatolicus* is an endemic species in Suğla Lake. The invasive fish species of *Carassius carassius* is the major threat to the aquatic diversity of the Lake. The wetlands in the surrounding area of Suğla Lake cover about 13.50 ha lands which host endangered bird and endemic fish species. Distribution of the Important Bird and Insect Areas were mapped by using ArcGIS 9.3 (Figure 4).

As seen in Figure 4, the Important Bird and Insect Areas are expanded in the areas where the Important Plant Areas have been determined.

3.1.3. Evaluation of the biodiversity function of landscapes

The biodiversity function of landscapes in the study area was determined by overlapping the maps of the Important Plant Areas and Important Bird and Insect Areas (Figure 5).

As seen in Figure 5, the landscape biodiversity function in the region of Suğla Lake includes Important Plant, Bird and Insect Areas. The biodiversity function of landscapes was evaluated by using 1–5 score system (1—indicating the lowest and 5—showing the highest biodiversity value) based upon the landscape attributes (e.g., plant diversity, protected natural old forest, presence of endemic species) (Uzun et al., 2011) (Table 2).

Assessment of Figure 5 and Table 2 shows that the biodiversity function of landscapes in the study area includes areas with very high biodiversity (e.g., distribution area of plant diversity and old natural forest), high biodiversity (e.g., microclimate area of Maviboğaz) and moderate biodiversity areas (e.g., the Important Insect Areas). The results of this evaluation show that the areas determined show the richness of species and maintenance of key ecosystem processes that can directly and/or indirectly contribute to the local livelihoods. This argument supports the findings of MA (2005) and Frank (2011).

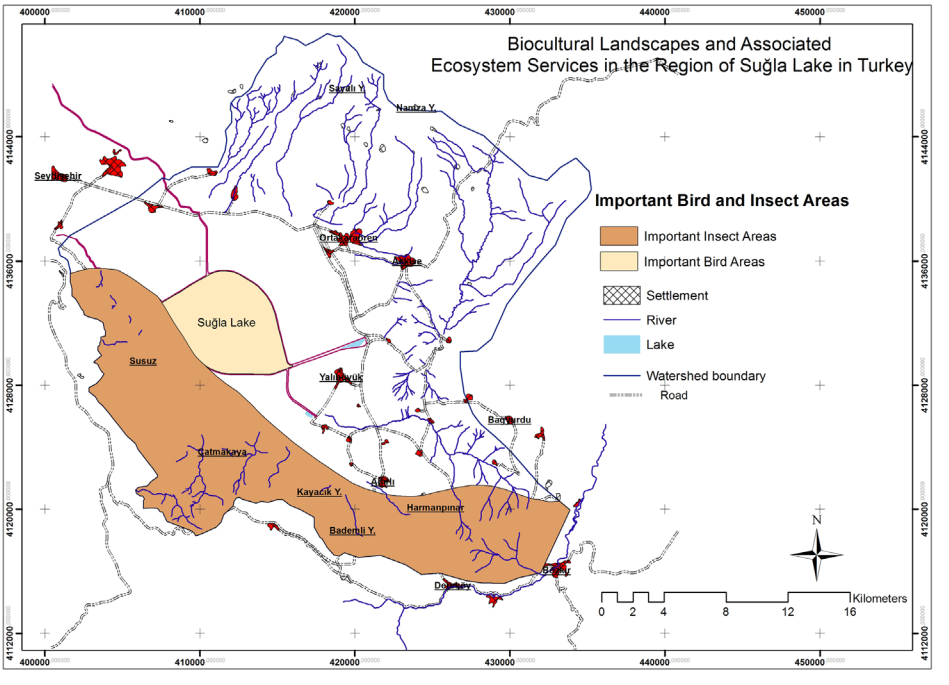


Figure 4. Important Bird and Insect Areas in the region of Suğla Lake.

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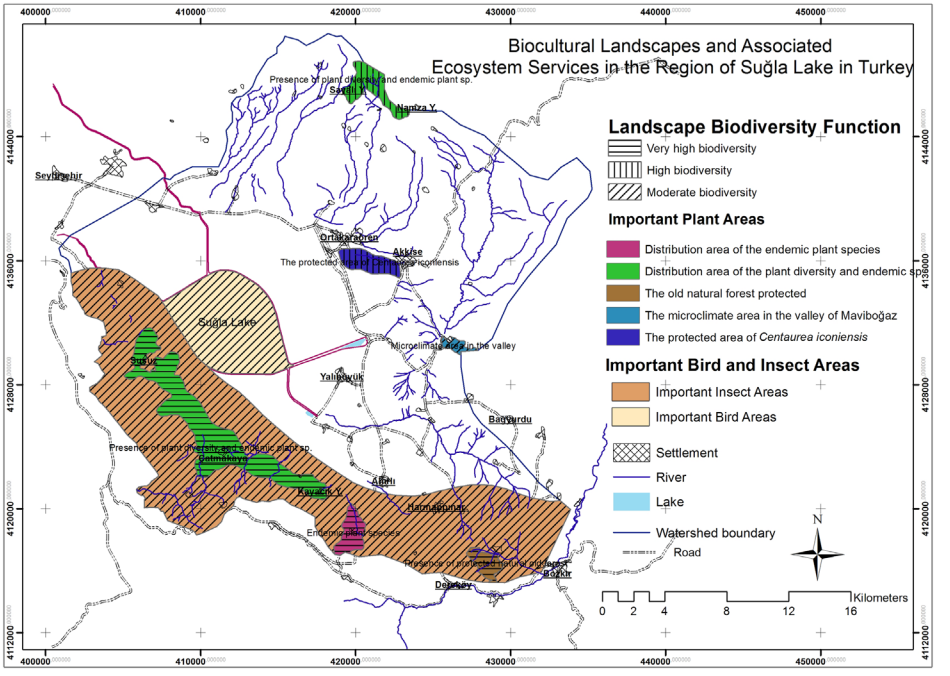


Figure 5. The biodiversity function of landscapes in the region of Suğla Lake (Uzun et al., 2011).

Table 2. Evaluation of the biodiversity function of landscapes in the region of Suğla Lake by using 1–5 score system (1: very low biodiversity function, 5: very high biodiversity function).

Type of landscape	Biodiversity value	Point
Important Plant Areas		
Presence of plant diversity and endemic plant species along the plateaus of Çatmakaya-Susuz-Kayacık and Sayalı-Namza.	Very high biodiversity function	5
Presence of old natural forest protected (mixed species of Pinus nigra and Quercis cerris).	Very high biodiversity function	5
Endemic plant diversity in the southern highlands of the location of Kayacık.	Very high biodiversity function	5
The protected area of Centaurea iconiensis located between Ortakaraören and Akkise villages.	Very high biodiversity function	5
Microclimate area of Maviboğaz	High biodiversity function	4
Important Bird and Insect Areas		
Important Bird Areas around Suğla Lake	High biodiversity function	4
Important Insect Areas around Susuz, Çatmakaya, Harmanpınarı and Bozkır villages	Moderate biodiversity function	3

3.2. Determination of the cultural diversity function of landscapes in the region of Suğla Lake

The cultural diversity function of landscapes in the region of Suğla Lake was investigated by data collection, literature review and site survey. Results of this assessment revealed that the study area includes important tangible (e.g., archaeological and historical sites such as Yalıhöyük) and intangible

Table 3. Evaluation of the cultural landscape components in the region of Suğla Lake (developed from Erduran et al., 2012).

Evaluation criteria	Name of village	Scoring system for the cultural landscapes components	Degree of the cultural landscape diversity
• Presence of historical and archaeological places • Presence of traditional architecture • Important historical monuments • Handicrafts • Religious places • Traditional agriculture and products (e.g., chickpea, viticulture and tahini) • Transhumance traditional lifestyle • Traditional festivals and festivities • Traditional fishing • Traditional knowledge • Recreation and aesthetic values	Çatmakaya, Harmanpınarı, Ortakaraören, Dereköy, Yalıhüyük, Akkise	7–9 points	Very high cultural landscape diversity
	Ahırlı, Çağlayan, Balıklava, Çiftlikköy, Kuruçay, Kayacık, Akçapınar	4–6 points	High cultural landscape diversity
	Bademli, Kayacık, Karacakuyu, Küçüköz, Büyüköz, Erdoğan, Kumluca, Kuran, Kesecik, Gökhüyük, Taşağıl, Gölyüzü, SusuzAşağıkaraören, Başkaraören, Yolören, Bozdam, Bağyurdu, Sazlı	Maximum 3 points	Moderate cultural landscape diversity

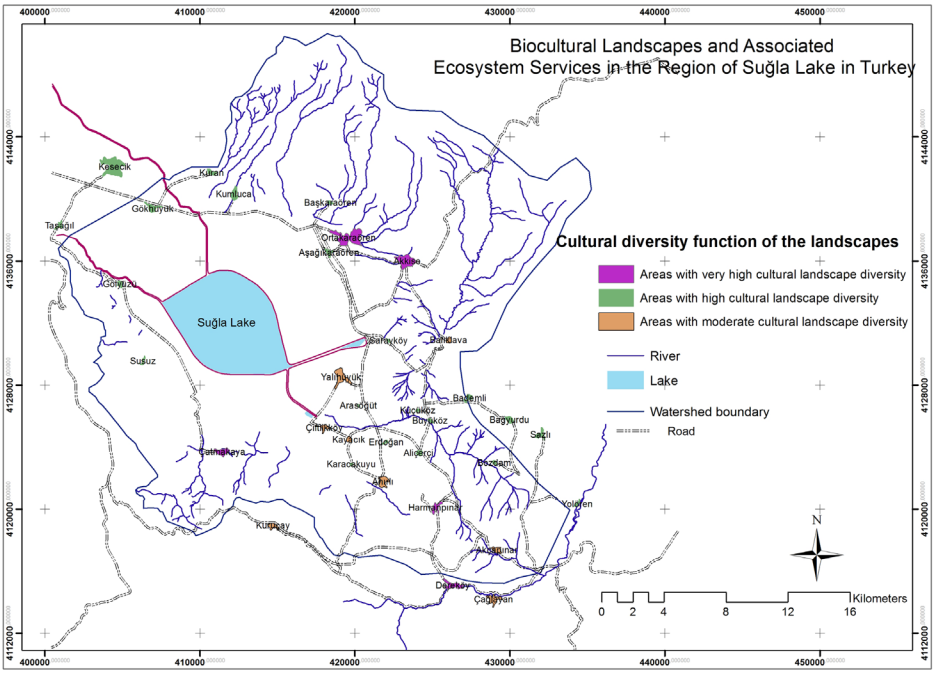


Figure 6. The cultural diversity function of landscapes in the region of Suğla Lake (Erduran et al., 2012; Uzun et al., 2012).

(e.g., festivals) cultural landscape components. The cultural landscape components were evaluated in accordance with the 11 criteria by using the 1–4 score system at the base of each village. The total value of the cultural landscape components in each village was estimated (Table 3). Accordingly, villages with 7–9 points (e.g., Ortakaraören and Dereköy) were evaluated as areas with very high cultural landscape diversity. The villages with 4–6 points (e.g., Çağlayan and Balıklava) were considered as areas with high cultural landscape diversity, and the villages with maximum 3 points (e.g., Büyüköz) were assessed as

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areas with moderate cultural landscape diversity. The result of this evaluation was transferred on the map by using ArcGIS 9.3 (Erduran et al., 2012) (Figure 6).

As seen in Figure 6, the cultural landscape diversity function is very high in the villages of Çatmakaya, Ortakaraören, Akkise, Dereköy and Harmanpınarı where the biodiversity function of landscapes is very high or high. This finding shows the positive interaction of biophysical and cultural systems in the determined sites. In addition, the finding shows that major ecological processes and associated ecosystem services still maintain in these sites. Understanding the connections between biodiversity and cultural diversity is highly critical for policy-making because it can contribute to restoring the resilience of the biocultural systems as well as increasing biodiversity conservation, food security and sustainable livelihoods in the region. This argument supports the findings of MA (2005), Frank (2011), Maffi and Woodley (2010), UNESCO (2001, 2005).

3.3. Biocultural landscapes and associated ecosystem services in the region of Suğla Lake

3.3.1. The biocultural landscapes in the region of Suğla Lake

The biocultural landscapes in the region of Suğla Lake were determined by overlapping the maps of the biodiversity and the cultural diversity functions of landscapes prepared in the previous sections (Figure 7). The biocultural landscapes in the study area were categorised as areas with very high, high and moderate cultural landscape diversity (Table 4).

Assessment of Table 4 and Figure 7 shows that the biocultural landscapes in the study area include areas with very high, high and moderate biocultural diversity. For example, the biocultural diversity is very high in Çatmakaya village where the biodiversity (e.g., presence of plant diversity and endemic plant species) and the cultural diversity functions (e.g., traditional agriculture practices, transhumance traditional lifestyle and presence of historical and archaeological areas) of landscapes were determined very high as well (Figure 8). For example, the biocultural diversity is high in the villages of Dereköy where the old natural forest and transhumance traditional lifestyle are available. Evaluation of this section shows that the biocultural landscapes in Suğla Region represents the linkages between biological

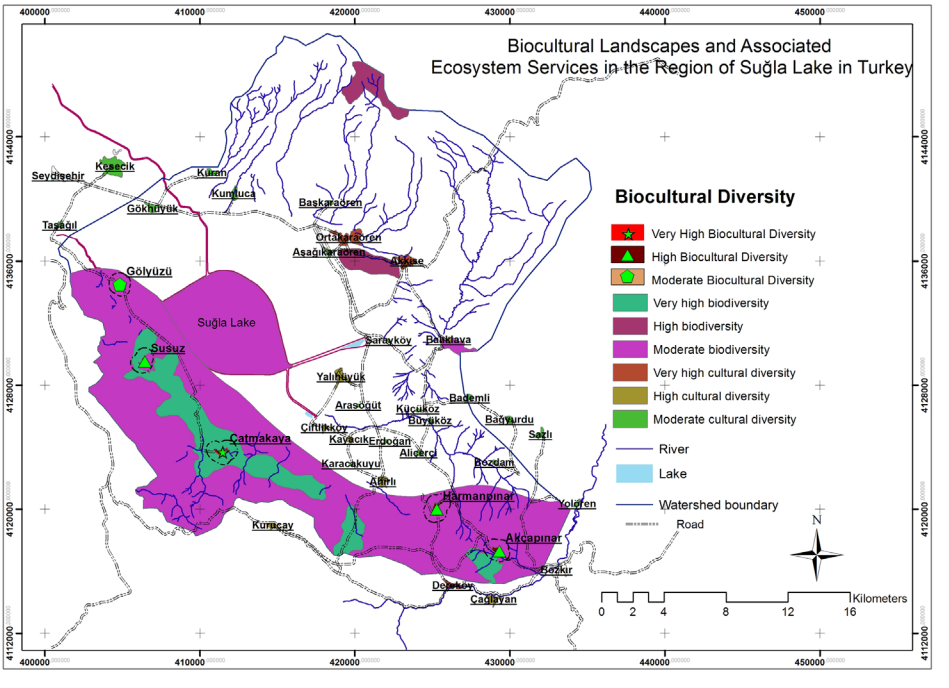


Figure 7. The biocultural landscapes in the region of Suğla Lake.

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Table 4. Evaluation of the biocultural landscapes in the study area.

Cultural diversity functions of landscapes	Biodiversity functions of landscapes		
	Very high biodiversity	High biodiversity	Moderate biodiversity
Very high cultural landscape diversity	Very High	Very High	High
High cultural landscape diversity	Very High	High	High
Moderate cultural landscape diversity	High	High	Moderate

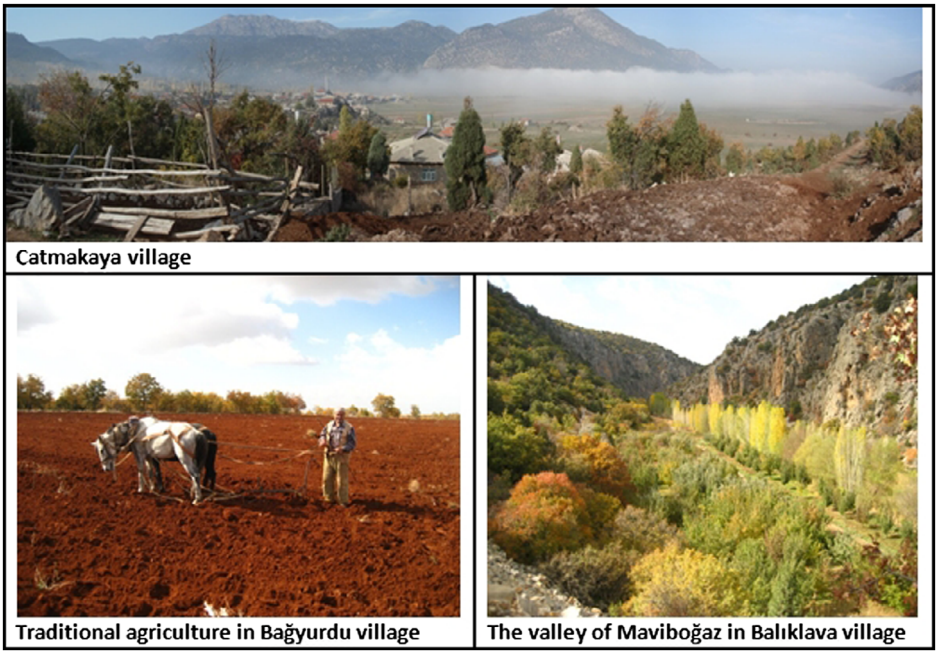


Figure 8. Rural landscape examples from the region of Suğla Lake.

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and cultural diversity (the sum of life) within a complex social-ecological system. Maintenance of this linkage forms the backbone of community well-being and also sustains biodiversity conservation in the region. This argument supports the findings of Maffi and Woodley (2010), Frank (2011). Breakdown of this linkage can cause the decline of ecosystem services obtained from the landscapes of Suğla Region. Therefore, we need to integrate the concepts of biocultural landscapes and ecosystem services into planning policies to enrich and maintain the linkages between nature and culture.

3.3.2. Major ecosystem services provided by the biocultural landscapes in the study area

Major ecosystem services associated with the biocultural landscapes in the region of Suğla Lake were examined by evaluating the components of the biological and cultural landscape diversity determined in the previous sections. Principles of the evaluation were developed by literature review. Potential ecosystem services provided by the biocultural landscapes are presented in Table 5.

Table 5 shows that the biocultural landscapes in the region of Suğla Lake not only include important areas for biodiversity conservation (e.g., Important Bird Areas and intrinsic aesthetic values of Maviboğaz and Arvana) but also host critical cultural services (e.g., traditional agricultural practices and traditional ecological knowledge). These services are either tangible (e.g., archaeological sites, historical monuments, flora and wetlands) or intangible (e.g., traditional ecological knowledge, transhumance lifestyle and festivals). Evaluation of the ecosystem services shows that the intrinsic

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Table 5. Major ecosystem services associated with the biocultural landscapes in Suğla Region (▲ = increase, ◄► = remain the same, ▼ = decrease).

Type of component	Definition of component	Example of ecosystem service	Threat to ecosystem service	Status	Potential response
Wealth of wetlands	The wetlands (13.50 ha) in the study area host a high biodiversity (e.g., endangered bird and endemic fish species).	Habitat for wildlife, raw and genetic materials, water regulation, waste treatment, erosion control and sediment retention, ecotourism and fishery.	• Discharge of agricultural wastes • Overgrazing • Water and soil pollution • Overuse of reed plants (Typha angustifolia, Phragmites australis) for making cultural products (e.g., reed mat and construction material). • Uncontrolled hunting • Destruction of habitats	▼	• Establishment of Important Plant and Bird Areas • Controlled and limited use of resources • Prohibition of hunting • Wetland restoration
Biodiversity	The biodiversity in the study area include 438 flora (Duran & Şanda, 2010) and 262 fauna species (Mergen, 2010).	The biodiversity provides suitable conditions for different types of habitats and benefits for human well-being (e.g., food, soil formation, genetic resources and recreation).	• Invasive plants • Erosion • Overgrazing • Stubble burning • Waste storage • Illegal hunting • Decline in the number of some species such as Phxinellus anatolicus, wolf, partridges, and quails.	▼	• Establishment of Important Plant and Bird Areas • Controlled use of biodiversity • Waste management • Raising awareness of people on biodiversity for human well-being and wildlife protection.
Water abundance and marine values	Suğla Lake covers about 13.50 ha surface area and provides habitat for 3 fish (e.g., Phoxinellus anatolicus) and 72 bird (e.g., Ardea cinerea) species.	Suğla Lake provides a range of ecosystem services such as foods, water for drinking, irrigation and industrial uses, water regulation, ecotourism and fishery.	• Water pollution • Over and uncontrolled use of water resources have caused the decline of water level	▼	• Construction of water treatment system • Development of an action plan for water use and treatment • Support for modern irrigation systems • Strengthening inter agency cooperation • Establishment of Important Bird Areas • Controlled fishing
Forests	The forests in the study area cover about 34.854,4 ha area (Ayan, 2010).	The forests provide a range of services such as food, stabilising soils, carbon storage, filtering pollutants, and habitat for species and recreation.	• Low level of regeneration • Drying in the stand of Abies cilicica Carr. due to insect diseases and drought • Overgrazing • Waste storage • Illegal logging	▼	• Forest regeneration • Controlled and limited use of forest resources • Raising awareness of people on values of the forests

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Recreation and ecotourism	The intrinsic qualities of natural areas and cultural values provide opportunities for recreation and ecotourism.	Presence of trekking, bird watching, traditional fishing and spectacular landscapes are the major source of ecotourism development.	Uncontrolled ecotourism and recreation initiatives due to the lack of relevant plans.	▼	Development of ecotourism and recreation plans
Aesthetic	The spectacular natural sceneries of Maviboğaz and Arvana and diversity of the landforms provide high aesthetic qualities.	Recreation and ecotourism, inspiration, feeling well and opportunities for socialisation.	Waste storage	▼	Waste management
Traditional agriculture and fishing practices (e.g., chickpea)	The community members still maintain traditional agriculture (e.g., chickpea, viticulture and tahini production) and fishery practices.	Foods, good health, traditional diet system.	• Overuse of pesticides • Decline in the number of some native species such as chickpea • Uncertainty in land ownership	▼	• Clarification of land ownership • Controlled use of pesticides • Promotion of micro-credits and support for maintenance of traditional practices.
Traditional ecological knowledge (TEK)	Traditional agriculture and fishery practices and use of medicinal, aromatic and other useful plants have led to accumulation of associated TEK	Sufficient nutritious foods, good health, social cohesion, ability to help each other, science and education, traditional diet system	• Emigration of the younger generation • Lack of interest of younger generation in TEK and relevant practices. • Absence of detailed studies about TEK.	▼	• Support for studies about TEK. • Documentation of TEK. • Development of strategies about maintenance of TEK. • Integration of TEK in modern science and planning strategies.
Cultural heritage (cultural & natural)	Presence of archaeological sites, historical monuments, traditional transhumance lifestyle, handicrafts, festivals and traditional architecture, outstanding landscapes of Maviboğaz and Arvana.	Cultural identity, sense of place.	• Emigration of the younger generation • Lack of interest of younger generation in traditional life style and relevant practices. • Waste storage in the landscapes.	▼	• Protection of archaeological and historical sites. • Support for strategies and projects about maintenance of traditional culture, knowledge and practices. • Protection of the landscapes • Waste management.
Research and monitoring	Variety in nature and culture provides opportunities for scientific research, education and learning.	Ecological and cultural studies, integration of traditional and modern sciences, school excursions.	• Lack of studies on TEK and other relevant practices. • Lack of integration of modern and traditional scientific systems.	▲	• Research about ecological and social systems was carried out in the framework of the project. • Support for studies about cultural heritage and TEK • Integration of modern and traditional science.

natural values of the biocultural landscapes enrich the intellectual, emotional, spiritual, creative aspects of human existence and well-being in the study area. Thus, the culture structures the landscapes and the landscapes inculcate the culture in the region. This finding supports the arguments of Nassauer (1995), WCPA (2000), Harmon (2004), Müller et al. (2010), Tengberg et al. (2012). Within this context, the concept of ecosystem services should be integrated into landscape and spatial planning to maintain and enhance benefits of ecosystem services for human well-being.

4. Conclusion

Diversity of cultures, landforms and biodiversity has caused emergence of the significant natural, cultural, biocultural and socio-ecological productive landscapes in Turkey. If such landscapes are effectively managed, they can provide a range of ecosystem services that can contribute to local livelihoods and human well-being, food production and security, support for green economy initiatives, achievement of the Millennium Development Goals and relevant national development policies in the country. Therefore, policy-makers should be aware of the benefits of human nature co-existence and support effective institutions and policies for good governance of landscapes and associated ecosystem services by adapting human-centred design approaches such as design of biocultural landscapes.

The results of this study show that integration of ecosystem services into physical and spatial planning in Turkey can increase the better understanding of the way in which societies manipulate ecosystems and then relate that to cultural and spiritual systems. Such an approach can encourage policy-makers, nature conservationists and spatial planners for sustainable management of landscapes with their associated ecosystem services. In addition, design and implementation of a project about *Ecosystem Assessment of Turkey* can provide opportunities to evaluate current ecosystems of Turkey and their ecosystem services at landscape scale within a global forum. Within this context, a landscape-level approach should be implemented to reduce loss of ecosystem services and biodiversity in Turkey.

On the other hand, the drivers of change examined (e.g., land use change, emigration of the younger generation and intensification of agriculture) can threaten the biocultural landscapes and associated ecosystem services in the region of Suğla Lake. Integration of the concepts of ecosystem services and biocultural landscapes into landscape planning policies can therefore provide a range of contributions in the region. Major ones include: maintenance of the ecological processes, sustainable protection of the cultural components, diversification of the local economy, development of sustainable local livelihoods and improvement of the quality of life and well-being.

Disclosure statement

No potential conflict of interest was reported by the authors.

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