International journal of Rural Development, Environment and Health Research (IJREH)
ISSN: 2456-8678
[Vol-5, Issue-2, Mar-Apr, 2021]
Issue DOI: https://dx.doi.org/10.22161/ijreh.5.2
Article DOI: https://dx.doi.org/10.22161/ijreh.5.2.2

Analysis of the Landscape Services in Çankırı, Ilgaz Region

Betül Tülek[1], Meryem Atik[2]

[1]Faculty of Forestry, Department of Landscape Architecture, University of Çankırı Karatekin, Çankırı, Turkey
[2]Faculty of Architecture, Department of Landscape Architecture, University of Akdeniz, Antalya, Turkey

Received: 02 Dec 2020; Received in revised form: 03 Feb 2021; Accepted: 25 Feb 2021; Available online: 21 Mar 2021

Abstract— *The mutual relationship between man and nature brings multiple characters, functions and benefits to the landscape. Landscape services are crucial for the social and economic development and vital activities of human beings. Landscapes produce goods and services in the industry needs as well as that are directly needed by the individual in the cities and in the countryside.*

In this study, Çankırı, Ilgaz Region landscape services are analysed and defined in multifunctional way which are based on the basin scale. Then, qualitative and quantitative surveys were conducted to determine the priorities and significance for the Ilgaz Region and the priority services were identified.

Keywords— ***Landscape Planning, Landscape Services, Land use, Çankırı, Ilgaz Region***

I. INTRODUCTION

"Landscape" means an area, as perceived by people, whose character is the result of the interaction between man and nature [10]. Landscape has an important dynamic structure within its different characters existing by natural, social, economic and cultural influences. First of all, determination, mapping and the functions that they perform at the highest level of these resources are important to be taken into account when land use and management decisions are taken in the planning process. In this context, landscape function analysis enables to the decision of conservation and strategies about landscapes by way of the function of the landscape [38].

Landscape function is defined as the capacity of a landscape to provide goods and services to the society with different environmental variations in the landscape [34]. Landscape functions analysis is a guide about landscape services. The systematic of landscape services discussed in many times with their differences and descriptions with functions and processes. "Functions" can be converted into useful when evaluated by people and a function can offer many different services. Without human influence, the functions continue to work while there are benefits due to use and value of the landscape [13, 15, 28].

Landscape services have integrated quality in the planning and management of landscapes, especially in the basin scale. Landscapes are a very complex mosaic with natural, semi-natural and human-shaped features and are important in terms of supporting human welfare and life in basin scale. For this reason, multiple approaches, such as pollution, spreading of invasive species, rapid population and residential areas, fragmentation and loss of habitats, are analyzed holistically in the basin scale, should be considered in landscape planning and management decisions that may affect landscapes, are vital for human welfare.

It is very important to understand landscape services in terms of human well-being and sustainability of human life. Mankind believes the landscape and biodiversity that must be protected and preserved and that it should be protected and treated with care as it is in nature with the future awareness. In this context, [30] emphasized that the landscape services should be included in landscape analysis and planning; [26] emphasized that the landscape services necessity on decision-making process of exploring with different spatial scales.

In this research, natural and cultural landscapes of Çankırı, Ilgaz Region have been analysed in basin scale; ecological,

social, cultural, visual and aesthetic dimensions of landscape services are evaluated; a survey was conducted to determine the importance of the ecological, aesthetic, cultural and economic values of the area to local people, local administrators and experts in order to determine the priority services in the research area. In a multifunctional way of studying at the research area will possible to be a guide in terms of creating a basis for landscape planning decisions, effectively assessing sensitive and risky areas in the region and improving the regional landscape. It is expected that the data obtained will clear up to the future planning decisions for the Ilgaz Region.

II. MATERIAL AND METHOD

Ilgaz Region is the main material of this research. It has been examined in terms of the land use types of natural and cultural resource values within the area of 958 km^2 and the landscape services presented by the region (Fig 1).

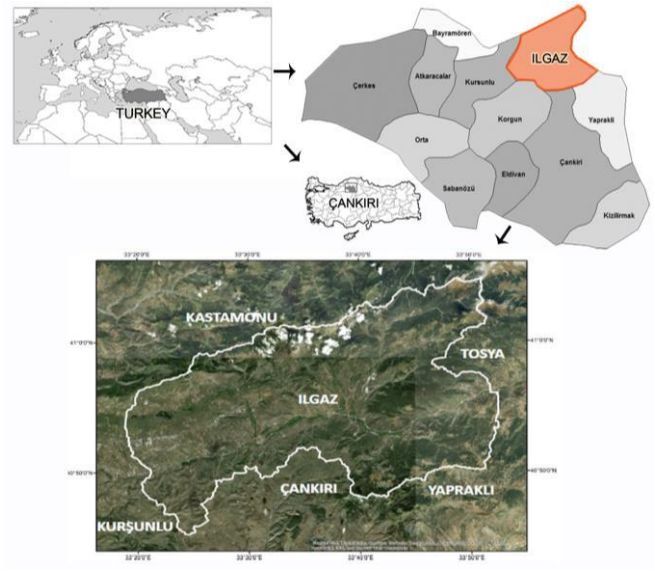

Fig. 1: Location of Ilgaz Region [3, 4, 37]

In the beginning of the research, many of the data were obtained from the results of the previous researches, thesis researches, articles, books and related internet surveys. Besides, some maps, plans, reports, photographs and visual and field analysis study were obtained from the field, RapidEye satellite image with 5 multispectral bands of 2013 and CORINE Classification System 2. Level Land Cover map data obtained from Ilgaz Forest Management Department, topographic maps and digital elevation maps, geological maps, soil maps, climate data and vegetation maps, ArcGIS 10.1 software to transfer of numerical data to the computer environment and SPSS 15.0 program to make necessary analysis of the relationships between landuse types and landscape services, and finally SPSS 15.0 and Nvivo 10 softwares were used for analysis of oral interviews with the local community.

In the last step of the reserach, priority and importance of Ilgaz Region landscapes and the risk factors such as fire, landslide and flood were analysed that could guide future planning decisions. Ilgaz Region landscape services assessments were mapped by GIS and handled with expert opinions and 3-degree zoning has been done by the way of the distribution of priority landscape services. New suggestions were developed to improve landscapes of the region, to effectively evaluate vulnerable and risky areas and to become a basis for landscape planning decisions to be made for the region with a multi-dimensional viewpoint for all the relationships in the research.

III. RESULTS AND DISCUSSION

3.1. Landscape and landscape services

Landscape is a spatial and dynamic asset which consist of human and nature interaction [6, 7, 35]. "Function" is described as an ecosystem component which interaction between spatial elements and flow of energy, material and species [19]. "Landscape function" is the capacity of goods and services that are provided to society by landscape. These goods and services consist of natural and cultural services such as plants benefits like timber, fuel etc., landscape aesthetics, habitats, water regulation [14, 27]. The capacity of landscape goods and services do not show the equal distribution but it depends on the interactions between spatial and temporal and socio-economic and biophysical diversity of landscape [14, 40, 33, 41].

Landscape, as defined in the European Landscape Convention [10], is a holistic approach with spatial and mental dynamic assets, and the result of people-place interactions [6, 7, 36]. People have influenced landscapes throughout time to adapt it to their changing demands, and at the same time, landscapes have influenced people. Particularly in the context of local collaborative and multidisciplinary landscape planning, *'landscape services*' concept would be more appropriate than 'ecosystem services' to enable the incorporation of both natural and cultural aspects, the consideration of spatial patterns, and the involvement of stakeholders. Landscapes were seen as spatial human ecological systems, which delivered a wide range of functions valued by humans for economic, socio-cultural, and ecological reasons [34]. The application of the landscape services concept to collaborative landscape planning requires the consideration of additional issues when compared to the ecosystem services approach.

Common International Classification of Ecosystem Services (CICES) classification is developed by [24]

which has three categories of services: provisioning, regulation/maintenance and cultural. These services are related to three types of functions: resource, sink, and service. According to the key terms there is a distinction between function and service. Functions are considered as an intermediate concept between processes and services. Functions are defined as the capacity of ecosystems to provide services and benefits to human users, whereas services are assumed to depend on the existence of beneficiaries. Services are defined as the direct and indirect contributions to human welfare, whereas benefits are considered to be the welfare gains derived from ecosystems [24].

CICES classification makes it an interesting starting point for applying the concept of landscape services. The classification description shows the way in which CICES classification has been adapted to the concept of landscape services (Table 1). Additional services have been added to the provisioning and regulating categories. However, the main changes are introduced in the cultural group. This category is rearranged to include the different contributions of landscape to human well-being dimensions in a more comprehensive and consistent way [39].

The contribution of landscapes to human well-being do not only arise in the interaction of biotic and abiotic processes, but also address human processes. Landscape services include cultural and social benefits, social welfare, health and personal awareness. Landscape has an important role for regulating both ecological and perceptual processes [39]. Landscape service seems an appropriate concept to link landscape ecological knowledge to the field of collaborative landscape planning.

Table 1. Landscape services classification based on CICES classification [24]

THEME	CLASS	GROUP
Provisioning	Nutrition	Terrestrial plant and animal foodstuffs
		Freshwater plant and animal foodstuffs
		Marine plant and animal foodstuffs
	Material	Potable water
	Energy	Biotic materials
	Daily activities	Abiotic materials
		Renewable biofuels
		Renewable abiotic energy sources
		Place to live
		Place to work
		Place to move
Regulation and Maintenance	Regulation of wastes	Bioremediation
		Dilution and sequestration
	Flow regulation	Air flow regulation
		Water flow regulation
		Mass flow regulation
	Regulation of physical environment	Atmospheric regulation
		Water quality regulation
		Pedogenesis and soil quality regulation
	Regulation of biotic environment	Lifecycle maintenance and habitat protection
		Pest and disease control
	Regulation of the spatial structure	Gene pool protection
		Connection of spaces
		Buffer disturbing use
		Provision of spatial complexity of the place
Cultural and Social	***Health***	**Mental health**
		Physical health
	Enjoyment	**Passive enjoyment**
		Active enjoyment
	Self-fulfillment (personal)	**Way-finding**
		Scientific resources
		Didactic resources
	Social fulfillment	**Spiritual experience**
		Source of inspiration
		Social interactions
		Place identity
		Sense of continuity

3.2. Land use types and landscape services of Ilgaz Region

Ilgaz Region land use data were determined, digitized and transferred to the GIS by using of 2013 Rapid-Eye Satellite Image and CORINE Classification System Based on the 2nd level data and landuse map was created. Forests make up a significant part of the region, support the ecological resources and the region stands out with its natural landscape characteristics. Forest area 785,82 km^2 (81,83%), agricultural area 160,24 km^2 (16,7%), settlement area 13,4 km^2 (13,4%) are observed to cover on

the region. Minimized of land use area distribution is mine.

Ilgaz Region provides many different services at local and regional scale within the context of landscape diversity in terms of topography, climate, vegetation and settlement, transportation, agriculture, animal husbandry, forestry, raw materials, medical and aromatic products, water resources and genetic resources. Ilgaz Region landscape services are mapped by interpreting the sources of food (agriculture, animal husbandry and fish), biological raw materials, fresh water, pollination, genetic and medicinal-aromatic plants, air quality (carbon sequestration), cultural history and recreation-ecotourism; the regional current services and functions have been tried to be analysed Ilgaz Region landscape services are assessed by using quantitative units and indicators which are ha/item/ton for food services, m^3 /ton for biological raw materials services, m^3/sn for fresh water services, item /ton for genetic sources, ton for climate regulation services and item for recreation-ecotourism services. To determine the priority services of the region, data collection related to the research area, examination of existing studies about the region and questionnaires with local residents, local administrators and experts conducted to determine the significance of the ecological, aesthetic, cultural and economic values were taking into account in the light of the indicators [37] (Fig. 2).

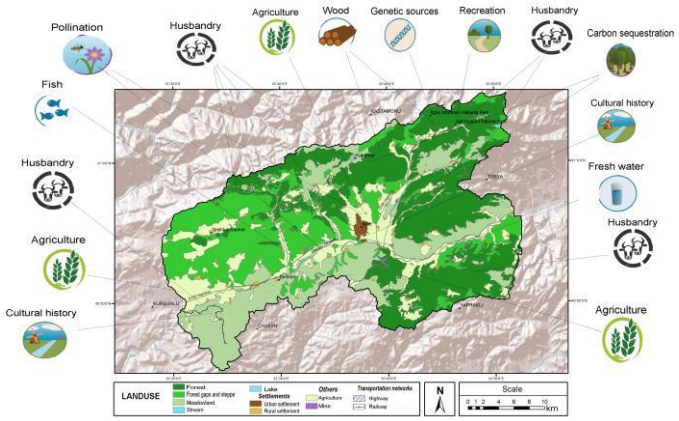

Fig. 2: Landuse types and landscape services of Ilgaz Region [37]

Food services are carried out through the production of plants (grains, legumes, vegetables, fruits) and animal (meat, milk, eggs), as well as by fisheries, aquaculture (fish and other seafood) and picked up from nature directly (fruits, seeds, mushroom) [2]. Agriculture is mostly doing along the Devrez Stream. The main agricultural products are sugar beet, wheat, potato, barley, apple and plum. Devrez Stream and other river valleys, "irrigated agriculture" is being done. Irrigated agricultural lands are about 38% of total land. Fruits such as apples, pears, peaches, plums, quince, apricots, cherries, almonds, walnuts, sour cherries; vegetables such as tomatoes, peppers, cabbages and wheat, barley, rice, sugar beet, potatoes, feed plants that support animal husbandry are grown in the region where traditional farming methods are applied [12]. When the region is examined in terms of fish and aquaculture production areas, fish productions are carried out in various lakes and ponds in the region and fish hunting is carried out. Ilgaz has a trout farming plant in Aşağıbozan village. The capacity of the plant and the production amount is 5 tons /year trout. The food sources are particularly done in and around Devrez Stream; animal husbandry and wild plants collecting are done in Ilgaz city and *Pinus nigra* forests. Both Ilgaz Mountains National Park surrounded by dense forests and rural settlements support food services of the region.

While the production of biological and inorganic raw materials are being evaluated in the region, the forest areas where the production of forest products and mine areas are taken into consideration. Ilgaz Region total forest area is 66.051 hectares. The products made from the main forest products in the region are logs, mine poles, wooden pole, paper wood, fibre chip, firewood and secondary product is poles [12]. There are 8 mine sites in the region and manganese is extracted. Some important bentonite deposits are in Çankırı throughout Turkey, around 2 million tons of bentonite are extracted. Most of the deposits are operated or have still been operating. Cement raw materials and talc reserves are also important in the region [29]. A large majority of the mines are still in operation and are located around the Devrez Stream. Forest products and raw material sources are in and around Ilgaz city center and its surroundings *Pinus nigra* forests and also Ilgaz Mountains National Park *Pinus sylvestrist* and *Abies nordmanniana subsp. bornmulleriana* forests are stand out.

The hydrogeological structure of the region is extremely important in terms of freshwater production. In this context, the founts, fountains and wells are exposed in the basin as an important water spots where the drinking and using water are provided. There are more than 350 founts, more than 200 fountains and wells in the region. The major source of water are Ödemiş Thermal Spring and Köy Pınarı. In Tosya district, important streams are Devrez Stream, Deringöz Stream, Gavur Stream, Gökçay Stream [31].

The genetic resources have been investigated by considering the wildlife habitats of rare plants, birds and butterflies and growing areas of the medical plants. As genetic resources, it is important to identify and protect endemic plant and their wildlife habitats, rare bird and butterfly species in terms of gene conservation for plants

and animals. Ilgaz Mountains, Natural Life Protection Association (DHKD) is carried out by "Turkey's Important Plant Areas Project (ÖBA)" has been identified as one of the 122 important plant areas [32]. Ilgaz Mountains are the one of the most important endemism center in Turkey in terms of plant species richness. The region has important bird and butterfly habitats. Ilgaz Mountains National Park and Kadınçayırı Natural Park are important Bird Watching Points. Ilgaz Mountain National Park is also one of the "Important Bird Area" in 97 points in Turkey [23]. Ilgaz Mountain and its surroundings are home to various bird species. The rocky high sections of the Ilgaz Mountains contain a large number of predator species. These include the Red Vulture, the Bearded Vulture, the Little Eagle, the Red Hawk and the Black Kite [11]. Regarding the growing of medicinal and aromatic plants in the region, the Rural and Agricultural Development Support Institution (TKDK) has started to provide regional trainings in order to support the studies to be made in this scope especially for the last 3 years. In Kurşunlu district, *Phaselia tanacetifolia* and *Lavandula officinalis* have started to be produced within the scope of medical and aromatic plants. *Astragalus* is produced in Hacımuslu village.

Ilgaz Mountains National Park *Pinus sylvestrist, Abies nordmanniana subsp. Bornmulleriana, Pinus nigra* forests plays a major role in regulating air quality of Ilgaz Region. Also surface waters (streams, lakes and ponds) are one of the most important indicator for regulating the quality of the air around of Devrez Stream.

Ilgaz Region recreation potential is quite high. Kırkpınar and Kadınçayırı (Yıldıztepe) are the main recreational areas that allow picnic and other recreational activities in the region. In addition, Ilgaz Mountains, Tepelice, Kale Canyon, Ödemiş Thermal Springs, Derbent Cemetery and Küçükhacet Hill offer significant natural and cultural tourism potential. Ilgaz Mountain National Park is declared with nature conservation function, Kadınçayırı Natural Park is declared as Natural Park in 2013 and Ilgaz Mountain Wildlife Development Area have important tourism potentials for the region. The availability of transportation and facilities in the National Park and the availability of transportation networks in the Kadınçayırı Natural Park are positively affecting the recreation and ecotourism potential of the region.

3.3. . Determination of the importance for Ilgaz landscape services

In order to determine the priorities in the research area, a questionnaire was conducted to local residents, local administrators and experts to determine the importance of the ecological, aesthetic, cultural and economic values of the area. Here, bilateral comparisons were made and 25 expert opinions were applied. Qualitative and quantitative analyzes were conducted for the questionnaires. Participants were selected from previously identified stakeholder groups (Central Government, Local Government, Non-Governmental Organizations, Private Sector and Local People). At the same time, knowledge and experience about the research field was taken into consideration. In this context, as questionnaire participants,

- Representing the **Central Management**, Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks and 2 experts are selected from DSİ 5th Region Directorate,

- Representing the **Local Government**, 7 experts are selected from Çankırı Provincial Culture and Tourism Directorate, Çankırı Food, Agriculture and Livestock Provincial Directorate, Çankırı Environment and Urbanism Provincial Directorate, Ilgaz Municipality and Ilgaz Forest Management Directorate,

- Representing the **Nongovernmental Organizations**, an expert is selected who is the chairman of Çankırı Mountaineering and Nature Clubs Association,

- Representing the **Private Sector**, a Documentarian, a Nature Photographer and an expert of TRT correspondent are selected,

- Representing the **Local People**, total of 14 meetings were held with the villagers and local authorities. The villagers who were interviewed were chosen as İnköy, Aşağı Bozan, Yukarı Bozan, Çörekçiler, Göllüce, Alibeyköy, Güneyköy, Yuvasaray, Yukarı Kayı, Dağardı, Mülayim, Belören, Kuşçayır and Belsöğüt villages as 5 km distance between them.

In the first part of the questionnaires evaluation to determine the importance of the Ilgaz Region landscape services in ecological, social and cultural and economic dimensions, detailed inquiries were made in all dimensions. Chi-Square Independence Test was applied in the inquiries. According to the result of Chi-Square test, Sign. (p value) is smaller than 5%, it is concluded that there are important relations between the questions. As a result of the evaluations,

- In **Ecological Dimension,** food and freshwater resources are in primary importance resources, while raw materials are in the second and medical and aromatic resources are in the third grade important resources.

- In **Social and Cultural Dimension,** cultural heritage values are 1. degree important resources, aesthetic values 2. degree, spiritual and ethical values 3. degree and cultural diversity 4. degree and inspiration and space

values are 5. degree important resources were determinded.

- In **Economical Dimension**, the economic benefits of animal productions in the region were determined to be 1. degree important resources, vegetative production is 2. degree and recreation and ecotourism services are 3. degree important values (Table 2).

Table 2. Relationships between landscape services of Ilgaz Region as the results of Chi-Square Independence Test [37]

ECOLOGİCAL SERVICES	**IMPORTANCE VALUE (MEAN)**
Food	**1,64**
Fresh water	1,00
Food	**2,08**
Raw material	0,60
Food	**2,52**
Medical and aromatic resources	0,16
Fresh water	**2,12**
Raw material	0,64
Fresh water	**2,72**
Medical and aromatic resources	0,08
Raw material	**2,28**
Medical and aromatic resources	0,44
SOCIAL AND CULTURAL SERVICES	
Cultural heritage	**2,28**
Cultural diversity	0,36
Cultural heritage	**2,04**
Spiritual and Ethical Values	0,64
Cultural diversity	0,84
Spiritual and Ethical Values	**1,84**
VISUAL AND AESTHETIC SERVICES	
Aesthetic value	**2,08**
Inspiration value	0,64
Aesthetic value	**1,88**
Space value	0,92
Inspiration value	**1,44**
Space value	1,32
ECONOMICAL SERVICES	
Agricultural production	0,56
Animal production	**2,16**
Agricultural production	**1,68**
Recreation and ecotourism	1,00
Animal production	**2,40**
Recreation and ecotourism	0,28

Questionnaires have also examined the order of importance for ecological, social and cultural, visual and aesthetic, economic dimensions. Descriptive statistics were used in the evaluation of the data (Table 3).

Table 3. The results of descriptive statistics for ecological, social and cultural, visual and aesthetic, economical dimensions [37]

	Level of Importance -Frequency-					**Total**	**Mean**
Ecological	**1**	**2**	**3**	**4**	**5**		
Food - *Fresh water*	**10**	**3**	5	*1*	*6*	25	2,60
Food - *Raw material*	**14**	**3**	4	*1*	*3*	25	2,04
Food - *Medical and aromatic resources*	**17**	**4**	4	-	-	25	1,48
Fresh water - *Raw material*	**16**	-	5	*1*	*3*	25	2,00
Fresh water - *Medical and aromatic resources*	**20**	**3**	2	-	-	25	1,28
Raw material - *Medical and aromatic resources*	**15**	**5**	2	-	*3*	25	1,84
Social and Cultural							
Cultural heritage - *Cultural diversity*	**15**	**4**	4	1	*1*	*25*	1,76
Cultural heritage - *Spiritual and Ethical Values*	**14**	**3**	3	2	*3*	*25*	2,08
Cultural diversity - *Spiritual and Ethical Values*	**4**	**2**	5	1	*13*	*25*	3,68
Visual and Aesthetic							
Aesthetic value - *Inspiration value*	**15**	**1**	5	1	*3*	*25*	2,04
Aesthetic value - *Space value*	**13**	**3**	2	-	*7*	*25*	2,40

Inspiration value - *Space value*	**9**	**3**	3	-	*10*	*25*	2,96
Economical							
Agricultural production - *Animal production*	**3**	**1**	3	3	*15*	*25*	4,04
Agricultural production - *Recreation and ecotourism*	**12**	**2**	2	4	*5*	*25*	2,52
Animal production - *Recreation and ecotourism*	**16**	**5**	2	1	*1*	*25*	1,64

In the last part of the questionnaire, the mean value, was found to be a very important factor, which was 1.40, in terms of *ecological dimension*. *Social and cultural dimensions* were determined as the least important factor. While 72% of the experts indicated *ecological dimension* to be very important, 16% of them emphasized that *visual and aesthetic dimension* was very important, 8% of them indicated economic dimension and 4% of them indicated *social and cultural dimensions* were very important (Table 4).

Table 4. Descriptive statistical results on the general assessment of the importance levels of Ilgaz Region landscape services [37]

Dimensions	Number of Observations (N)	Min.	Max.	Mean	Std. Deviation
Ecological	25	1,00	4,00	**1,40**	0,764
Social and Cultural	25	1,00	4,00	**3,04**	0,790
Visual and Aesthetic	25	1,00	4,00	2,64	1,075
Economical	25	1,00	4,00	2,92	1,038

Oral interviews and open-ended questions are based on the work of [17] in the questionnaires. While the participant questionnaire was asked open-ended questions, there were also markings on the A3 size color satellite image on the mentioned areas. Qualitative analysis methods have been applied in this part of the research. The analyzes were evaluated with using basic coverage analysis and matrix coding methods of Nvivo 10 software according to [18] and [21]. Based on the responses and the voice recordings for the open ended questions, the basic coverage analyzes are defined as the most commonly used words. As a result, for the 4 different services mentioned in Table 5, the interviews which were most benefited from Ilgaz Region landscapes were analyzed by matrix coding method.

Table 5. Matrix coding results for Ilgaz Region landscapes [37]

Dimensions of Participants	Matrix coding results	
	Service and product	**Number of Persons**
Ecological dimension	Agricultural production	25
	Animal production	20
	Fresh water resources	17
	Raw material	14
	Beekeeping	10
	Medical and aromatic resources	11
Social and cultural dimension	Historical and cultural assests	24
	Traditions	4
Visual and aesthetic dimension	Aesthetic and inspiration value	17
Economical dimension	Animal productions economic value	11

As a result of the Ilgaz Region landscape services inquiries, it was observed that the most interpretations were made on *ecological services* and the first order was taken by *agriculture and livestock*. Subsequently, much interpretation of *historical and cultural assets* has been made within the context of *social and cultural services* (Fig. 3).

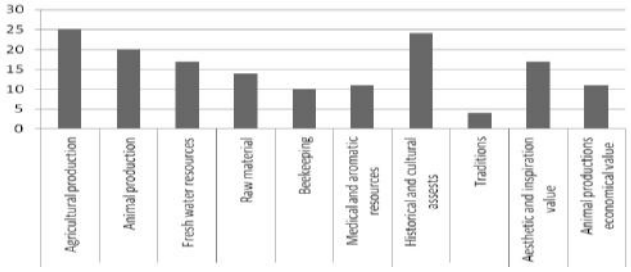

Fig. 3. Evaluation of Ilgaz Region landscape services by matrix coding [37]

3.4. . Identification of priority landscape services in research area

Within the scope of the research, a significance map has been developed which will serve as a basis for landscape planning studies based on the services determined by the questionnaires conducted in order to determine the importance levels of the priority landscape services in the research area. The concept of multifunctional landscapes is based on [22], [26] and [1] studies, Ilgaz Region is divided into 1 km^2 fractions and in the direction of the answers obtained from the questionnaires, significiance evaluations were made separately for food services, fresh water services, historical and cultural services, raw materials, recreation and ecotourism and habitat services. Habitat service evaluations were not covered by questionnaires; they were evaluated by data collection and field studies of the research area. "1" value were given to 1 km^2 fractions which provide a service; "0" value were given to 1 km^2 fractions which could not provide any service (Fig. 4).

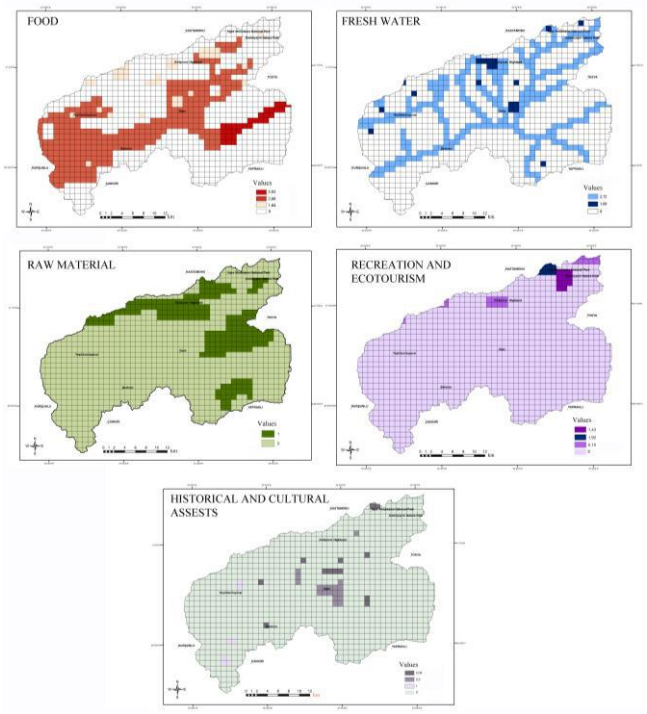

Fig. 4. Each ecological units landscape service evaluation in Ilgaz Region [37]

The significance values were calculated for each services and were matched by using ArcGIS 10.1 software, all the significance values were collected and zonning map were created. It is necessary to take into account the fact that each unit in the region can provide more than one service and the value provided by all ecological units in the region in order to determine the total value of the service in a given region.

In this direction, the average importance values of all the services and the quantitative and qualitative questionnaires' evaluations were gotten together and new importance values were obtained. These identified significance values were handled with the qualitative evaluation together of oral interviews and the zones were determined for the landscapes services in the region. If there is more than one service in a single frame, the most prominent feature is taken into consideration (Fig. 5).

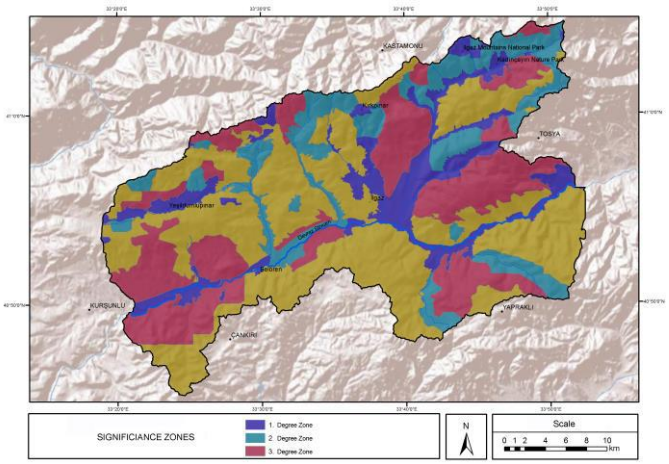

Fig. 5. Zonning map of significiance degrees for Ilgaz Region landscape services [37]

At the ecological dimension, food and fresh water services are the first order in the region. In this dimension, freshwater and food resources are defined as the most important services in all dimensions. The presence of the mining activities in the region, which is closest to the Devrez Stream have great pressure on these resources. Significant services are provided to the region, especially in terms of seasonal of raw materials resources.

At social and cultural dimension, both registered and unregistered assets are extremely important in terms of regional landscapes. *At economical dimension*, recreation and ecotourism activities are particularly important in terms of areas where activities are carried out while the first order is livestock at the region. As a result of the evaluations, all the maps have been added for the determination of the multifunctional areas providing more than one function in the Ilgaz Region. The total results of the values obtained with squares are reflected in the zoning map. For the fields that have been registered, 3 degree zones are required.

IV. CONCLUSION

1.Degree-the most significiance zones in the region are concentrated around the Devrez Stream and the Ilgaz Mountain National Park. The most important areas are especially where agricultural activities are intensive. These areas are also have importance which provide 2 and more services with livestock, recreation, historical and cultural features and fresh water resource.

The 2.degree mostly significiance zones in the region are Devrez Stream, Kızılçay Stream, Bucura Stream, Pazar Stream, Yuvaçay Stream, Karaman Stream, Yuvasaray Village on Kızılçay and Yerkuyu Village. The areas with up to 2 different services in these region are discussed together.

The 3.degree significiance zones are Yumukören, Göllüce, Sivricek, Kızılibrik, Kavaklı, Çörekçiler village and its surroundings and a region from Hacıhasan border to Tosya especially where raw materials are provided from, around Kaleköy where especially beekeeping is concentrated or only by providing a single service such as historical features.

Besides, the fire risk is particularly high at 1. and 2. degree significiance zones when examined in the past events. In 3. degree significiance zones are important with the risk of landslide is high especially around Kaleköy, Dağardı villages. Particularly in areas that are important in the first place, burning of stubble in agricultural areas, floods, risky areas due to the pressures created by mine quarries.

Forests are the most important ecosystems that affect and regulate Earth's climate. Forest landscapes have climate protection functions by protecting settlements, agricultural areas and recreational facilities from harmful effects of cold and windy weather, extreme weather changes and repairing the locational climate.

Ilgaz Region water resources are evaluated with drinking water and freshwater and surface water resources such as rivers, lakes and ponds. Gökçay, Bozan Stream, Yuva Stream are the main streams that feed to Devrez Stream Basin and they are irrigation water sources in agricultural production.

As an example of a research for benefits by forest landscapes are timber and firewood and especially non-wood products such as daphne, thyme, lime, mushroom, chestnut and salep are provided in the region of Küre Mountains National Park [8].

In addition to some studies' contributions to living and movement of landscapes, protection of links between species, support for biodiversity, topics such as climate improvement, genetic resources, water control, human health and welfare have been added.

In Turkey there are limited researches about ecosystem services. One of the example is about Sultansazlığı National Park ecosystem services economic values were critised and annually total more than 1 billion TL income have been determined from several ecosystem products and services. In another example, in 2013, Bolu forests ecosystems economic income has been determined as $ 341.4 million with basin protection, carbon sequestration and soil erosion control and; the total economic value has been determined as 86.4 million $ with wood, firewood, non-wood forest products, honey production, recreation, hunting and grazing services [16].

Within the context of the research, Ilgaz Region has been assessed for food, energy, climate regulation, water resources, pollination, biological raw materials and industrial products, recreational and ecotourism value and willing to pay. Based on the work of [20] and [9], the economic value of pollination has been calculated in terms of insect pollinations of honey bee product value with an USA sample. Here, the value of pollination which is the value of nature, cannot be reached a clear pollination value in terms of containing the product value. Within the information obtained from the Provincial Directorate of Agriculture, Livestock and Livestock in the region, mushrooms are picked up by local people especially in the spring and autumn immediately from Ilgaz Mountains. More than 150 tons mushrooms have been collected per year and their income has an important contribution to the regional economy.

[16] has pointed out that the service, function and structure components of landscapes must be taken into account in social and economic values, regardless of their asset and natural science values. So far, inside of a priority of economic investments and social policies; the ecological elements, events and processes underlying the goods, services and services presented by nature have been neglected in the economic system with the acceptance of zero value. On the other hand landscape was limited only with visual objects and design, will have more acceptance in the processes on planning platforms with economic value and multiple services.

Another important service of the region economy is observed in fertilizer and biogas production. Biogas technology is an inexpensive and environmentally friendly energy source that enables both energy can be derived from organic waste materials and also allowing the wastes to be brought to the soil [5]. It is possible to obtain 13.128.965 kWh electricity per year with biogas production facility to be installed in the region.

State parties are responsible to reduce the contents of include the greenhouse gases (chlorofluorocarbons, carbon

dioxide, sulfur dioxide, methane, nitrous oxide, sulfur hexafluoride, HFC's and PFC's) emissions according to Kyoto Protocol which has been signed in 1992 in Rio de Janeiro, Brazil and is a kind of an additional protocol of the United Nations Framework Convention on Climate Change (UNFCCC). Kyoto Protocol gives the permission of credit facility for carbon accumulation to reduce greenhouse gases [16].

REFERENCES

[1] Albayrak, İ. (2012). Ekosistem Servislerine Dayalı Havza Yönetim Modelinin İstanbulÖmerli Havzası Örneğinde Uygulanabilirliği (Applicability of Ecosystem Services Based Watershed Management Model in Istanbul–Omerli Case) Doktora Tezi (PhD Thesis). İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul, 198 s.

[2] Alder, J., Benin, S., Cassman, K.G., Cooper, H.D., Johns, T., Gaskell, J. Grainger, R., Kadungure, S., Otte, J., Rola, A., Watson R., Wijkstrom, U., Devendra, C. (2005). Food inHassan, R., Scholes, R. ve Ash, N., eds, Ecosystems and Human Well-being: Current State and Trends Volume 1, 211 - 238, Island Press, Washington DC, London.

[3] Anonymous, (2009). Türkiyenin Dünyada Yeri Haritası (Map of Turkey's Place in the World). Retrieved May 10, from http://aygunhoca.com/cografi-haritalar/72-turkiye-haritalari/502-turkiyenin-dunyada-yeri-haritasi.html.

[4] Anonymous, (2017). Çankırı'nın ilçeleri (Çankırı districts). Retrieved May 10, from http://www.alternatifpower.com.tr/resimler/2187644_14035 34180.pdf.

[5] Anonymous, (2018). Biyogaz Üretimi ve Faydaları (Biogas Production and Benefits). Retrieved May 22, from http://www.alternatifpower.com.tr/resimler/2187644_14035 34180.pdf.

[6] Antrop, M. (2000). Background concepts for integrated landscape analysis. Agriculture, Ecosystems and Environment 77:17-28.

[7] Antrop, M., Sevenant M., Tagliaferro C., Van Eetvelde V., Witlox F. (2012). Setting a framework for valuing the multifunctional landscape and its multiple perceptions. Pages 23-52 in C. M. Van der Heide and W. Heijman, editors. The economic value of landscapes. Routledge, Oxford, UK.

[8] Avcıoğlu Çokçalışkan, B., Karadeniz,N., Bakır, B., Özdemir, G., (2015). Peyzaj Planlamada Ekosistem Hizmetlerinin Mekânsal Analizi: Küre Dağları Milli Parkı Çalışması Broşürü, Peyzaj Analizi Çalıştayı 2016, Çukurova Üniversitesi, Adana.

[9] Barfield, A., Bergstorm, J., Ferreira, S. (2012). An cconomic valuation of pollination services in Georgia. Southern Agricultural Economics Association Annual Meeting, Birmingham, AL, Feb 4-7, 2012.

[10] Council of Europe. (2000). European Landscape Convention. Retrieved May 30, from http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/176.

[11] Çakır, M. (2007). Ilgaz Dağı Milli Parkı'nda Farklı Orman Kuruluşlarına Ait Toprakların Bazı Fiziksel ve Kimyasal Özellikleri (Basılmamış Yüksek Lisans Tezi). Ankara: Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Orman Mühendisliği Anabilim Dalı.

[12] Çankırı Governorate. (2021). İlçelerimiz-Ilgaz (Our district-Ilgaz). Retrieved March 4, from http://www.cankiri.gov.tr/ilcelerimiz.

[13] Daily, G.C. (1997). Introduction: what are ecosystem services, in Daily, G.C.,eds.,Nature's Services. Island Press, 1–10, Washington DC.

[14] De Groot, R.S. (1992). Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision Making. Wolters-Noordhoff, Groningen.

[15] De Groot, R.S., Wilson, M., Boumans, R. (2002). A typology for the description, classification and valuation of ecosystem functions, goods and services. Ecol Econ 41:393–408.

[16] Doğan, M. (2012). Sultan Sazlığı Milli Parkı Ekosistem Himzetlerinin Bedellendirilmesi (Biyokıymetlendirilmesi). (Valuing Ecosystem Services of Sultan Sazlığı National Park), Akademik Araştırma. Orman ve Su İşleri Bakanlığı, Ankara.

[17] Fagerholm, N., Käyhkö N., Ndumbaro F., Khamis M. (2012). Community stakeholders' knowledge in landscape assessments – mapping indicators for landscape services. Ecological Indicators 18:421:433.

[18] Fletcher, R., Baulcom, C., Hall, C., Hussain, S. (2014). Revealing marine cultural ecosystem services in the Black Sea. Marine Policy50 (2014):151–161.

[19] Forman, T.T.R. & Godron, M. (1986). Landscape ecology. John Wıley and Sons, USA.

[20] Gallai, N., J.-M. Salles, J. Settele, B. E. Vaissiere. (2009). "Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline."Ecological Economics 68: 810-821.

[21] Gould, R. K., Ardoin N. M., Woodside U., Satterfield T., Hannahs N., Daily G. C. (2014). The forest has a story: cultural ecosystem services in Kona, Hawai'i. Ecology and Society 19(3): 55.

[22] Gulickx, M.M.C., Verburg, P.H., Stoorvogel, J.J., Koka, K., Veldkamp., A. (2013). Mapping landscape services: A case study in a multifunctional rural landscape in The Netherlands. Ecological Indicators 24, 273–283.

[23] Gümüş, C. Kalem, S. Menteş, İ. (2002). Ilgaz Dağlarının Biyolojik Çeşitliliği ve Doğa Koruma Açısından Önemi, Kastamonu, Türkiye Dağları 1. Ulusal Sempozyumu, ss. 442-446.

[24] Haines, R.Y & Potschin, M. (2010). The links between biodiversity, ecosystem services and human well-being. Centre for Environmental Management, School of Geography, University of Nottingham. Retrieved April 14, from https://www.nottingham.ac.uk/cem/pdf/Haines-Young&Potschin_2010.pdf.

[25] Hermann, A., Schleifer, S., Wrbka, T. (2011). The concept of ecosystem services regarding landscape research: A review. Living Reviews in Landscape Research, (5),1.

[26] Hermann, A., Kuttner, M., Renetzeder, C., Gyuro, E.,

Tirászi, A., Brandenburg, C., Allex, B., Ziener, K., Wrbka, T. (2013). Assesment framework for landscape services in European cultural landscapes : An Austrian Hungarian case study. Ecological Indicators, Pages 12 (Online Article), http://www.sciencedirect.com/science/article/pii/S1470160X13000381.

[27] MEA. (2003). Ecosystem and Human Well-Being - A framework for Assessment, Millennium Ecosystem Assessment,Washington DC, Island Press.

[28] MEA. (2005). Ecosystems and Human Well-Being - Biodiversity Synthesis, Millennium Ecosystem Assessment, Island Press, Washington DC.

[29] Ministry of Forest and Water Affairs. (2013). Çankırı Doğa Turizmi Master Planı 2013-2023.89, Ankara, 89 s.

[30] Müller, F., De Groot, R., Willemen, L. (2010). Ecosystem services at the lansdcape scale: the need for the integrative approaches. Landcape Online, (23), 1-11.

[31] Northern Anatolia Development Agency. (2013). Tosya İlçe Analizi. Retrieved February 10, from http://www.kuzka.org.tr/eskiyedek/NewsDownload/HZ4X7Tosya_Ilce_Analizi.pdf.

[32] ÖBANET. (2015). Türkiye'nin ÖBA'ları. Retrieved April 20, from http://obanettr.org/default.asp?baslik=turkiyenin_obalari&page=1&a=88&b=1&c=75.

[33] Syrbe, R.U., Bastian, O., Roder,M., James, P. (2007). A framework formonitoring landscape functions: The Saxon Academy Landscape Monitoring Approach (SALMA), exemplified by soil investigations in the Kleine Spree floodplain (Saxony, Germany). Landscape Urban Planning. 79, 190–199.

[34] Termorshuizen, J. W. & Opdam, P. (2009). Landscape services as a bridge between landscape ecology and sustainable development. Landscape Ecology (2009) 24:1037–1052.

[35] Tress, B. & Tress, G. (2001). Capitalising on multiplicity: A trandisciplinary systems approach to landscape research. Landscape and Urban Planning, 57(3-4), 143-157. DOI: 10.1016/S0169-2046(01)00200-6

[36] Tress, B, Tress, G, De´Camps, H, D'hauteserre, A.M., (2001). Bridging human and natural sciences in landscape research. Landscape Urban Planning 57:137–141. doi:10.1016/ S0169-2046(01)00199-2.

[37] Tülek, B. (2017). Çankırı, Ilgaz Bölgesi Peyzajlarının Sağladığı Faydaların Peyzaj Yapıları, Karakterleri ve Fonksiyonları Açısından Çok Yönlü Analizi (Multifunctional Analysis of Çankiri, Ilgaz Regional Landscape Services in Terms of Landscape Structures, Characters and Functions). Akdeniz Üniversitesi Fen Bilimleri Enstitüsü, Peyzaj Mimarlığı Ana Bilim Dalı, Doktora Tezi (PhD Thesis), 176 Sayfa, 2017 Antalya.

[38] Uzun, O., Dilek, F., Çetinkaya, G., Erduran, F., Açiksöz, S. (2010). Landscape management, conservation and planning project of Suğla wetland watershed and Bozkir-Seydişehir-AhirliYalihüyük counties in Konya province. 1-2 Report. Ministry of Environment and forest, General directorate of nature protection and natural parks. Ankara-Turkey.

[39] Vallés-Planells, M., F. Galiana, V. Van, Eetvelde. (2014). A classification of landscape services to support local landscape planning. Ecology and Society 19(1):44.

[40] Wiggering, H. Dalchow, C., Glemnitz, M., Helming, K., Muller, K., Schultz, A., Stachow, U., Zander, P. (2006). Indicators for multifunctional land use – linking socio-economic requirements with landscape potentials. Ecol. Indic. 6, 238–249.

[41] Willemen, L., Verburg, P.H., Hein, L., & Van Mensvoort M.E.F. (2008). Spatial characterization of landscape functions. Landscape and Urban Planning 88, 34-43.