ÇOMÜ Zir. Fak. Derg. (COMU J. Agric. Fac.)
Yıl: 11 (2): 417-427
ISSN: 2147–8384 / e-ISSN: 2564–6826
doi: 10.33202/comuagri.1287015

Research Article

Research of The Uludağ National Park in Terms of Resource Economy

Gökhan Uzel[1*] **Serkan Gürlük**[2]

[1]Bursa Uludağ University, Karacabey Vocational School, Department of Crop and Animal Production, OrganicAgriculture Program, Karacabey, Bursa
[2] Bursa Uludağ University, Faculty of Agriculture, Department of Agricultural Economics, Nilüfer, Bursa
*Corresponding author: uzelgokhan@uludag.edu.tr

Received Date: 24.04.2023 Accepted Date: 04.09.2023

Abstract

The potential of forest-mountain ecosystem services as a source of sustainable development has been widely recognized. This paper aims to provide comprehensive economic value resource parameters of Uludağ National Park (UNP), the region of Bursa, Turkey. In this context, 10 ecosystem parameters were determined under 3 categories. The first of these groups is the supplier parameters. Group of supplier parameters consists of crop production, animal production, industrial and firewood production, grazing, beekeeping and non-wood forest products. Group of regulatory parameters as regulators of the ecosystem consists of biodiversity, carbon sequestration and water resources. Within the scope of socio-economic parameter, there is tourism-recreation value.Valution is based on a wide variety of techniques, drawings on market prices, results of local surveys and other econometric valuation methods called as Faustman and Hartman. It shows that at UNP, water resources provide annual benefits of about 147 046 $ ha^{-1}, secondly biodiversity provides a 15 312 $ ha^{-1} annualy and carbon sequestration has a 6 806 $ ha^{-1} annual value. After this regulatory parameters, as a socio-economic parameter tourism and recreation provides 4 362 $ ha^{-1} economic value annualyand supplier resource parameters following them. The paper shows the degree of importance of the UNP main values for the country and region as a whole. It also discusses some reasons of concern when drawing policy tools for improving UNP income and conservation practices local and regional level.

Keywords: Environmental valuation, Mountain-forest ecosystems, Uludağ, Bursa, Turkey

Uludağ Milli Parkı'nın Kaynak Ekonomisi Açısından İncelenmesi

Öz

Bir sürdürülebilir kalkınma kaynağı olarak dağ-orman ekosistem hizmetlerinin potansiyeli geniş çapta kabul görmektedir. Bu araştırma, Türkiye'nin Bursa ilinde yer alan Uludağ Milli Park (UMP)'ı doğal kaynak hizmetlerinin kapsamlı ekonomik değer tahminlerini sağlamayı amaçlamaktadır. Bu kapsamda 3 kategori altında, 10 adet ekosistem parametresi belirlenmiştir. Bu gruplardan ilki tedarik edici parametrelerdir. Tedarik edici parametreler grubu, bitkisel üretim, hayvansal üretim, endüstriyel ve yakacak odun üretimi, otlatma, arıcılık ve odun dışı orman ürünlerinden oluşmaktadır. Ekosistemin düzenleyicileri olarak regüle edici parametreler grubu, biyoçeşitlilik, karbon tutulumu ve su kaynaklarından oluşmaktadır. Sosyo-ekonomik parametre kapsamında ise turizm-rekreasyon değeri bulunmaktadır. Değerleme, çok çeşitli tekniklere, piyasa fiyatlarına ilişkin alan çalışmalarına, yerel araştırmaların sonuçlarına ve diğer ekonometrik değerleme metotlarına dayanarak gerçekleştirilmiştir. Faustman ve Hartman olarak adlandırılan ve dağ-orman ekosistemlerinin ekonomik değerlemesinde kullanılan yöntemler UMP'de su kaynaklarının yıllık yaklaşık 147 046 $ ha^{-1} yıllık fayda sağladığını, biyoçeşitliliğin yıllık 15 312 $ ha^{-1} fayda sağladığını ve karbon tutulumunun yıllık 6 806 $ ha^{-1} ekonomik değer oluşturduğunu göstermiştir. Regüle edici parametreleri, bir sosyo-ekonomik değer parametresi olan turizm ve rekreasyon izlemiş, yıllık 4 362 $ ha^{-1} düzeyinde ekonomik değer sağladığı belirlenmiştir. Bu kapsamda araştırma sonuçları UMP'de yarattığı faydaların bir bütün olarak ülke ve bölge için önemini ortaya koymaktadır. Araştırmada ayrıca, yerel ve bölgesel düzeyde UMP hizmet ve koruma uygulamalarını iyileştirebilmek için uygulanabilecek politika araçları tartışılmıştır.

Anahtar Kelimeler: Çevresel değerleme, Dağ-orman ekosistemleri, Uludağ, Bursa, Türkiye

Introduction

Everything that is suitable for meeting human needs directly or indirectly can be described as a resource. While resources in the economy are classified as labor, capital and nature; Natural resources are living and non-living things in the physical environment and are objects that can be used for human needs. While all these resources are necessary for the realization of production, the management of each of them in the economy differs. The management of natural resources, on the other hand, has very different characteristics. Because, while many features of natural resources can be explained with market prices, many features cannot be explained with market prices and there are great problems in their use, allocation, and leaving them to future generations at least in quantity and quality as they are today. Natural resources can belong to a region (forests), a country (streams), or even the entire world (atmosphere). Therefore, natural resource management problems arise both in the country's agenda and in the world's agenda; These are known as "environmental problems".

Worldwide, mountainous areas are recognized as critical regions for ecosystem continuity (Gret-Regamey et al., 2012). Various mountain ecosystem areas support a wide variety of ecosystem services such as energy, water, food, shelter, medical reserves and cultural ecosystem services, and are sources of human needs (Huber et al., 2013). With its regulatory function, it plays a role in carbon sequestration and maintaining the continuity of the hydrological cycle (Kroupova et al., 2016). In addition, these areas provide an opportunity to generate income through tourism carried out by people who visit to participate in cultural ecosystem services. In this direction, sustainable management principles of mountainous ecosystem areas should be put forward and various benefits should be calculated for the protection and development of natural resources. Because the percentage of protected natural areas in Turkey is 6.95% in terrestrial areas and 1.76% in marine areas (Anonymous, 2017a). These rates are as follows: 27.28% terrestrial and maritime 50.36% maritime in France, 37.75% terrestrial and 45.36% marine in Germany, 28.73% terrestrial and marine 44.2% marine in England and Italy. On the other hand the rates for terrestrial and marine areas are 21.51% and 9.74% respectively(Anonymous, 2017b). In line with these data, it is of great importance to determine the values of natural resources, to develop them and to make them sustainable.

The benefits of natural ecosystems are many. There are some of them that have been determined and that have not yet been determined or that have not been fully determined. Therefore, the conservation and management of natural resources is a multidisciplinary issue with biological, geological, chemical, environmental and economic relations. Ecosystems have a regulatory role in natural events. Thanks to these opportunities it creates, suitable environments for habitats are provided. All of these actually create beneficial environments for humanity.

Many researches have been carried out on the ecosystemof the Uludağ ecosystem(forests, grasslands, flora, fauna etc.), which constitutes the study area of this research. But there is no an economic valuation about this ecosystem resources. Uludağ National Park, which has an area of 12 762 hectares, is 71% forest, 28% grassland and rocky areas, 0.4% open areas, 0.1% water-covered areas, 0.8% of them are residential areas. Uludağ has a very rich habitat diversity such as woodlands, maquis, peatlands, subalpine heaths, alpine steep cliffs and open areas. There are 1320 plant species in Uludağ, which is a plant diversity center, and it is home to a total of 171 endemic species, 33 of which are Uludağ and 138 are Turkey endemics. In addition, Uludağ constitutes the habitat of 3 globally endangered species and 54 endangered species in Europe (Özhatay et al., 2003; Daşkın, 2008).

Uludağ is also open to mountaineering, picnic, recreation, camping, and trekking activities during the summer season. Uludag consists of two development areas. In the first development area, where the hotels area is also located; There are 12 public facilities and 22 mechanical facilities serving ski tourism. In the second development zone, there are 4 tourism facilities belonging to the private sector serve. Tourism and public facilities in the National Park serve mostly for winter tourism. During the summer season, accommodation can be made in the Sarıalan and Çobankaya Camping and Daily Usage Areas. In the Sarıalan Camping and Daily Use Area, there are 12 cottages serving in the summer season and there is a camping area for 300 tents.

Due to its proximity to large residential areas such as Bursa and İstanbul, the increasing use of people in Uludağ and the environmental pressure arising in this direction are also increasing the search for "area protection and rational use" (Erten and Gündüz, 2011). It is obvious that a resource valuation study that will be integrated with environmental management plans is necessary to make the Uludağ ecosystem healthier and more sustainable. Natural resources with poorly determined resource values

are exposed to excessive consumption or pollution. The increasing use of Uludağ causes various major problems such as environmental problems, legislation, infrastructure, transportation and accommodation. Pressures on resource values can create hard-to-repair damages in Uludağ's ecosystem; can create environmental costs and degrade the ecological and economic value of the region.

In this research, the environmental threats of Uludağ Ecosystem, which is one of the richest natural mountain-forest ecosystems in Turkey in terms of ecological character and biological diversity, were investigated; Within the framework of ecosystem-user relations, the total economic value has been tried to be estimated by Faustmann and Hartman project valuation methods. In this context, the optimal management strategy of the Uludağ National Park area has been tried to be put forward and the things to be done in terms of the management of the area have been discussed. In the light of the general evaluation of the information and data obtained in the whole study and the results of the analysis, solution suggestions were made to insure the environmental sustainability of Uludağ National Park and to improve the environmental quality.

Material and Method

Economics has produced important valuation methods in revealing the resource values in question. The methods that can be classified as market price methods and alternative market methods have found a lot of use in recent years. The economic valuation of supply services is based on data from the relevant research area. A variety of valuation methods developed in the environmental economics literature are used (Dixon et al. 1994; Braden and Kolstad 1991; Organization for Economic Cooperation and Development 1995; Winpenny 1991). In the mountain-forest ecosystems such UNP it is difficult to estimate the value of supply services. Some supply service and supply product parameters, whose quantities and prices are known, are marketed in established markets, while other value parameters are not readily available. Some wood-based value parameters, such as industrial and firewood, with regional differences, are traded in small, informal markets. Some non-timber forest products, such as mushrooms, are marketable but generally harvested and consumed for free. So the data were obtained from the units of Bursa Directorate of Provincial Agricultural and Forestry. The obtained data were evaluated economically by various market price valuation techniques.

There are also goods and services that do not have a market in determining the total economic value of natural resources. In the determination of these resource values, methods such as travel cost method, hedonic price method and contingent valuation method are used. These methods, which will be defined as survey methods, are carried out with people who plan to use the natural resource. In this context, a survey study was applied within the framework of the travel cost method in determining the socio-economic value of the UNP. Environmental relations between UNP and users were also examined in the survey study. The total number of visitors in the target visitors is 1 697 976 people per year. With this direction according to travel cost technique, the number of samples was determined as 245, and study based on a total of 278 interviews with the visitors of the UNP. In line with the results of the survey, the total expenditure average of the visits made to UNP in a year by 278 visitors who participated in the economic analysis was found. Individual consumer surplus was found by dividing the average travel cost value with the average number of visits. The total consumer surplus value was obtained by multiplying the calculated individual consumer surplus value with the total number of visitors to UNP in a year. Within the scope of the travel cost method, the individual travel cost, that is, the willingness to pay was found. The calculated total willingness to pay value corresponds to the one-year recreational use value of Uludağ National Park.

In recent years, with the development of econometric methods, approaches that examine the management of mountain-forest ecosystems from an economic point of view have been developed. Many advanced economic analyzes can be made based on single and endless rotation forestry systems. Because forest management can be considered successful if the benefits that can be obtained from the forest system are maximized. Administrative failures cause social welfare losses. Therefore, a successful forest rotation model is also always needed. In this direction, Faustmann approach made important contributions to natural resource management and especially to the economic analysis of mountain-forest ecosystems in the middle of the 19th century. When is the best time to harvest a forest stand? Faustmann model solves this problem. The model finds an optimal rotation length to maximize

the net present value of timber revenues from infinite identical rotations. The model mainly has a single rotation and a specific tree growth function. It is predicted that the amount of lumber to be harvested will change over time as the tree grows. The beginning of the Faustmann analysis indicates the amount of lumber in the rotational age T with q(T) in m^3 form. If it is assumed that there is a homogeneous tree group in the whole tree (stand) (such an assumption will be used for UNP) Q(T) shows the whole timber amount of the stand. The nq(T) = Q(T) equation is mentioned here, where n represents the number of trees in the stand. If the initial stock amount is shown with Q_0, it can be said that this value is the Q(T) value at T = 0. The stand's timber amount is related to the growth rate of biomass α and the bearing capacity of stand K. The growth rate varies depending on whether the tree structure is thin or thick. It is known that the growth rate of thick textured trees will be lower. The carrying capacity is the maximum timber volume that the stand can support. Based on these data, the basic model was developed through the following biomass lumber volume:

$$Q(T) = \frac{K}{1 + \left[\frac{K - Q_0}{Q_0}\right] e^{-\alpha T}} \qquad K>Q_0>0 \tag{1}$$

Equation 1 indicates an "S" curve that remains at low levels initially for timber biological mass and increases up to the bearing capacity level in line with the rotation age. In the model, it is assumed that price, cost and interest rate (discount rate) to be used in the analysis are fixed under a fully competitive market. In the setup of the stand, a fixed price (S) is incurred at the beginning of the rotation. However, it is then assumed that the stand grows under a natural environment without incurring any costs. Harvest costs (C) and stamping price (p) are market prices. Here, two important costs have to be included in the analysis. The first one is the interest incomes that the expenses incurred for the stand during the growth period will be lost until the product is harvested. This cost will increase as the rotation interval becomes longer. This opportunity cost is reflected in the model with an interest rate (r). Naturally, the present value of the T-aged stand can be brought up to date with a reduction factor (e^{-rT}). The initial planting cost, S, is not subjected to reduction. At this point, the equation giving the net present value of harvested stand in T rotation length will be as follows:

$$N(T)=(p-C)Q(T)e^{-rT}–S \tag{2}$$

Another cost is related to the land value and it is an important cause of environmental management problems. Since the places near forest zones are valued excessively, it may cause such areas to be converted into money and used in further zones. In other words, alternative income that can be obtained by renting or selling the land is the second type of cost in this model. Assuming that all ecological and economic parameters are constant, the problem that forest management will face in the next period is the same. In other words, the problem in each rotation will remain the same.

Therefore, V(T) will give the sum of the net current rate of the timber value obtained by cutting trees at the end of the rotation period and the present rate of bare land value at the end of the rotation period:

$$V(T)=[(p-C)Q(T)e^{-rT}–S]+V(T)e^{-rT} \tag{3}$$

The following equation can be written here:

$$V(T) = \frac{(p-C)Q(T)e^{-rT} - S}{1 - e^{-rT}} \tag{4}$$

In line with community interests, Equation 4 needs to be maximized. Thus, an economically inefficient natural resource management will be against society. The equality that maximizes V(T):

$$MAX_T : V(T) = \frac{(p-C)Q(T)e^{-rT} - S}{1-e^{-rT}} \tag{5}$$

For the maximization problem, the first derivative bound to V(T) should be equalized to zero.

V(T*)=

$$\frac{(1-e^{-rT^*})[(p-C)Q_{T^*}e^{-rT^*} - re^{-rT^*}(p-C)Q(T^*)]}{(1-e^{-rT^*})^2} - \frac{re^{-rT^*}[(p-C)Q(T^*)e^{-rT^*} - S]}{(1-e^{-rT^*})^2} = 0 \tag{6}$$

The expression of QT in the equation indicates that the first derivative based on the T rotation period is considered. The expression T* indicates the optimal rotation year. An easier form of Equation 6 can be written as follows:

$$\frac{(p-C)Q_T}{(p-C)Q(T) - S} = \frac{r}{1-e^{-rT}} \tag{7}$$

Equation 7 is called the Faustmann formula, which shows the optimal rotation length (Amacher et al. 2009). The easier representation of Equation 7 as a calculation tool can be given as follows:

$$(p-C)Q_T = r\left[(p-C)Q(T) + V(T)\right] \tag{8}$$

Equation 8 explains that the effective rotation period of stand will occur if the rate of change in forest value is equal to the rate of return to be earned by converting trees and forest land into capital. In an economic sense, the left side of equation is the marginal product value of timber that is allocated for the stand growth. The right side of the equation is the sum of the capital (opportunity cost of this choice) due to the capital used by growing timber if the land is not used for further purposes.

Hartman (1976) adds stand independent non-timber benefits to Faustmann's moodel. Equation 10 refers to the Hartman solution as an extended approach of Faustmann optimal forestland management. For the Hartman solution, there is a need for a function that describes the entire flow of non-timber benefits. Because the optimal rotation conditions change with the benefit of non-timber values. In the Hartman approach, environmental benefit values B(t) occurring during infinite rotation are included in the model by Boman et al. (2010) for the effective rotation period T:

$$(P-C)Q_T + B(T) = r\left[(P-C)Q(T) + V(T)\right] \tag{9}$$

And with this approach Faustmann-based Hartman solution algorithm was used in forest land management in order to use the value of water resources, biodiversity and carbon sequestration related benefits in UNP management and make it more meaningful. Briefly the application of the valuation methods in relation to the mountain-forests in the Uludağ National Park (Table 1).

Table 1. Methods for valuing resource parameter values of UNP

Ecosystem Service Category	Product or Service	Valuation method
Supplier	Crop production	Market price available
Supplier	Animal production	Market price available
Supplier	Industrial timber	Market price available
Supplier	Fire timber	Market price available
Supplier	Grazing	Market price available
Supplier	Non-timber forest	Market price available
Supplier	Beekeeping	Market price available
Regulatory	Biodiversity	Faustman and Hartman Rotation Method
Regulatory	Carbon sequestration	Faustman and Hartman Rotation Method
Regulatory	Water resources	Faustman and Hartman Rotation Method
Socio-economic	Tourism and recreation	Travel Cost Method

Thus, in this study, by using market price method, Faustman and Hartman approaches and travel cost method that will reflect the economic value of Uludağ Ecosystem were determined; characteristics of one current situation and two better ecological situations will be introduced. With the results to be obtained, natural resource managers will have benefits such as planning, imposing temporary limitations on the use of resources, and better understanding the cost of environmental damage that will occur in Bursa Province.

Results and Discussion

Traditional Agricultural Crop Production and Animal Production

A large part of agriculture in UNP consists of small-scale agricultural enterprises(BTOM, 2020). The number of enterprises that produce products for sale in traditional markets is less. As of 2019, UNP produced 67 753 997 TL of vegetable production economic value. A total crop yield of 26 418.9 tons was achieved. When we compare the economic value of the herbal product obtained as of 2019 with the 12 762 ha land area, which is the UNP areal size, the UNP generates an economic value of 5 525.5 TL year^{-1} per hectare (BTOM, 2020).

When the total number of UNP animals is examined, it is seen that the weight is in small cattle breeding. There are 773 cattle fattening animals against the total number of 4 443 sheep and goats. Dairy culture cattle breeds constitute a large part of the cattle breeding activities. When the UNP total milk production values are examined, it is seen that there is a bovine milk production of around 2 500 tons. In ovine breeding, the annual total milk production is at the level of 1 322 tons (BTOM, 2020).

When the total economic values of UNP livestock are examined, it is seen that the biggest economic income item is cultured cattle. Culture cattle is followed by sheep breeding with a value of 3 433 900 TL year^{-1}. It is followed by revenues from goat and hybrid cattle breeding, respectively. The total economic income created by UNP as of 2019 is 11 372 810 TL year^{-1}. When the economic income from livestock farming is considered in terms of UNP area, it creates an annual income of 891.14 TL ha^{-1}.

Industrial and Fire Timber Production

Another economic value item for UNP is industrial wood production. The economic value provided by industrial wood production from UNP is estimated to be 3 318 397.8 TL year^{-1}. The economic value per hectare is realized at the level of 260.02 TL year^{-1}.

Another wood production item in UNP is the production activity for firewood. A large part of the firewood need in UNP is obtained from the sale of the cuts made in the area to the local people. Households called “forest villagers” report that they cannot provide a reliable supply of firewood and are therefore forced to cut illegally.

The total economic value created through the sale of firewood from the UNP is estimated to be 355 334.99 TL year^{-1}. The economic value per hectare is at the level of 27.84 TL year^{-1}.

Grazing

Animals grazing in forests or pastures consume forage crops. Grazing is practiced as a public right of local communities or in return for a symbolic tax paid by forest users to local authorities. In this context, in order to determine the economic value of the forage in the pastures for grazing, the forage production per hectare in these areas was calculated by taking into account the grazing areas in Alaçam and Saitabat settlements in the UNP.

In addition to 543.25 grazing areas in the UNP area, there are 562.25 ha grazing areas in the region, including 19 ha of pastureland in Saitabat and Alaçam settlements. In this direction, it has been estimated that the total usable feed level per unit area is 4 498 tons. The unit feed price of the pastures in the region is 0.95 TL kg^{-1}. When these values are multiplied with each other, the UNP grazing economic value of 4 273 100 TL $year^{-1}$ has been estimated. The economic value per hectare through grazing activity was estimated at 334.8 TL ha^{-1}.

Beekeeping

The economic valuation of honey, another mountain-forest ecosystem product, is based on the amount of honey produced by the beehives in the area and the market prices of the honey. Honey production in UNP is carried out in the settlements of Süleymaniye, Kirazlı, Soğukpınar, Bağlı, Güneybudaklar, Küçükdeliler and Büyükdeliler, which are close to the National Park. Data are based on information from these settlements. There is no honey production in the National Park area.

Average amount of honey production per hive in UNP varies between 15-18 kg. There are 365 active hives. Flower and secretory honeys are produced. As of 2019, the total annual honey production of the region was 5 350 kg. The market price of honey obtained from the region is 40 TL kg^{-1}. Based on the available data, it has been estimated that the total economic value of honey produced without expenses is 214 000 TL $year^{-1}$. The UNP per hectare value obtained by honey production was realized as 16.76 TL ha^{-1}.

Non-Timber Forest Products

This category includes species found in mountain-forest ecosystems such as chestnut, cones, laurel shoots, acorns, and barkless fruits. These products are usually sold in local markets and economic value estimates are made over market prices (Croitoru, 2007).

The total economic value obtained from non-wood forest products in UNP is at the level of 207 619.34 TL $year^{-1}$. In this direction, it has been estimated that the economic value obtained by the production of non-wood forest products is realized at the level of 16.26 TL per hectare of UNP.

Biodiversity

The ignorance and loss of biological diversity in the economic system constitutes an important environmental externality problem. The reason why this important natural resource is not taken into account in economic decision-making mechanisms is that the services it creates are considered free of charge. Environmental valuation approaches are important economic research tools for solving this problem.

Within the framework of the biodiversity value determination approach used in the study, the net present value of the UNP at the beginning of the rotation was calculated as 12.2 million dollars. When the optimal rotation is reached, it has been determined that the total economic value obtained is 195 420 422.6 dollars.

Carbon Sequestration

Regarding carbon sequestration, which is another regulatory value parameter, since the forest ecosystem in the forest area constitutes the subject of the research, the value of the carbon sequestration service of the mentioned area was calculated. In parallel with the scientific literature followed in revealing the carbon accumulation and balance sheet in the UNP forests, it was determined that the economic value created by the UNP through carbon sequestration was at the level of 86 858 172 dollars.

If the carbon price is 5 US dollars, it is determined that the rotation is reached in the 52nd year. In the model previously calculated with the 52nd year rotation value of 3 827.90 USD ha^{-1} Faustmann rotation, the stand value was 956 USD ha^{-1} with the 44th year rotation.

Water Resources

Again, in the calculation of the forest water value of the UNP examined in the study, some hydrological functions were subjected to economic analysis. In particular, ecosystem services related to the mixing of surface runoff due to precipitation with groundwater and the regulation of surface runoff have been analyzed economically. In this context, it has been determined that the UNP creates an annual economic value of 1 876 607 177.76 $. It was determined that this value per hectare was at the level of 147 046.48 $. It has been observed that the determined forest water resource value constitutes a very high economic value compared to other regulatory parameters.

Tourism and Recreation Value

Travel cost method is one of the methods used to estimate consumer behavior and value of areas in tourism-recreation areas in ecosystems. In other words, it is a method in which the value of a tourism-recreation area is estimated by considering the expenditure of visitors to reach the area and in the area. In this direction, it has been used for more than forty years to reveal the socio-economic value created by mountain-forest ecosystems. By dividing the average travel cost value with the average number of visits, the individual consumer surplus was found to be 229.85 TL. The total consumer surplus value was obtained by multiplying the calculated individual consumer surplus value with the total number of visitors to Uludağ National Park in a year. According to the data provided by Bursa Regional Forestry Directorate for 2019, the number of visitors to the area in a year is 1 697 000 people. Accordingly, the total consumer surplus is:

Total Willingness to Pay(TWP)= 229.85×1 697 000= 390 065 827.33 TL

Total Willingness to Pay(TWP)= 390 065 827.33 TL/Year estimated at 55.67 million dollars.

UNP Total Economic Value

Table 2 shows the final and overall results of the UNP valuation research. The total estimated economic value created by UNP based on various product types and services was estimated at $2 227 052 303.33 $ year^{-1} as of 2020. The economic value per hectare was realized as 174 506.52 $ ha^{-1}.

Table 2. UNP Total economic value

Ecosystem Service Category	**Product or Service**	**Total Economic Value-2020(TL)**	**Total Economic Value-2020($)**	**$ ha^{-1}**
Supplier	Crop production	67 753 997	9 671 129.20	757.80
Supplier	Animal production	11 372 810	1 623 342.08	127.20
Supplier	Industrial timber	3 318 397.8	473 664.36	37.11
Supplier	Fire timber	355 334.9	50 720.10	3.97
Supplier	Grazing	4 273 100	609 937.48	47.79
Supplier	Non-timber forest products	207 619	29 635.30	2.32
Supplier	Beekeeping	214 000	30 546.11	2.39
Regulatory	Biodiversity	1 367 942 955.12	195 420 422.16	15 312.68
Regulatory	Carbon sequestration	608 007 204	86 858 172	6 806
Regulatory	Water resources	13 136 250 244.32	1 876 607 177.76	147 046,48
Socio-economic	Tourism and recreation	390 065 827.33	55.677.556.78	4 362.76
TOTAL		**15 589 761 489.47**	**2 227 052 303.33**	**174 506,52**

When the UNP economic value components are examined, it is seen that the largest component belongs to the water resources service with a value of 147 046.48 $ ha^{-1}. This value constitutes 84.30% of the total economic value in UMP. It is followed by biodiversity service with a value of 15 312.68 $ ha^{-1}. The ratio of the benefit obtained from biodiversity, which is an indirect service parameter, to the total economic benefit is at the level of 8.77%. Again, the ratio of the carbon sequestration parameter to the total economic benefit is at the level of 3.90%. The share of tourism-recreation service, which is another important parameter, was determined as 2.45%. The share of supplier service parameters was only 0.58% (Figure 1).

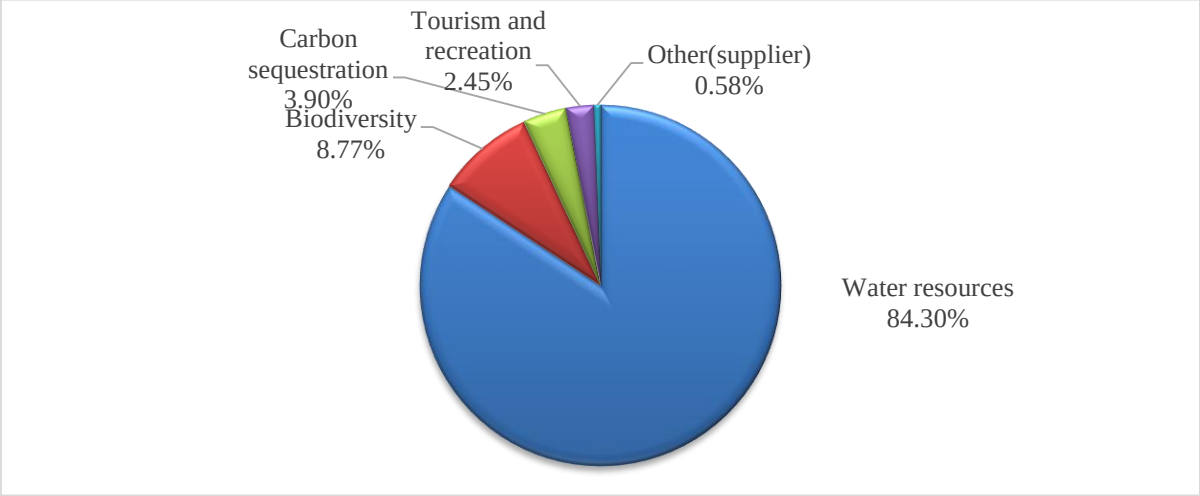

Figure 1. Proportional distribution of UNP service parameters

Conclusions and Recommendations

The most important factor of environmental pressure on the Uludağ region is the intense human use. The number of visitors reaching the annual level of 1 697 498 and the uncontrolled growth in the system and the resulting infrastructure and superstructure development initiatives cause negative and irreversible environmental effects. The management plan prepared by the Regional Forestry Directorate for Uludağ is not qualified to meet the needs of the region. There is no long-term resource rotation and carrying capacity-based management plan for the site. For this reason, there are deficiencies in the allocation of public resources. In order to solve this problem, it is necessary to reconsider managerial practices, resources and values, their activities and financing needs, in a way that will be arranged in certain periods.

Regarding agricultural activities, uncontrolled subsistence agriculture is practiced in the region, and there is no support for rural development. A single market for agricultural and non-timber products tailored to the region's characteristics should be created, and local traditional products and marketing activities should be supported.

The region's uncontrolled agricultural activity creates an unsustainable impact on biodiversity and ecosystem carrying capacity. To eliminate this pressure, organic farming should be supported, local seeds should be diversified, training should be provided, and local collaborations should be strengthened.

No scientific management is applied in the management of the area. Optimal/sustainable agricultural production levels should be determined and monitored based on scientific approaches.

Regarding grazing activities, pastoral grazing and largely unplanned grazing are practiced in Uludag National Park. It was calculated that the number of animals allowed to graze in the area far exceeded the grazing capacity of the area. In this context, an optimal and sustainable grazing plan should be developed for the area.

There is no comprehensive data on the economic value of grazing activities in the area, and managers are insufficient and lack knowledge on this subject. For this reason, it is necessary to establish a detailed data set for the grass yield, carrying capacity, seasonal changes, and regional grazing characteristics of the area.

Inventory of non-timber forest products is an issue that deserves special attention. It was noted that there is currently no inventory or sub-plan for non-timber forest products in the National Park Region. No data on production and carrying capacity are available, and available data are minimal. A management plan for non-timber forest products, resource values, carrying capacity, and marketing opportunities must be developed immediately.

It was highlighted that there is no information on non-timber forest products inventory in the National Park Management Plan. A similar lack is observed in the Regional Forestry Directorate and the Regional Chiefdom plans. Local people collect products with economic value, such as mushroom species and chestnuts, without any registration system. This causes severe damage to medicinal-aromatic plants, endemic species, and biodiversity. A detailed inventory of non-timber forest products should be made in the area. It is essential to conduct multidisciplinary field studies in line with this objective. A mechanism for monitoring and tracking needs to be developed. A separate and specific budget plan for non-timber forest products and a management plan should be developed. Assistance from government officials is needed at this point. The budget plan to be prepared for funding and activities could be more functional in providing the necessary government support on a larger scale.

There is no certification and marketing system for local and natural products. Data management for non-timber products should be carried out with great seriousness. Research and development activities should be promoted with the financial support provided.

The benefits of UNP to the carbon economy are clear. Therefore, when designing or assigning areas such as National Parks, they should be taken into account not only for timber values but also for their role in carbon securization.

In the fieldwork analyzes to be carried out physically, the pollution that occurs in areas with excessive carbon accumulation will reflect the pollution created by the nearby settlement. Therefore, it is possible to determine the economic evaluation of the pollution caused by Bursa city industry with measurements to be made at different points in the UNP and Bursa center.

A contemporary management approach to biodiversity should be implemented in our country. First of all, the most approximate values should be revealed to the existing natural resource inventory through qualified environmental valuation studies. Management principles should be established where the values excluding usage rates are also taken into account. Benefits and costs should be determined by revealing biodiversity values, future profit acquisition and natural protection areas. In some cases, when making decisions between letting the natural resource to itself and declaring a natural protection area, methodological approaches in this study may be required. It is stated that there is a need for a supreme board consisting of agricultural engineers, ecologists, biologists, ecologists, ethnobotanists, health policy decision-makers, garden plants specialists, legal advisors, people responsible for national park management, pharmacologists, plant breeders, plant pathologists and resource economists in the natural resource management system, in which biodiversity is also taken into consideration.

It is seen that the economic benefits of the UNP related to the protection of water resources in the area are under threat by various risk factors (landslide, erosion, flooding, etc.). In this context, it has been determined that there is no risk action plan in the administrative units. It has been determined that no studies, examinations or measurements have been made for a factor that creates a large negative externality such as erosion. It has been observed that there is no study on the interaction of the area water source with biodiversity, carbon sequestration and other parameters. At this point, studies on field hydrology and their interactions with the research field will provide benefits for the holistic management of the field.

These conclusions and recommendations represents an approach to the total economic value and management practices of the UNP. It is clear that the area has biological and ecological benefits that have not yet been explained, and that the total economic value will increase when these benefits are revealed in other studies in the future.

Note: This study was produced from doctoral thesis.

Researchers Contribution Rate Statement Summary of Researchers

The authors declare that they have contributed equally to the manuscript.

Conflict of Interests Statement

"The author(s) declare that they have no known competing financial or non-financial, professional, or personal conflicts that could have appeared to influence the work reported in this paper."

References

Amacher, G.S., Ollikainen, M. and Koskela, E., 2009. Economics of Forest Resources. MIT Press, Cambridge. 424p.

Anonymous, 2017a. https://data.worldbank.org/indicator/ER.LND.PTLD.ZS?end=2014&locations=TR&name_desc=true&start=1990&view=chart, (24.04.2023).

Anonymous, 2017b. Protected Area Statistics. https://www.protectedplanet.net/, (24.04.2023).

Boman, M., Jacobsen J.B., Strange N., Norman J., 2010. Forest amenity values and the rotation age decision: A Nordic perspective. Ecological Bulletins. 53: 7-20.

Braden, J.B., Kolstad, C.D., 1991. Measuring the Demand for Environmental Quality. Elsevier, Amsterdam.

BTOM, 2020. Bursa Directorate of Provincial Agriculture and Forestry. Bursa.

Burgess, J. C., 2000. Economics of Tropical Forest Land Use. Doctoral Thesis. University College London, Department of Economics. Doctoral Thesis.

Croitoru, L., 2007. How Much are Mediterranean Forest Worth. Forest Policy and Economics. 9: 536-545.

Daşkın, R., 2008. Flora of Uludağ Mountain. Bursa Uludağ University, Institute of Science, Department of Biology. Doctoral Thesis.

Dixon, J.A., Scura L.F., Carpenter L.A. and Sherman P.B., 1994. Economic Analysis of Environmental Impacts. Earthscan, London.

Erten, S., Gündüz, P., 2011. Peyzaj Planlama ve Kentsel Tasarımda Koruma-Kullanma için Yeni Bir Sistem Yaklaşımı Önerisi: Uludağ Milli Parkı ve Rejenerasyon. Megaron. 6(2): 109-122.

Faustmann, M., 1849. On the determination of the value which forest land and immature stands possess for forestry. Reprinted in Journal of Forest Economics, 1(1995): 7-44.

Gret-Regamey, A., Brunner, S.H. and Kienast, F., 2012. Mountain Ecosystem Services: Who Cares? Mountain Resources and Development. 32(s1): 23-34.

Hartman, R., 1976. "The harvesting decision When a Standing Forest Has Value." Economic Inquiry, 14: 52-8.

Huber, R., Rigling, A., Bebi, P., Brand, F.S., Briner, S., Buttler, A., Elkin, C., Gillet, F., Gret-Regamey, A., Hirschi, C., Lischke, H., Scholz, R.W., Seidl, R., Spiegelberger, T., Walz, A., Zimmerman, W. and Bugman, H., 2013. Sustainable land use in mountain regions under global change: synthesis across scales and disciplines. Ecology and Society. 18(3): 36.

Karacan, A. R., 2007. Çevre Ekonomisi ve Politikası. Ege Üniversitesi Yayınları. İzmir, Türkiye, 763s.

Kroupova, Z.Z., Havlikova, M., Halova, P. and Maly, M., 2016. Economic Valuation of Mountain Landscapes and Ecosystems: A Meta-Analysis of Case Studies.Agris on-line Papers in Economics and Informatics. 8(3): 103-112.

OECD, 1995. The Economic Appraisal for Environmental Projects and Policies- A Practical Guide. OECD, Paris.

Özhatay, N., Byfield, A. ve Atay, S., 2003. Türkiye'nin Önemli Bitki Alanları. Doğal Hayatı Koruma Vakfı Yayınları. İstanbul, Türkiye. 88s.

Swallow, S.K., Sedjo, R.A., 2000. Eco-Labeling Consequences in General Equilibrium: A Graphical Assessment. Land Economics. 76: 28-36. doi: 10.2307/3147255

Winpenny, J.T. 1991. Values for the Environment. A Guide to Economic Appraisal. Overseas Development Institute. HMSO, London.