

Economic Values of Supplier Resource Products in Mountain Forest Ecosystems: The Case of Uludag National Park

Gokhan UZEL^{1,*} and Serkan GURLUK²

¹Department of Crop and Animal Production, Bursa Uludag University, Karacabey, 16700, TURKEY

²Department of Agricultural Economics, Bursa Uludag University, 16059, TURKEY

Received: 04.07.2022; Accepted: 28.11.2022; Published Online: 14.12.2022

ABSTRACT

As a source of livelihood and sustainable development, the sources of supply crops in ecosystems have been widely accepted. However, the efforts made to evaluate these resources in a comprehensive way remained at a low level. In this research, it is aimed to make comprehensive estimations of the benefits of the supplier products found in Uludag National Park (UNP). Six main supplier product groups have been identified. Agricultural production, industrial wood, firewood, grazing, beekeeping and other non-wood forest products. The data were obtained from the units of Bursa Forestry Regional Directorate that make up the UNP. The obtained data were evaluated economically by various techniques. The results of the research showed that the supply products in the UNP provide an annual benefit of \$12 488 974 and 985.63/ha. In this context, the research reveals the degree of importance of the benefits provided by the supplier products. It also discusses policies that can be implemented to increase rural income and improve forest protection in the UNP region.

Keywords: Mountain-forest ecosystems, supplier benefits, economic evaluation, Uludag National Park

INTRODUCTION

Uludag National Park provides a variety of wood and non-timber forest products. It provides products such as honey and pasture fodder, and contributes significantly to the well-being of many rural people. Other resources make essential contributions to local and national economies. However, many supply values are also unknown to decision-makers.

Limited recognition of supply values is often due to insufficient knowledge of their importance and value. Statistical data at the regional and national levels are often incomplete or scattered. In particular, there is little reliable information on non-timber forest products traded in small local markets and consumed for subsistence (Gram 2001; Bishop 1999). In the Uludag ecosystem region, it is apparent that a significant portion of the products offered by suppliers escapes official markets, and therefore there is a lack of data. This leads to economic and environmental pressures. It increases deforestation through alternative land use, and unsustainable collection of certain non-timber forest products can lead to resource depletion or environmental damage (erosion, etc.). These situations can lead to welfare losses in the long run.

Most efforts to estimate these benefits have focused only on products traded in official markets. No studies have been conducted to demonstrate the value of benefits such as grazing and non-timber forest products. Most attempts to value non-timber forest products also remained local and weak. Estimates at a larger scale, both locally and nationally, are needed to estimate the contribution of supply parameters for mountain-forest ecosystems to economic well-being (Neumann and Hirsch 2000). In this context, this research aims to partially fill this gap by providing comprehensive estimates of supply product values in Uludag National Park (UNP).

The research first summarizes the scope and specific objectives of the study. It then identifies the supply value parameters and economic values in Uludag National Park under the methods and approaches used in the assessment. Finally, some recommendations for improved forest policy in the study area are presented.

* Corresponding author: uzeltokhan@uludag.edu.tr

MATERIALS AND METHODS

Within the scope of Uludag National Park Management Plan, as settlements in interaction with the area, the municipalities of Nilüfer, Yildirim, Kestel, and Gursu, which are affiliated to Bursa Metropolitan Municipality, and the settlements of Kirazlı, Süleymaniye, Soğukpınar, Bağlı, Hüseyinalan, Alaçam, and Saitabat, which are affiliated to these municipalities, are considered as UNP research area. Kestel and Gursu districts, located in the east and northeast of the city and 12 km away from Bursa city center, are almost united with Bursa city. It can be said that urban development threatens the vegetation on the foothills that supports UNP.



Figure 1. Uludag National Park.

Table 1. Populations of settlements interacting with the UNP between 1990 and 2020.

SETTLEMENT	1990	1997	2000	2007	2013	2020
Kirazlı	2 663	1 638	1 976	1 581	910	955
Süleymaniye	176	253	254	53	167	145
Soğukpınar	512	819	780	230	325	311
Bağlı	535	523	557	487	426	416
Hüseyinalan	268	265	299	81	120	101
Alaçam	566	517	572	419	584	487
Saitabat	308	345	389	285	480	402
TOTAL	5 028	4 360	4 827	3 136	3 012	2 817

Source: BOBM 2014; Anonymous 2019.

In 2020, the total population of settlements interacting with Uludag National Park was 2,817 (Table 1). Comparing 1990 and 2020, we can see that the population is decreasing. The settlement areas of Süleymaniye and Hüseyinalan are mostly inhabited only in summer, and permanent residence is limited. The reality of rural Turkey can be seen in this region. It can be stated that the young population has left the region due to unemployment, and if this situation continues, the region could be abandoned in 20 years. In terms of the robust protection of the ecosystem, this decline can be considered a good development. However, local people, traditions, cuisine, architectural styles, local crops and animal species based on local genetic resources are part of the regional texture and should be protected.

One of the various livelihoods of households living within the boundaries of the UNP are recreational services such as ski instructors and guides for visitors coming to Uludag. Picnic area services and trout farming are conducted in various forest parts. However, as noted in international declarations, there is little or no awareness of sustainable management of mountain areas, such as rural development, food security, culture, and tourism.

Local people within the boundaries of UNP meet their needs for firewood from the forests, and the primary sources of income are agriculture and livestock. In this context, the data on the distribution of settlements in the UNP research area are presented in Table 2.

Table 2. Area composition of rural settlements near the area (ha).

SETTLEMENT (ha)	Settlement area	Forest Area	Pasture
Kirazlı	168.3	-	-
Soğukpınar	29.6	4 911	-
Bağlı	16.4	1 317	-
Hüseyinalan	50	1 816	-
Süleymaniye	25	212	-
Alaçam	28	1 017	11
Saitabat	48	1 412	8
TOTAL	365.3	10 685	19

Source: BTOM 2020

*The pasture area in Süleymaniye has been removed from the status of the pasture area because it has deteriorated.

10 685 ha of the 12 762 ha area in UNP is forested. Industrial and fuelwood production, non-timber forest products, traditional grazing, agriculture, and water resources fall within the scope of forest ecosystem supply services. In this context, the importance of on-site resource management is increasing. At this stage, it can be said that the most important economic value in the area is agricultural production.

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). 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.

RESULTS AND DISCUSSION

Traditional agriculture and crop production

Much of the agriculture in UNP is small-scale farming, and there are fewer farms producing products for sale in traditional markets. The table below (Table 3) provides information on agricultural activities in seven rural settlements in UNP.

Table 3. Distribution of agricultural land in settlements in UNP in 2019 (ha).

Settlement (ha)	Agricultural Land	Field crops	Vegetable Products	Fruit Products	Unused Agricultural Land	Fallowing
Kirazlı	1012.6	235	58	658.9	60.7	-
Soğukpınar	417.1	28.5	2.1	118.3	168.2	-
Bağlı	522.7	33	10.5	77.7	301.5	100
Hüseyinalan	35.7	13	2.9	19.6	0.2	-
Süleymaniye	-	-	-	-	8.5	-
Alaçam	295	31.2	11.8	85	110	-
Saitabat	57.5	10	1.5	22.4	18.6	-
TOTAL	2340.6	350.7	86.8	981.9	667.7	100

Source: BTOM 2020

The largest area in UNP is the Kirazlı settlement. About half of the total agricultural land of 2 340.6 hectares is located in this settlement. Kirazlı is followed Bağlı settlement with 522 hectares of agricultural land. Sogukpinar and Alacam follow these two settlements, with agricultural lands of 417.1 and 295 hectares, respectively.

The settlement of Süleymaniye is a summer area, and permanent residence is limited in this area. Therefore, there is no agricultural activity in this area. Since Saitabat is a settlement whose primary source of income is tourism, agricultural activity is also at a quite low level.

In terms of vegetable and fruit products, the settlement of Kirazlı ranks first. The amount of unused agricultural land, especially in Sogukpinar and Bağlı settlements, is remarkable. As for the general production category, fruit products dominate. The cultivation of strawberries, raspberries, and cherries stands out.

In this context, it is possible to determine the economic value derived from the cultivation of agricultural products. It is emphasized that determining the value of natural resources is of great importance for successful environmental management (Bann 1998). Production value approach was used to determine the economic value in agricultural product cultivation. The calculation of economic value was based on the data provided by the Provincial Directorate of Agriculture and Forestry in Bursa. In this direction, the values used to determine the production value of crop products in UNP are:

- Agricultural cultivated area by product type
- Average yield per hectare by product type
- The market price of the product
- and the values of the quantity of product sold.

The economic values of crop production calculated in this context are shown in Table 4.

Table 4. UNP crop production value.

Settlement	Cultivation Area (da)	Total yield (Ton)	Economic value (\$/Year)
Kirazlı	9 320	22 356.6	6 949 531.8
Sogukpinar	1 549	1 537.2	1 027 755.1
Bağlı	1 212	1 434.7	926 352.4
Hüseyinalan	365	360.4	188 021.3
Süleymaniye	-	-	-
Alaçam	640	634	312 749.4
Saitabat	110	96	266 719.0
TOTAL	13 196	26 418.9	9 671 129

Source: BTOM, 2020

When we look at the values in Table 4, UNP produced an economic value of crop production of 9 671 129 \$ as of 2019. Kirazlı settlement ranks first in agricultural production, and the ratio, which is about 50 percent for the agricultural area, is 71.8 percent for economic value. Again, Sogukpinar and Bağlı settlements are considered settlements that produce significant economic value.

A similar picture emerges when the statistics for total yield and cultivated area are examined. Kirazlı settlement produced 22 356.6 tons, and Sogukpinar and Bağlı settlements produced 1 537.2 and 1 434.7 tons of crop products, respectively. The total crop yield was 26 418,9 tons.

When we compare the economic value of the crop product obtained in 2019 with the area of 12 762 ha, which is the area size of UNP, the UNP generates an economic value of 757.80 \$/year per hectare.

Livestock

Another parameter of agricultural production is the economic profit obtained from livestock and animal husbandry, and another important source of livelihood in UNP is animal husbandry. In line with the interviews held with the Provincial Directorate of Agriculture and Forestry in Bursa and the region's residents, data on livestock production in the research region UNP were collected. The obtained data are presented in Table 5.

Table 5: The total number of animals in Uludag National Park (head).

SETTLEMENT	Breeding Cattle	Crossbred Cattle	Domestic Cattle	Sheep	Goat
Kirazlı	120	75	-	1 451	55
Soğukpınar	33	26	14	270	-
Bağlı	142	83	3	1 237	1 354
Alaçam	111	137	-	-	14
Saitabat	3	24	2	-	-
Hüseyinalan	-	-	-	-	-
Süleymaniye	-	-	-	32	30
TOTAL	409	345	19	2 990	1 453

Source: BTOM, 2020

When we examine the total number of UNP animals, we find that it is in favor of ovine breeding. The total number of 4 443 sheep and goats is compared to 773 cattle fattening animals. Dairy breeds make up a large part of cattle breeding activities. Similar to the crop production values, it can be seen that the weighted production is realized in Kirazlı and Bağlı settlements, and Alaçam settlement follows them. Subsistence agriculture dominates in the other settlements. The activity other than subsistence agriculture is the number of milked animals. Table 6 shows the number of milked animals.

Table 6. Uludag National Park total number of milked animals (head).

SETTLEMENT	Breeding Cattle	Crossbred Cattle	Domestic Cattle	Sheep	Goat
Kirazlı	72	50	-	1 117	41
Soğukpınar	13	11	13	201	-
Bağlı	75	31	2	957	764
Alaçam	61	53	-	-	11
Saitabat	3	8	2	-	-
Hüseyinalan	-	-	-	-	-
Süleymaniye	-	-	-	32	29
TOTAL	224	153	17	2 307	845

Source: BTOM 2020

Dairy breeds dominate the animal population, and meat breeds have no economic importance. The activity is carried out as subsistence breeding, and the total values of milk production from milked animals that are not subsistence activities are shown in Table 7.

Table 7. Total milk production in Uludag National Park (tons).

SETTLEMENT	Breeding Cattle	Crossbred Cattle	Domestic Cattle	Sheep	Goat
Kirazlı	504	300	-	335.1	30.7
Soğukpınar	91	66	11.7	60.3	-
Bağlı	525	186	1.8	287.1	573
Alaçam	427	318	-	-	8.2
Saitabat	21	48	1.8	-	-
Hüseyinalan	-	-	-	-	-
Süleymaniye	-	-	-	6.4	21.7
TOTAL	1 568	918	15.3	688.9	633.6

Source: BTOM 2020

When we look at the values of UNP total milk production, we find that there is a cow milk production of about 2 500 tons. In sheep farming, the total annual milk production is 1 322 tons. Again, most of the production takes place in the settlements of Kirazlı, Soğukpınar, and Bağlı. It can be seen that ovine livestock production is more intensive, especially in Bağlı settlement. The annual economic value created within the realized production is given in Table 8.

Table 8. The total economic value of livestock breeding in Uludag National Park

Type of livestock	Economic value (\$/year)
Breeding Cattle	514 773.4
Crossbred Cattle	301 378.8
Domestic Cattle	5 022.9
Sheep	490 151.0
Goat	312 015.7
GRAND TOTAL	1 623 342

*National Milk Council raw milk price recommendation from January 1, 2020, to December 31, 2020; cow: 2.30 TL/kg, sheep: 4.60 TL/kg, goat: 3.45 TL/kg.

When we look at the total economic values of UNP livestock farming, we find that the largest economic income item is breeding cattle. Breeding cattle is followed by sheep breeding with a 514 773.4 \$/year value, followed by income from goat and crossbred cattle. The total economic income created by UNP in 2019 was 1 623 342 \$/year. If the economic income from cattle breeding is considered in the area of UNP, the annual income is 127.20 \$/ha.

Industrial wood production

Another economic value item for UNP is industrial wood production. In the production of wood, which is considered a source of supply in mountain and forest ecosystems, two types of utilization are mentioned—the commercial form of utilization and the non-commercial form of utilization (FAO, 2017). While the commercial form of utilization consists of using tree resources for the production of industrial timber, logs, sawn timber, pit timber, pulpwood, and fiber-chip wood, the non-commercial utilization consists of leaving forests in their regime and pursuing the development of values such as carbon storage, biodiversity, and so on.

Since wood products have become available for industrial markets, it has become easier to determine the economic value they create. Numbers such as logging, transfer, and marketing values can be easily tracked, and total economic value can be determined. At this point, Pearce and Pearce (2001) found in their study that sustainable management practices for upland forests that include regulation of economic value parameters such as carbon management, biodiversity, and water resources generate less economic value than unsustainable timber production activities that include industrial and fuelwood harvesting. However, given the diversity and complexity of mountain-forest ecosystems, there are still many uncertainties. The proportion of reduction rates also plays a critical role in that unsustainable forest management practices such as timber production are more profitable than sustainable forest management practices. This is because when the non-zero reduction rates are adopted, the opportunity costs of timber production begin to emerge. Considering that the general rule in forest management is considered successful when the benefits derived from the forest system are maximized, for a successful forest rotation model, the economic benefits from non-timber benefits should not be less than the benefits from traditional forestry activities.

In this context, timber production is not allowed within the boundaries of the National Park, and the focus is on the carbon storage value of the forest rather than the commercial timber value. However, to meet the needs of the national park's villagers and supply the markets with needed raw materials, the public carries out industrial timber production in the region. The trees harvested in the region are categorized and marketed as industrial timber, fine and split industrial timber, logs, pit timber, pulpwood, bark paper wood, and fiber-chip wood. The area harvested, the number of trees harvested, and the number of trees sold in the UNP region are shown in Table 9.

Table 9. Industrial wood production

FOREST AREA	Harvested area (ha)	Quantity Harvested(m ³)	Quantity Sold(m ³)	Market Value (\$)
Uludag National Park	-	-	-	-
Kirazlı	36	1 505	1 060	87 522.8
Hüseyinalan	88	2 988	2 707	223 513.5
Sogukpinar	80	2 780	2 780	82 753.7
Baglı	115	3 446	3 446	80 016.9
Alaçam	-	-	-	-
Saitabat	-	-	-	-
Süleymaniye	-	-	-	-
TOTAL	319	10 719	9 993	473 664.36

Note: The table includes values for industrial wood, fine and splits industrial wood, logs, pit wood, paper wood, bark paper wood, and fiber-chip wood (market values are the sum of softwood and hardwood values).

Source: BOBM 2020

When we look at Table 9, it is clear that there are four settlement areas where industrial cut is performed. The largest harvest area is in Bagli settlement with 115 ha. It is followed by Huseyinalan with 88 ha and Sogukpinar and Kirazli with 80 and 36 ha, respectively. According to the information, there is no industrial cut in the other three settlements. After sorting out the waste, the cut quantities are primarily offered to the market.

Looking at the cut quantity, we can see that the Bagli settlement ranks first with a cut quantity of 3 446 m³. Sogukpinar, Huseyinalan and Kirazli follow it. In 2019, 4 493 m³ of timber was harvested from 319 ha, and 3 767 m³ was offered to the market.

In the economic evaluation of industrial timber, the timber value is based on the data of annual sustainable production (m³). In addition to the harvested, cut, and sold timber values, the Bursa Regional Forestry Directorate provided information on logging maps and logging sales figures.

Considering the economic value of timber production in the National Park within the framework of this information, it is found that the highest economic return is obtained in the settlement of Huseyinalan with a value of 223 513.5 \$/year. It accounts for about 50% of the total industrial economic value in the research area. It is followed by Kirazli, which accounts for 18.4% of the industrial economic value, Sogukpinar for 17.4%, and Bagli settlement for 16.8%.

In this context, it was estimated that UNP's economic value of industrial timber production is 473 664.36 \$/year, and the economic value per hectare is 37.115 \$/year.

Firewood production

A large part of the firewood needs in UNP is met by selling the woodcut in the area to the local population. Households referred to as "forest villagers" report that they cannot secure a reliable supply of firewood and are therefore forced to cut illegally. For this reason, trees are harvested in the area to meet the region's firewood needs. The quantity of firewood harvested and sold in this context is shown in Table 10.

Looking at Table 10, it can be seen that the quantity of trees harvested for firewood production in the 319 ha area mentioned in the previous section is the highest in Kirazli settlement with 885 m³. Saitabat and Alacam follow it with cut volumes of 780 m³ and 750 m³. Again, it can be seen that there are cut quantities in Bagli and Sogukpinar that have economic value. In Bagli and Sogukpinar settlements, the quantity of cutting is 657 m³ and 532 m³, respectively. Finally, in the low-population settlements of Huseyinalan and Suleymaniye, the annual cut volumes are 205 m³ and 110 m³, respectively. Much of the woodcut for fuelwood production is sold, and if any is left over, it is donated to the residents in the region.

Table 10. Firewood production in Uludag National Park.

SETTLEMENT	Harvested (m ³) Quantity (m ³)	Sold (m ³) Quantity (m ³)	Market Value (\$/Year)
Kirazlı	885	885	13 855.2
Hüseyinalan	205	205	3 209.3
Soğukpınar	532	532	3 487.4
Bağlı	657	657	4 492.9
Alaçam	750	750	11 741.6
Saitabat	780	780	12 211.3
Süleymaniye	110	110	1 722.1
TOTAL	3 919	3 919	50 720.10

Source: BOBM, 2020

In this context, if we consider the economic value created by firewood production, the settlement of Kirazlı ranks first with 13 855.2 \$/year. It is followed by Saitabat settlement with 12 211.3 \$/year and Bağlı settlement with 4 492.9 \$/year. It can also be seen that Soğukpınar, Bağlı, and Hüseyinalan settlements generate significant economic value through the sale of firewood.

The total economic value created by the sale of firewood from UNP is estimated at 50 720.10 \$/year, and the economic value per hectare is 3.97 \$/year.

Grazing

Animals grazing in forests or pastures eat 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. Since the taxes are usually nominal wages, they do not reflect the actual value of the grazing activity. Therefore, the forage used for grazing activities is estimated using the substitution approach. The amount of forage grazed annually in forests and pastures is converted into the equivalent of forage units based on a comparison of nutrient content (Croitoru 2007).

In this context, to determine the economic value of forage in pastures, the forage production per hectare on these lands was calculated, taking into account the pastures in the settlements of Alaçam and Saitabat in UNP. According to the UNP grazing plan, the areas approved for grazing activities and their sizes are the Buyukdere Plateau and Celebiyayla regions, which include the utilization areas of Yaylim Hill in the north, Altınpınar Hill in the south, Buyukdere and Celebiyayla settlements in the west and Kacakciyolu village in the west.

The grazing system is pastoral grazing. The condition of the grass and the yield of the pasture is in a "good" condition. A total of 2 000 sheep and goats are allowed to graze on these lands. Grazing occurs in Celebiyayla locality in the years ending with an even number and in Buyukdereyayla locality in the ensuing odd years. The grazing season is between June 1 and October 15 (BOBM 2019). In addition to the 543.25 hectares of grazing land in the UNP area, there are 562.25 hectares of grazing land in the region, including 19 hectares of grazing land in the settlements of Saitabat and Alaçam. The current usage rates of forages (usable hay yield) were determined through the interviews held with the authorities. Since the yield status of pastures was categorized as "good," the grass yield was assumed to be between 75-90%. In this context, the annual economic value created by the grazing activity is presented in Table 11.

In line with the information obtained from the Provincial Directorate of Agriculture and Forestry in Bursa, it was determined that 562.25 ha of pastureland had a hay yield of 8 ton/ha per unit area (Table 11). Accordingly, it was estimated that the total usable forage per unit area was 4.498 tons. The unit forage price for pastures in the region is 0.95 TL/kg. When these values are multiplied together, the economic value of UNP grazing was estimated to be 609 937.48 TL/year. Accordingly, the economic value per hectare from grazing was estimated at 47.7 \$/ha.

However, it was found that grazing is done with herders and is largely unplanned in UNP. It was calculated that the number of animals allowed to graze in the area far exceeded the grazing capacity of the area (Cacan and Kokten 2014). An optimal and sustainable grazing strategy is not followed. As a result of uncontrolled grazing, the species and endemic species living in the area are likely to be harmed. It was noted that there is no detailed data set for the area's unique features. In this case, another economic value parameter is a severe threat and economic loss for species such as non-timber forest products (mushrooms, honey, etc.).

Table 11. The economic value of forage for grazing.

The economic value of forage for grazing								Economic Value (TL)
	UNP (ha)	Settlement Grazing Area (ha) in relation to UNP	Total (ha)	Forage-dry grass produced per unit area (ton/ha)	Usable feed per unit area (ton)	Current usage (kg at 90% efficiency level)	Price (TL/kg)	
Forest soil (pasture)	543.25	19	562.25	8 ton	4 498	4 498 ton=4 498 000 kg	0.95	4 273 100
Total								609 937,48 “47.7 \$/ha”

*Current forage usage rates (usable hay yield) were obtained from interviews held with the authorities. **The yield status of the pasture is considered to be in the "good" category. In this case, weed yield is accepted to be between 75-90%.

Non-timber forest products

This category includes species in upland forest ecosystems such as chestnuts, cones, bay shoots, acorns, and barkless fruits. These products are usually sold in local markets, and their economic value is estimated based on market prices (Croitoru 2007). However, the markets established for these products are in a fragile state. Therefore, market prices and product volume statistics for these values can be misleading. In this context, production value approach should be preferred when market values cannot be obtained. In the case of unavailable values, determining economic value using the benefits transfer approach from a neighboring country with similar mountain forest conditions is preferred (Turker et al. 2005).

The approach for determining the economic value of non-timber forest products is based on market prices according to the data provided by Bursa Regional Forestry Directorate. At this point, the data needed for the valuation are:

- The total annual yield of the products concerned,
- The quantities of the products reserved for consumption,
- The quantities of the products sold,
- Market prices (TL/kg) (Bann 2010).

There is no inventory or sub-plan for non-timber forest products in UNP research area, no production and carrying capacity data are available, and available data are minimal. In line with the data obtained in this context, species with economic value, harvest volumes, and market prices in UNP were obtained from Bursa Regional Forestry Directorate, Non-Timber Forest Products Department. The total yield is intended for the market. Considering the information obtained in this direction, the economic value of non-timber forest products in UNP is given in Table 12.

Table 12. Production and economic value of non-timber forest products in Uludag National Park.

Non-timber Products	Forest	Quantity Sold	Unit Value (\$/kg)	Total Economic Value (\$)
Bush Wood		386 m ³	-	1 652.9
Laurel Sprout		1 611 057 kg	0.117	27 595.2
Chestnut		9 635 kg	0.039	384.9
Cone		118.038 kg	0.018	2.18
TOTAL		-	-	29 635.30

Source: BOBM 2020

When we look at the annual economic value created by non-timber forest products, we find that laurel sprouts create the highest yield in the region. In 2019, the economic yield of laurel sprouts was 27 595.2 \$/year. It is followed by bush wood with 1652.9 \$/year and chestnut with 384.9 \$/year. The cones were also obtained in a minimal amount. UNP's total economic value of non-timber forest products is 29 635.30 \$/year.

Accordingly, it was estimated that the economic value obtained from the production of non-timber forest products is 2.32 \$ per hectare in UNP. However, as mentioned in the previous sections, the regional forestry directorates do not have a detailed inventory of non-timber forest products, and it is stated in the UNP management plan that there is no inventory of non-timber forest products in the region, so it is necessary to expand the calculated economic values.

Beekeeping

The economic valuation of honey, another product of the upland forest ecosystem, is based on the amount of honey produced by beehives in the region and the market prices. In most countries, data on the amount of honey produced in forests and adjacent areas are available in aggregate form. The estimation is based on the number of hives placed in the forests and the data on the yield of the hives (Croitoru 2007).

The data on honey production in the region was obtained from the Beekeepers Association of Bursa (BAYBIR). The information obtained is presented in Table 13.

Table 13. Honey production and economic value (Uludag National Park).

Area	Honey Production (per hive)	Number of Active Hives	Market Price of Honey (\$/kg)	Honey Type	Honey production total (kg)	Total Economic Value (TL/Year)
UNP	15-18 kg	365	5.70 \$ Retail	Flower and Secretion Honey	5 350 kg	30 546.11 \$/Year

*The economic life of a hive is ten years.
Source: BAYBIR 2020

Honey production in UNP takes place in Suleymaniye, Kirazli, Sogukpinar, Bagli, Guneybudaklar, Kucukdeliler and Buyukdeliler settlements, which are located near the National Park. The data are based on the information obtained from these settlements. There is no honey production in the area of the National Park.

The average honey production per hive in UNP varies between 15 and 18 kg. There are 365 active beehives, and flower and secretion honey are produced. In 2019, the total annual honey production of the region was 5 350 kg. The market price of honey obtained from the region is 5.70 \$/kg. Based on the available data, the total economic value of honey produced was estimated at 30 546.11 \$/year. The value of UNP per hectare obtained from honey production was 2.39 \$/ha.

UNP supply parameters' overall economic value

Table 14 summarizes the final and general results of the UNP valuation application. UNP's estimated total economic value based on different products and services was estimated at 12 488 974.6 \$/year for 2019, and the economic value per hectare was 978.60 \$/ha.

Table 14. The total economic value of the supply products and services in Uludag National Park

Ecosystem Category	Service	Product or Service	Total Economic Value (TEV)-2020 (TL)	Total Economic Value-2020 (\$)	\$/ha
Supplier		Crop	67 753 997	9 671 129.20	764.85
Supplier		Animal product	11 372 810	1 623 342.08	127.20
Supplier		Industrial wood	3 318 397.8	473 664.36	37.11
Supplier		Firewood	355 334.9	50 720.10	3.974
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
Grand Total		-	87 495 258.7	12 488 974.66	985.63

*Exchange rate; \$1 = 7.0058 TL.

Looking at the components of the economic value of UNP, the ratio of economic income from crop and animal production to total economic value is 90.4%. The total share of industrial timber, firewood, pastureland, non-timber forest products, and beekeeping is 10%. Within this share, the economic value of 609 937.48 \$/year and the total value obtained from grazing activity is about 5%. The remaining economic value shares are 3.7% from industrial timber, 0.4% from firewood, 0.2% from beekeeping, and 0.2% from other non-timber forest products.

Table 15. The total economic value of supply products and services in UNP.

Service/Product	Valuation Method	Value\$/ha	Source
Crop	Market value	764.85	Bann, C. 1998.
Animal product	Market value	127.20	Bann, C. 1998.
Industrial wood	Market value	37.11	Efimed and Ctfc, 2014.
Firewood	Market value	3.974	Efimed and Ctfc, 2014.
Grazing	Market value	47.79	Croituru, L. 2007
Non-timber forest products	Market value	2.32	Chopra, K 1993.
Beekeeping	Market value	2.39	Moran, D 2009.
Grand Total	-	985.63	-

Looking at the economic values obtained per hectare in UNP, the crop production value, which accounts for 81.4% of the total economic value, has the highest economic value per hectare with an economic value of 5 525.50 TL/ha. The value of animal production follows it with 764.85 \$/ha. Industrial wood production has a value of 37.11 \$/ha, and firewood production has a value of 3.974 \$/ha. For grazing, this value is 47.79 \$/ha. For beekeeping and other non-timber forest products, this value is 2.32 \$/ha and 2.39 \$/ha, respectively.

CONCLUSIONS

The economic valuation for the UNP is designed to consider the fundamental economic value categories. The data used for the valuation are based on public institutions and field research data. However, it should be noted that there are deficiencies in the data and resource inventory in public agencies and local governments.

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.

It is observed that there are some problems in the implementation of laws and regulations related to Uludag mountain-forest ecosystem. It is observed that the titles such as the protection of the UMP biodiversity, the protection of natural resources and the determination of the conditions of use are not taken into account. Although it is seen as a positive development that the UMP Water Resources Management Plan, which includes wetlands, rivers, underground water resources and lakes, was put forward in 2019, it can be said that no planning has been carried out in line with the second goal of protecting biodiversity. Again, it was observed that the parameters for the holistic management of mountainous ecosystems, which were expressed in declarations such as "1991 Alpine Convention" and "1992 Agenda 21", were not followed in UMP. In this context, it is clear that there is a low level of awareness in administrative authorities regarding sustainable mountainous area management, expressed in international declarations, such as rural development, food security, culture-tourism.

At this point, as stated in the 2018 Mountain Forum, sustainability parameters such as climate change, food systems, agro-biodiversity, which affect energy and water in mountainous areas, should be carefully monitored. In order for this to happen in UMP, all kinds of political and legal infrastructure must be prepared. It is necessary to take steps by evaluating the environmental impacts of all kinds of projects that concern UMP mountain-forest ecosystem and revealing them with valuation methods.

In evaluating the final and overall results of the UNP assessment study, it was determined that the annual economic value created by Uludag National Park research region through the supply products and services is \$12 488 974.66 year. The economic value per hectare was estimated at \$985.63/Ha. The area has biological and ecological benefits that have not yet been explained. The total economic value will increase as these benefits are revealed in further studies in the future. It is expected that the results will help decision-makers to ensure the ecological sustainability of Uludag National Park and improve environmental quality.

REFERENCES

- Anonymous (2019). Bursa Population Informations. Access site: <http://www.nufusune.com/bursa-nufusu>(accessed: September 2020)
- Bann C (2010). Developing a Business Plan for Kure Mountains National Park and its Buffer Zone. Final Report. Ankara.
- Bann C (1998). The Economic Valuation of Tropical Forest Land Use Options: A Manual for Researchers. A Report for Economy and Environment Program for Southeast Asia Organization. Singapore.
- BAYBİR (2020). Face to face interview. Bursa Beekeepers Association. Bursa.(Interview date: 04/05/2020).
- Bishop JT (1999). Valuing Forests: A Review of Methods and Applications in Developing Countries. International Institute for Environmental and Development, London. 48pp.
- BOBM (2014). Uludağ National Park Management Plan. Bursa Regional Directorate of Forestry. Bursa.
- BOBM (2019). Uludağ National Park Grazing Plan. Bursa Regional Directorate of Forestry. Bursa.
- Braden JB, Kolstad CD (1991). Measuring the Demand for Environmental Quality. Elsevier, Amsterdam.
- BTOM (2020). Bursa Directorate of Provincial Agriculture and Forestry Official Records. Bursa.
- Chopra K (1993). The Value of Non-Timber Forest Products: An Estimation for Tropical Deciduous Forest in India. *Economic Botany*, 47:3. doi: 10.1007/BF02862291.
- Croitoru L (2007). How Much are Mediterranean Forest Worth? *Forest Policy and Economics*, 9: 536-545. doi: 10.1016/j.forpol.2006.04.001
- Çaçan E and Kökten K. (2014). Research on the Yield Herbage and Grazing Capacity of a Range in Çiçekliyayla Village, Central District Bingöl. *Turkish Journal of Agricultural and Natural Sciences*, 2: 1727-1733.
- Dixon JA, Scura LF, Carpenter LA and Sherman PB (1994). Economic Analysis of Environmental Impacts. Earthscan, London.
- EFIMED and CTFC (2014). Optimizing the Production of Goods and Services by Mediterranean Forests in a Context of Global Changes. Methods and Tools for Socio-Economic Assessment of Goods and Services Provided by Mediterranean Forest Ecosystems. Technical Report. Joensuu.
- Gram S (2001). Economic Valuation of Special Forest Products: An Assessment of Methodological shortcomings. *Ecological Economics*, 36: 109-117.
- Moran D (2009). Identification and Valuation of Ecosystem Goods and Services in the Yıldız Mountain Area. Draft Final Report. Ankara.
- Neumann RP and Hirsch E (2000). Commercialisation of Non-timber Forest Products: Review and Analysis of the Research. Center for International Forestry Research, Bogor, Indonesia, p. 176.
- OECD (1995). The Economic Appraisal for Environmental Projects and Policies- A Practical Guide. OECD, Paris.
- Pearce DW and Pearce CGT (2001). The Value of Forest Ecosystems Report for Biological Diversity Convention. University College London.
- Türker M, Pak M and Öztürk A (2005). Valuing Mediterranean Forests: Towards Total Economic Value (s. 195–211) inside. CABI Publishing: Wallingford.
- Winpenny JT (1991). Values for the Environment. A Guide to Economic Appraisal. Overseas Development Institute. HMSO, London.