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Original Article

The Impact of Recreational Use on Land Cover at Uludağ National Park (Turkey)

Serir Uzun[1], Günay Çakır[2], Oktay Yıldız[3], Necmi Aksoy[3], Murat Sargıncı[3], Bülent Toprak[4], Haldun Müderrisoğlu[1]

[1]Department of Landscape Architecture, Düzce University, Faculty of Forestry, Düzce, Turkey
[2]Department of Forestry, Gümüşhane University, Gümüşhane Vocatioanal School, Gümüşhane, Turkey
[3]Department of Forest Engineering, Düzce University, Faculty of Forestry, Düzce, Turkey
[4]Department of Forest Engineering, İzmir Katip Çelebi University, Faculty of Forestry, İzmir, Turkey

ABSTRACT

The intense pressure resulting from population growth and urbanization along with technology has created the need for utilizing natural areas for tourism and recreational purposes and has necessitated the protection, development, and planning of natural resources for people to benefit from. Due to the importance of determining temporal changes within the framework of the protection-use balance, this study examined the changes occurring within the recreational areas of the Uludağ National Park between the years 1970 and 2010 from human use. As a result of the recreational facilities offered to visitors, an average of 550 000 people benefits annually from the area, which was designated as a national park in 1961. The study included the camping and picnic sites of Sarıalan, Çobankaya, Kirazlıyayla, and Karabelen situated within the park and the ski site of the first development zone. High-resolution satellite images and aerial photographs of the areas at different dates were employed. The temporal changes in the selected areas were analyzed by digital image processing with the help of the geographic information system. Upon examining the impact of the recreational use changes occurring on the land cover, it was revealed that building areas had increased by 15 ha (2.57%), road areas by 21 ha (7.89%), and bare land areas by 67 ha (.53%), while the meadowland areas had decreased by 223 ha (119.37%). The forested areas had increased by 78 ha (48.93%), woodland areas by 79 ha (59.37%) and were not adversely affected, mainly due to the protection status of the park.

Keywords: Land use/cover change, natural land, recreation, remote sensing

Introduction

Forests and their environs are important resources that can enhance the quality of life for those who want to escape from their intense working tempo by seeking relief in a natural setting. In particular, the importance of places outside the big cities to camp, picnic, and relax is increasing. The ensuing pressure on natural resources must be controlled by the protection/use balance. In order to preserve the natural balance, it is absolutely necessary that the changes occurring over time should be monitored and undesirable effects should be averted.

Although outdoor recreational activities in a natural habitat may seem harmless enough, the source of these activities creates pressure on the area. The results of these pressures can be observed in the wildlife, vegetation, water resources, and soil. Studies investigating the ecological effects of recreational usage have primarily examined impacts on the vegetation and the soil (Bright, 1986; Jim, 1987) and have emphasized that these effects are severe and long-lasting (Cole, 1993). Recreational activities were observed to impact vegetation more rapidly than they did the soil, primarily in the form of the reduction of seeding and multiplication capacity; the reduction could be observed in the height and leaf size of the vegetation, deterioration of the vegetation composition, reduction of the vegetation cover and as a consequence, in the development of bare soil surface (Edington & Edington, 1986; Liddle, 1997; Marion, 1998; Weaver & Dale, 1978). This situation causes a change in the life cycle and ecological balance, reduces their resistance, and prevents the plants from successfully regenerating.

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Corresponding Author:
Serir Uzun
e-mail:
seriruzun@duzce.edu.tr

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The impacts of visitors and their activities are seen not only on the plants but also on the soil. Recreational activities wear away the upper layer of the soil which is rich in organic substances, resulting in compaction of the soil (Cole, 1993). Monti and Mackintosh (1979) reported that recreational use crushed the soil and reduced its porosity, thus reducing its water retention capacity. Alessa and Earnhart (2000) concluded that this compression caused deterioration of the root structures of the plants and decreased their ability to take in nutrients from the soil. These deteriorations, which are found in the soil structure in the state of recreational use, induce plant loss indirectly, where the soil is causing destruction of the soil (Marion, 1998).

In addition, recreational activities also increase the amount of settlement features such as roads and buildings within the natural areas. Increases may occur over time in the number of accommodation facilities, parking areas, roads, restaurants, etc., due to the growing number of visitors and due to the diversity of the activities on offer. Pickering and Hill (2007) reported that recreational activities as well as the increased infrastructure requirements both had a negative impact on protected areas.

When investigating the recreational effects, it is essential to determine the amount of activity in the current situation, the temporal change of the impact, the relationship between the current situation and the management objective for the area, and the strengths and weaknesses of the management model (Cole, 1990; Hendee et al., 1990). Monitoring of the natural environmental changes in protected areas is important in order to understand the human relationships and interactions, and using the analysis techniques of time/space dimensions is essential in making the right planning decisions. Change analysis is used to reveal the changes occurring in a thing or phenomenon by observing these changes in a historical timeline (Lu et al., 2004), and it is also used to determine the directional and proportional changes of a regional pattern (İnan, 2004). Among the current information technologies, the effective use of historical data to guide future planning is possible only by using remote sensing and the geographic information system (GIS) together (Çakır, 2006; Çakır et al., 2016). The data obtained through remote sensing techniques are widely used today in the analysis of change. For the analysis of land use and land cover change in forested areas, GIS can be applied along with the use of remote sensing techniques for analysis of forest vegetation change, forest loss, forest productivity, renewal, etc. (Lu et al., 2004).

The purpose of this study was to examine the temporal changes occurring in the recreational activity areas within the Uludağ National Park between 1970 and 2010 by utilizing historical data obtained from aerial photographs and high-resolution satellite images. The data for the areas used for various recreational purposes were evaluated by transferring them to GIS databases and carrying out positional analyses with the aim of revealing the temporal effects of the different recreational activities.

Methods

Material

Study area: The Uludağ National Park in Bursa Province, Turkey, was chosen as the study area because it provides recreational possibilities for both the summer and winter months, has a high number of visitors, provides a diversity of recreational facilities, and is situated within convenient proximity of large cities. Uludağ, in the north of western Anatolia, is the highest peak in the Marmara Region, with an altitude of 2543 m. According to the Greenwich meridian, Uludağ National Park is situated between 29° 03′ 16″–29° 16′ 34 east longitudes and 40° 03′ 28″–40° 10′ 17″ northern latitudes (Mengili, 1986).

Uludağ National Park, covering an area of 12 762 ha, is located at the transition point between the Mediterranean and the Black Sea climate zones. Due to its altitude, the continental climate dominates the area, where the average annual temperature is 4.8ºC, and the average annual rainfall is 1.521 mm. The annual number of snowy days is 81.2, with the maximum snow depth measured as 430 cm. The prevailing wind directions are north, north-west and south-west. In the area where most of the hotels are located, the average duration of snow cover is 180.3 days (Öztürk, 2010).

The most important feature of the national park is the forest belt formed by the plant communities changing from the Bursa Plain up to the peaks of Uludağ. A significant place in world forestry literature is given to the botanist Mayer for the characterization of the plant belts at various altitudes. The National Park has about 137 endemic species in terms of plant diversity including 31 species endemic for Uludağ and 107 species endemic for Turkey. Moreover, Uludağ constitutes the habitat for three endangered species and for 54 species within the European distribution range (DKMPGM, 2008).

Uludağ National Park provides an opportunity for a variety of recreational activities, including picnicking, camping, skiing, and mountaineering. The picnic sites of Sarıalan, Kirazlıyayla, and Karabelen, the camping sites of Çobankaya and Sarıalan, all located within the Uludağ National Park, and the first tourism development zone were determined as the study areas, encompassing a total of about 70 ha. The reason for choosing only these sites for the research was the fact that the visitor intensity is very high in these areas, while recreational use is not allowed in other areas of the park.

Uludağ National Park is the center of winter tourism in Turkey in terms of its accommodation, recreational, and entertainment facilities along with the ski slopes and mechanical facilities. Within the first development zone, there are 15 accommodation facilities operated by public institutions and 19 operated by the private sector as well as 16 mechanical facilities (DKMOGM, 2008).

The Uludağ National Park hosts an average of 545 319 visitors per year, with the most highly visited months being July,

February, January, August, March, December, June, April, September, May, November, and October, respectively (ÇED, 2008). Although Uludağ National Park is the most important winter tourism center, most visitors come to the park in July due to the fact that it offers recreational activities such as camping, picnicking, and nature walks, and consequently, the park has become a focus point for visitors also in the summer (Akesen, 1978).

Raster data: The following raster data were used to analyze the temporal changes occurring in the land types of the recreational usage areas in Uludağ National Park:

1. Topographic maps at a scale of 1/25 000 prepared by the General Command of Cartography,
2. Pan-sharpened Color QUICKBIRD PAN AND QUICKBIRD MS 4 Band satellite images were taken in 2010 with a spatial resolution of .56 m,
3. 1.0 m Pan-sharpened Color IKONOS 4 Band satellite images were taken in 2004,
4. Digital landscape type maps of the Forest Management Plan (FMP) at a scale of 1/ 25 000,
5. Black-and-white aerial photographs at an average scale of 1/22 000 taken in 1970, and calibration information.

Vector data: The following vector data were used to analyze the temporal changes occurring in the land types of the recreational usage areas in Uludağ National Park:

1. Vector land-use map obtained by the controlled classification of the Landsat Satellite image,
2. Equivalent height curves with 10-m intervals,
3. Digital terrain model database obtained by the digital and visual interpretation of the satellite images/aerial photographs.

Methods

The remote sensing data of the five picnics/camping sites and the first development zone located in different places were first coordinated with the European Datum ED 50 coordinate system via image processing software. The Erdas Imagine 8.3 module was used to transfer the aerial photographs to the coordinate axis. Ortho images (1-m accuracy) were created by using the calibration information of the aerial photographs and the digital terrain model of the area. The high-resolution satellite images were coordinated with the help of the digital terrain model, ground control points, and 1/25 000 scale standard topographic maps. Stand maps produced by the General Directorate of Forestry (OGM) Map and Photogrammetry Directorate in 2008 were used as the main source. These maps had been validated by the team making the OGM FMPs. In these FMP maps, the areas within and outside the forest regime are separated with 100% accuracy. The high-resolution satellite images and the aerial photographs were not subjected to controlled classification due to the fact that the study area did not cover a wide area and no residential areas were included. The aerial photographs and the satellite images were classified according to the land-use values predetermined by visual interpretation techniques. Data for the land use taken on different dates were stored in different layers. The remote sensing data obtained were coordinated with the Erdas Imagine 8.6 TM image processing software (in the geographical projection system) and were layered with the help of the Arc/Info 8.3 TM software. Table 1 shows the characteristics of the classified land-use areas. The changes in the obtained layers were given in meter square^2 and percentage. Basically, the image resolution was digitized at a level of 1/1000 in the digital environment. After establishing the database for 2010, transactions were carried out on data of the previous period based on the same layer boundaries. The three different historical layers obtained were combined in the GIS environment, and the temporal changes were analyzed. The data accuracy was also controlled with the help of GPS during the field trials, and the error rate (less than 60 cm) was determined to be the same as the geometric error obtained from the images (Figure 1).

Within the boundaries of the study area, there are forested areas, accommodation areas such as hotels and motels, and other settlement areas. The study area consists of sloping and partially flat terrain and has quite a rich geomorphological aspect.

The inventory result of the study area and the featured data collected from other resources were classified by hand, while the graphical data were entered into the digitized graphical database. The digital layers were integrated among themselves in terms of the spatial databases. At the same time, the findings were revealed by analyzing the differences among the resulting data layers in the GIS environment.

Results

Temporal change values of the Karabelen picnic site: The changes occurring within the Karabelen area are given in Table 2. According to this, the total forested area was 161 408.0 m^2 in 1970 and became 199 642.6 m^2 in 2010 after an increase of

Table 1.
Definition of the Land-Use Class

Status on the Image	Land-Use Class Type
Tree groups	Forested area
A few trees	Woodland
Vegetation areas without trees	Meadowland
No vegetation found	Bare soil area
Various buildings and hotels	Building area
Main and secondary roads	Road area

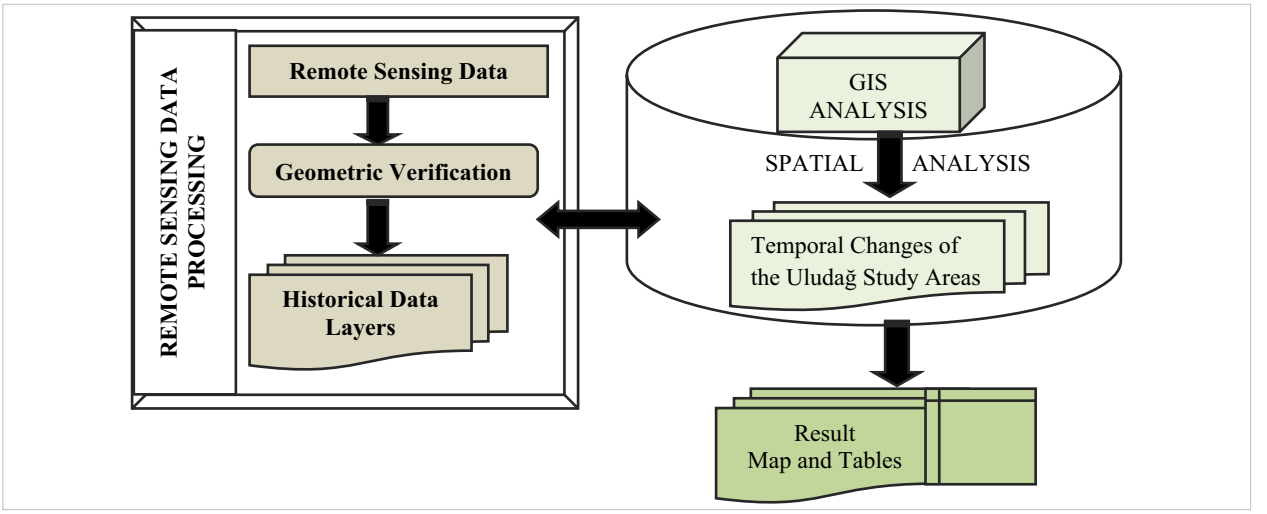

Figure 1.
The Flow Diagram of the Project Area's Remote Sensing Data Processing and Temporal Change Monitoring.

38 234.6 m^2. Increases can be observed in the temporal changes of the land use between 1970 and 2010; the forested area had increased by 15.91% and the building area by .09%, in addition to a 1.79% increase in the road area. On the other hand, a decrease of 1.71% was observed in the woodland area and 12.08% in the meadowland, while a 4% decrease was observed in the bare soil area.

The Karabelen picnic site is used extensively since it is the most easily accessible area within the Uludağ National Park. Not many changes were observed within this area in terms of woodland, building, or road areas. The lodgings made for the forest rangers, the wooden sheds, and the toilet facilities at the entrance gate demonstrated the increase in the building area. The increase in the forested area was assessed as a cause for the reduced meadowland and bare soil areas. In addition, the increase in the number of roads due to land use caused a decrease in the woodland area.

Temporal change values of the Kirazlıyayla picnic site: The changes occurring within the Kirazlıyayla area are given in Table 3. According to this, the total forested area, which was 386 056.3 m^2 in 1970, had increased by 73 268.7 m^2 and totaled 459 324.9 m^2 in 2010. Upon examination of the temporal changes of the land use from 1970 to 2010, it can be seen that the forested area had increased by 12.38%, the bare soil area by 3.16%, and the building area by .31%, along with a 1.70% increase of in the road area. On the other hand, a decrease of 1.42% was observed in the woodland, while the meadowland was reduced by 16.12%.

The Kirazlıyayla picnic site is an extensively used area and not many changes were observed in the woodland, building, or road areas. The guesthouses, hotels, restaurants, snack bars, and toilets along with the national park maintenance center and generator buildings situated in the area accounted for the increase in the building area. The inadequacy of the children's

Table 2.
The Land-Type Temporal Changes Occurred within the Karabelen Picnic Site Between 1970 and 2010 (The Areas Are Given in m^2)

		Type of Land Use in 2010							
		Forest	Wooded	Meadows	Soil	Building	Road	Total	%
Type of Land Use in 1970	Forest	161.408.0						161 408.0	67.18
	Wooded		600.9	2756.0	769.3	77.3	4077.6	8281.0	3.45
	Meadows	26 262.5	3096.4	17 953.8	1096.4	69.3	3794.1	52 272.4	21.75
	Soil	7697.5	490.0	2407.6	265.4	70.4	857.2	11 788.0	4.91
	Building							.0	.00
	Road	4274.5		122.0	57.5		2075.4	6529.4	2.71
	Total	199 642.6	4187.3	23 239.3	2188.6	216.9	10 804.2	240 278.9	
	%	83.09	1.74	9.67	.91	.09	4.50		

Table 3.
The Land-Type Temporal Changes Occurred within the Kirazliyayla Picnic Site Between 1970 and 2010 (The Areas are given in m²)

		Type of Land Use in 2010							
		Forest	Wooded	Meadows	Soil	Building	Road	Total	%
Type of Land Use in 1970	Forest	386 056.2						386 056.2	65.21
	Wooded		76.7	2081.4	5633.9	2074.4	5301.0	15 167.4	2.56
	Meadows	64 898.5	5141.6	53 438.6	20 083.1	2999.2	11 414.8	157 975.8	26.68
	Soil	3146.8	86.0	3827.8	1754.3	391.9	4.7	9211.4	1.56
	Building	1721.9		328.3	52.5	3971.4	1729.6	7803.7	1.32
	Road	3501.5	1441.1	2819.9	433.9	190.3	7434.1	15 820.8	2.67
	Total	459 324.9	6745.3	62 496.1	27 957.8	9627.1	25 884.1	592 035.3	
	%	77.58	1.14	10.56	4.72	1.63	4.37		

playground, football field, and parking areas expanded the bare soil area. The increases in forested, bare soil and road areas caused an increase in the meadowland, while the increases in the bare soil and road areas were evaluated as the causes for the reduction in woodland. The number of roads had also increased because of the heavy use of the area and the lack of parking.

Temporal change values of the Sarıalan picnic and camping site: The changes occurring within the Sarıalan picnic and camping area are given in Table 4. According to this, the total forest area, which was 125 450.0 m² in 1970, had increased by 81 482.4 m² to a total of 206 932.4 m² in 2010. Upon examining the temporal changes of the land use from 1970 to 2010, it can be seen that the forested area had increased by 7.78%, the woodland area by 49.51%, and the building area by .74%, while there was an increase of 2.28 % in the road area. On the other hand, a decrease of 53.70% was observed in the meadowland, and the bare soil area had decreased by 6.66%.

The Sarıalan picnic and camping area are the most developed area within the boundaries of Uludağ National Park in terms of recreational activities. In this situation, it is also effective that the last station of the cable car line and the minibus stops are situated in this area. The bungalows, sleeping quarters, mosque, health center, lodgings, administrative buildings, souvenir shops, restaurants, snack bars, toilets, and transformer, and cable car station buildings along with the radio link station of the Bursa Provincial Security Directorate are all situated in the area and illustrated the increase in the building area. The intensity of the area usage and the inadequate number of parking places were responsible for the increase in the road area. The increases in the forested and woodland areas can be assessed as causing the decrease in the meadowland.

Temporal change values of the Çobankaya camping site: The changes occurring within the Çobankaya camping area between the years 1970 and 2010 are given in Table 5. According to this, the total forested area, which was 295 058.1 m² in 1970, had increased by 133 077.4 m² to a total of 428 135.5 m² in 2010. Upon observing the temporal changes of the land use between 1970 and 2010, it can be seen that the forested area had increased by 11.93%, the

Table 4.
The Land-Type Temporal Changes Occurred within the Sarıalan Picnic and Camp Site Between 1970 and 2010 (The Areas are given in m²)

		Type of Land Use in 2010							
		Forest	Wooded	Meadows	Soil	Building	Road	Total	%
Type of Land Use in 1970	Forest	125 450.0						125 450.0	11.97
	Wooded		118 835.3	5104.9	1205.5	1209.1	2311.6	129 014.6	12.31
	Meadows	77 509.2	492 625.8	50 950.6	26 498.4	2960.5	17 558.8	668 103.1	63.76
	Soil	2310.1	32 540.6	47 706.3	9683.1	3369.2	11 815.9	107 590.2	10.27
	Building		52.4		4.1	787.3		843.8	.08
	Road	1663.1	3677.1	1648.9	455.3	273.8	9127.1	16 845.4	1.61
	Total	206 932.4	647 731.1	105 410.7	37 846.3	8599.9	40 813.4	1 047 847.1	
	%	19.75	61.82	10.06	3.61	.82	3.89		

Table 5.
The Land-Type Temporal Changes Occurred within the Çobankaya Camp Site Between 1970 and 2010 (The Areas Are Given in m²)

		Type of Land Use in 2010							
		Forest	Wooded	Meadows	Soil	Building	Road	Total	%
Type of Land Use in 1970	Forest	295 058.1						295 058.1	26.46
	Wooded		74 467.5	6218.6	6260.8	423.6	1608.5	88 978.9	7.98
	Meadows	128 512.9	126 008.6	247 216.6	84 679.8	641.6	11 101.9	598 161.5	53.63
	Soil	2516.8	14 118.4	54 424.5	37 384.9	169.2	6698.9	115 312.7	10.34
	Building							.0	.00
	Road	2047.7	2986.9	6028.4	986.1	116.3	5583.7	17 749.1	1.59
	Total	428 135.5	217 581.5	313 888.1	129 311.6	1350.6	24 993	1 115 260.3	100
	%	38.39	19.51	28.14	11.59	.12	2.24		

woodland area by 11.53%, the bare soil area by 1.25%, and the building area by .12%, along with an increase of 0.65% in the road area. On the other hand, a decrease of 25.49% was observed in the meadowland.

The Çobankaya campsite is another area within the national park where recreational activities are concentrated. The family camping with sleeping quarters, lodgings, a mosque, bathrooms and toilets, and storage buildings situated within this area showed a slight increase in the building area. It was observed that the lack of parking space led to an increase in both the road and the bare soil areas. The increases in the forested and woodland areas were assessed as the cause for the decline in the meadowland.

Temporal change values of the ski site of the first development zone: The changes occurring within the ski site of the first development zone between 1970 and 2010 are given in Table 6. According to this, the total forested area, which was 1 727 832.2 m^2 in 1970, had increased by 97 525 m^2 to a total of 1 825 357.3 m^2 in 2010. Upon examining the temporal changes of the land use from 1970 to 2010, it can be seen that the forested area had increased by .93%, the woodland area by 1.46%, the bare soil area by 6.78%, and the building area by 1.31%, along with an increase of 1.47% in the road area. On the other hand, a decrease of 11.98% was observed in the meadowland.

The accommodation facilities of the public and private sectors, the restaurants and cafes of the hotels, the mosque, fire station, and the 112-emergency aid station, all situated within the first development zone ski site, also called the Hotel Zone, showed an increase in the building area. There are currently many buildings and structures within this area, which have caused increases in the bare soil and road areas. The increases in the forested, woodland, and building areas were assessed as causing the decline in the meadowland.

Discussion, Conclusion, and Recommendations

When the land type changes in the Uludağ National Park between 1970 and 2010 were examined, it was observed that

Table 6.
The Land-Type Temporal Changes Occurred within the Ski Site of the 1st Development Zone Between 1970 and 2010 (The Areas Are Given in m²)

		Type of Land Use in 2010							
		Forest	Wooded	Meadows	Soil	Building	Road	Total	%
Type of Land Use in 1970	Forest	1 727 832						1 727 832.3	16.41
	Wooded		1 788 053	99 306.8	149 215.8	14 854.6	41 089.6	2 092 519.6	19.87
	Meadows	80 998.6	386 235.8	3 181 379	1 147 544	99 048.2	139 751	5 034 957	47.82
	Soil	7822.6	60 554.3	459 376.4	874 078.9	22 463.4	68 927.9	1 495 650.5	14.20
	Building		217.2	932.2	782.8	18 173.6	1872	21 977.7	.21
	Road	8703.8	11 197.2	33 206.3	37 374.6	5877.3	60 423.4	156 782.6	1.49
	Total	1 825 357	2 246 257	3 774 201	2 208 997	160 417.1	312 064.0	10 529 719.8	
	%	17.34	21.33	35.84	20.98	1.52	2.96		

the forested, building, and road areas were generally increased, while the meadowland areas generally decreased. With the increase in visitor numbers within the recreation areas and the diversification of the recreational activities, the structural and infrastructural requirements (hotels, guest houses, restaurants, toilets, etc.) had increased.

The greatest building area increase was detected in the first developmental zone ski site, whereas the Karabelen picnic site showed the least increase in this area. After the ski site, the second greatest increase in the building area was observed in the Sarıalan picnic and campsite, which is used for both picnic and camping activities. In addition, the fact that the cableway and minibus stations are within this area led to an increase in the intensity of area usage and consequently, to an increased number of buildings. The huge number of guesthouses and lodgings, the national park maintenance center, and the generator buildings are the reason for the increase of the building area within the Kirazlıyayla picnic site. Due to the topography of the land, the difficulty of accessing the Çobankaya campsite caused it to be the least developed location in terms of the building area.

The increase in the areas used for settlements and tourism also led to an increase in the transportation networks. The largest increase in the road surface area was observed in the Sarıalan site because it was used jointly for picnicking and camping. The least road surface area was detected within the Çobankaya area because it was the least exposed to recreational activities due to the transportation difficulty in reaching the site. In a study conducted by Priskin (2004), the direct effects on coastal tourism and recreation between 1965 and 1998 were revealed through an indicator measuring the transportation routes. In their research, Kintz et al. (2006) found that the forest areas increased over the years within protected zones. In the Uludağ National Park, an increase in the forested areas was ensured by restricting all unauthorized use other than recreational. The largest increase in the forested area was observed in the Karabelen picnic site, followed by the Kirazlıyayla picnic site, and then the Çobankaya and Sarıalan picnic and camping sites. The least increase in the forested area was detected in the first development zone ski site since the skiing sites are created in the alpine zone, which has challenging natural conditions. The construction of the ski slopes and hotel buildings was responsible for the cutting of the trees. Among the recreational usage areas, the ski sites seemed to be the places where the development of the forested areas was the most prevented.

A general decrease was observed in the meadowland of the recreational areas. The most important reason for this decrease was that the young saplings which were situated in meadowland in the 1970s had grown up to be trees by 2010. The biggest decrease in the meadowland was observed in Sarıalan, which is the most highly used area of the national park and allows both picnicking and camping. This was followed by the Çobankaya camping site, Kirazlıyayla picnic site, and the Karabelen picnic site, respectively. In the study conducted by Güleryüz et al. (1998), it was stated that the dominant plant forms in the first tourism development zone were mainly herbaceous plants and bushes. This statement was confirmed by the present study, and it was determined that the least reduction in the meadowland was observed in the ski site. Most of the meadowland in the Sarıalan picnic and camping site had been converted to woodland. This and the increase in the road surface area caused a reduction in the meadowland.

The woodland area showed a huge increase within the Sarıalan picnic and camping site, as well as demonstrating an increase in both the Çobankaya picnic site and the first development zone ski site, while a decrease was observed in the Karabelen and Kirazlıyayla picnic sites. The increase in the woodland within the Sarialan picnic and camping site, Çobankaya picnic site, and the first development zone was realized by the maturing of the trees during the period from 1970 until 2010. In addition, afforestation and conservation works had been carried out in open areas, which subsequently became forested. However, there was a decrease in the woodland area within the Karabelen picnic site due to the intense usage and the increasing need for roads because of the lack of parking areas. At the Kirazlıyayla picnic site, the increases in the bare soil, road, and building areas might have been caused either by intense usage or by the lack of parking space that led to a decrease in the woodland area.

The loss of vegetation due to recreational activities has been the subject of many studies. Roads (Donaldson & Bennet, 2004; Priskin, 2004), hotels (Buckley et al., 2000), and campsites (Smith & Newsome, 2002; Turton, 2005) can all cause the disappearance of the vegetation cover. In addition, the intensity of usage can cause the loss of vegetation in the recreation areas (Andres-Abellan et al., 2005; Cole & Marion, 1988). Increases in the bare soil areas were observed within the first development zone ski site, the Kirazlıyayla picnic site, and the Çobankaya camping site, while the Sarıalan picnic and camping site and the Karabelen picnic site showed decreases in terms of the bare soil area. The biggest increase in terms of bare soil was observed in the first development zone ski site. The bare soil area increases were due to the development of land suitable for recreational activities, intense usage, and car parking facilities.

In conclusion, skiing was the recreational activity that generated the most buildings and structures; The skiing site was the area where the most plant cover loss was observed; The most construction was carried out in areas where there was provision for more than one recreational activity; The loss of vegetation increased in areas where more than one recreational activity

was available at the same time; All recreational activities caused a decrease in the meadowland. Finally, in light of the findings of this study, it is recommended that the following issues be investigated: (1) the ability of the existing vegetation cover to renew itself, (2) the nature of the ecological research work in the field, (3) the ecological cost compared to the benefits of the recreational activities.

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