

**O 46. EVALUATION OF THE GÖREME NATURAL PARK IN TURKEY THE
FRAMEWORK OF ECOLOGICAL PLANNING**

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ABSTRACT: Göreme National Park is an detrited plateau located in the formerly active volcanic region of the Central Anatolian Plateau, as part of the Cappadocia region. The geomorphology of a volcanic tuff landscape sculpted with erosion, mountain ridges, valleys and "fairy chimneys" is a rare geographical formation in the world. As a protected World Heritage site, Göreme National Park is now the center of attraction with intense touristic visits, rapid urbanization and urban transformations, facing ecological stress. This article aims to evaluate the relationship between natural ecological values and anthropocentric effect-intensive development projects for the future use of Göreme National Park, which hosts different uses in the historical process and reflects the balance between human and nature. In this context, the current situation of Göreme National Park will be analyzed in the article, and an evaluation regarding ecological planning will be made in order to protect the ecological structure in line with the problems and potentials and existing features.

Keywords: *Göreme National Park, ecological planning, natural cnservation, land use*

INTRODUCTION

Cappadocia, whose borders in ancient times stretched to the Taurus Mountains in the south, Aksaray in the west, Malatya in the east and the Eastern Black Sea in the north, is now within the borders of the provinces of Nevşehir, Aksaray, Niğde, Kaysri and Kırşehir (**Figure 1**) (Mutlu,2015; Bulut,2018). Göreme Historical National Park is a weathered plateau located in the former active volcanic region of the Central Anatolian plateau, as part of the Cappadocia volcanic region. With its unique mountain ridges, valleys and geomorphological structure of fairy chimneys, volcanic tuff landscape sculpted by water and soil erosion, Cappadocia is among the rare landscapes of the world. In the historical geography Cappadocia Region has been one of the preferred settlement centers of Anatolia since ancient times, due to the easy formation of tuff cities by the local communities in the region, the fertile plains of Bagadania and Kataonia, the river networks, the religious center of ancient societies, Argaios Mountain (Mt. Erciyes), and since it is one of the important centers of the history of Christianity with its many historical churches, monasteries and chapels, from prehistoric times to the present day (Bulut,2018; Aydan-Ulusay, 2003). Göreme Historical National Park, located at a central point in the countryside of Nevşehir province, whose settlements date was dated to Prehistoric periods, is 10 kilometers away from the city center and was used as a religious education center from the early Christian period to the Byzantine period, while the necropolis of the people living in Avanos during the Roman Period was still being sed (Ayhan,2020, Bulut 2018, Mutlu,2015). Göreme Open-Air Museum, with its cultural and natural values, was included in the UNESCO Cultural Heritage List on December 6, 1985 as a World Cultural and Natural Heritage (Url 1). Göreme has the status of National Park, Archaeological Protected Site, Naturally Protected Site, Urban Protected Site and Tourism Protection and Development Area within the framework of the National Administrative Legislation of the State of Republic of Turkey. The natural assets of the region are the volcanic structure and geological formation values in the area, and the cultural assets are the historical tuff city heritage and fairy chimney structural values. This extraordinary nature and culture relationship of Cappadocia, which has been shaped by different cultures from early ages (from Hati, Assyrian, Hittite, Persian, Macedonian (Alexander the Great), Roman, Middle Byzantine, Seljuk, Principalities and Ottoman periods) to the present, is reflected in the physical space as;

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houses, churches, monasteries, underground cities, fairy chimneys. Göreme Historical National Park is believed to have been an important center for religious and secular life during the Middle Byzantine period (Kalas, 2004). Today, Tokalı Church carved into several rocks decorated with rich frescoes, Nuns and Priests Monastery, the architectural style and frescoes of St. Basil's Chapel, Elmalı Church, Yılanlı Church, Dark Church and Çarıklı Church are some of the prominent cultural and historical values of the region. Göreme National Park, which is under multiple site protections with its geomorphological natural values and unique cultural values, is exposed to the risk of losing its ecological balance due to intense mass tourism, rapid urbanization and widespread technical infrastructure development projects and anthropocentric arrangements organized for globalizing service needs. In this study, these ecological pressures on the natural and cultural values created through planning will be evaluated by describing the examples of the plan decisions of the Göreme Uzun Erimli Plan reflecting on the current land use, and the ecological problems and potentials determined regarding the Göreme National Park will be entered into the proactive ecological planning database as a scientific and rational framework (Kozłowsky, 1968-1985, Frey, 1999).



Figure 9. Cappadocia , Göreme Historical National Park (Map produced from the Map General Command Web Page and BingMaps)

MATERIALS AND METHODS

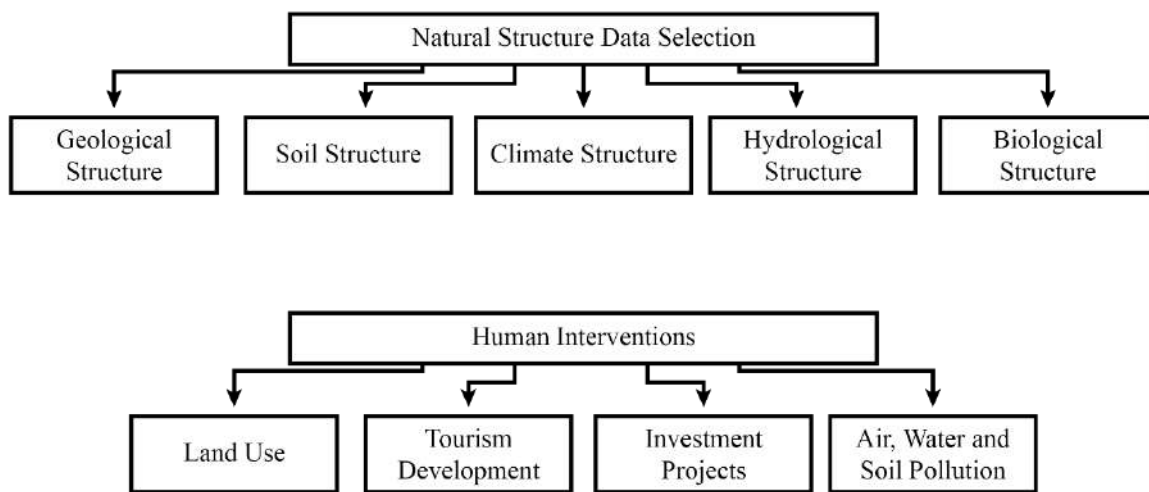
The effects of the Göreme Historical National Park Long Term Development Plan on the natural environment will be evaluated with the reflections of the existing landscape land use. The ecological effects of these plan decisions on the geomorphological features, historical and cultural features and recreational values, which are the National Park selection criteria of Göreme Historical National Park, will be evaluated in comparison with the data sets based on the literature.

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In order to determine the ecological effects of natural and human-induced interventions on Göreme Historical National Park, the climatic change, seismicity, soil structure, geomorphological structure, flora-fauna structure of the research area, land use decisions, tourism development decisions and environmental pollution values evaluation criteria composes the methodological flow framework of the research.

Each assessment component of the research area was evaluated separately using a set of attributes including ecological planning principles specific to the Natural and Cultural Heritage area as follows. Each component of the natural and cultural character of the world heritage site is not considered pointwise, but spatially, for the entire protection area (**Table 1**). Field data was obtained using Göreme Historical National Park Long Term Development Plan decisions, literature-based areal data and official government statistics. Another output of the study is the production of policies for the sustainability of Göreme's regional and local natural resources with rational ecological planning in a balance between protection and use.

Table 1. Methodology flow chart



The ecological sensitivity of the Long-term Development Plan of 2001 will be evaluated by comparing the data obtained from **Table 1** with the data obtained by Yıldırım and Çorakbaşı (2020) in the GIS based risk mapping study for the Göreme Historical National Park area and the rocky areas of Cappadocia. In **Table 2**, GHNP Ecological Structure Evaluation Criteria are defined in 4 scales.

SURVEY AREA, RESULTS AND DISCUSSIONS

Göreme Historical National Park administratively covers an area of 9572 ha within the borders of Nevşehir Province, Nevşehir Center, Avanos and Ürgüp Districts (T.R. Ministry of Forestry, National Parks Department, 2001), (**Figure 2**). In Göreme National Park, there are urban development areas of Göreme, Uçhisar and Avanos districts and areas belonging to Çavuşin, Zelve, Ürgüp district centers and Ortahisar settlement.

Table 2. GHNP Ecological structure evaluation criteria

Göreme National Park Components	Components Associated with Ecological Structure	Ecological Impact Factors	Ecological Pressure Degree				<u>Experimental Comparison: GIS Based Risk Maps for GHNP and Rocky Areas of Cappadocia by Yıldırım and Corakbas (2020)</u>	<u>Experimental Comparison: GHNP Long Term Development Plan (2001)</u>
			Very High	High	Moderate	Low		

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Settlements Within the National Park	Urban Areas	Population Development						
		Economic Structure-Tourism-Industry-Social Infrastructure						
		Technical Infrastructure, Air Quality, Water Quality -if Available Indicator of Ecological Health						
	Rural Areas	Population Development						
Farming Areas								
Natural Monuments-Fairy Chimneys								
Climate, Flora/Fauna, Habitat, Pest Species								
Cultural and Natural Heritage Assets	Natural Structure Landscape Examples	Terrestrial Ecology (Volcanic Tuff Landscape) e.g. Fairy Chimneys, Rocky places Vegetation and Fauna Habitat						
	Cultural Structure Landscape Examples	Urban texture Samples From Urban and Rural areas, Cut Rocks Shelters, Vernacular Architectural Structure Samples, Monumental Structures, Road and Street Textures						
Open-Air Museum	Göreme and Zelve Open-Air Museums	Visitor Density and Ecological Limits						

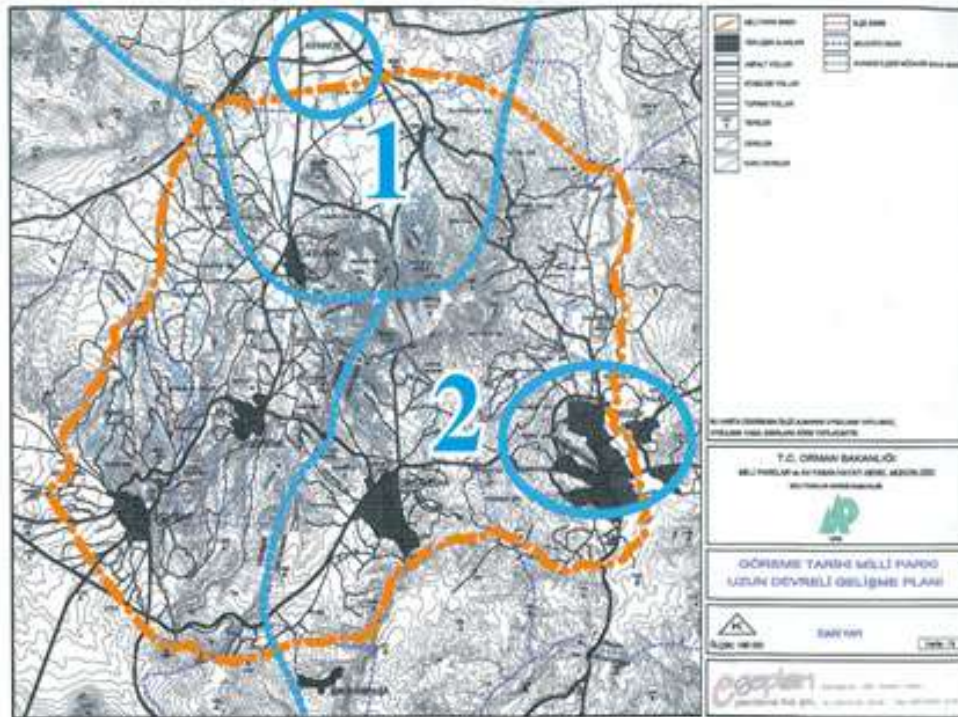


Figure 2. Göreme Historical National Park's Administrative Borders (T.R. Ministry of Forestry, Department of National Parks, 2001)

Ecological Effects of the Settlements in the National Park in terms of Population-Economic Structure-Technical Infrastructure

Population development and administrative structures of the settlements in Göreme Historical National Park are presented in Table 3 (Url 2). As can be seen from the table, Ürgüp and Avanos Municipalities have shown a rapid growth of approximately 2.25 in the last 30 years. On the other hand, although the population growth rate is suggested at a high rate in the National Park Protection plan, it does not meet the real population growth. This means that the rate of urban growth for the National Park is much higher than expected in the plan and that urban settlements develop contrary to ecological planning criteria, creating ecological pressure. **However, compared to Ürgüp, Avanos settlement, which entered the borders of the National Park in terms of development area, creates high/moderate ecological pressure.**

In Nevşehir, the labor force participation rate was 50.5%, the employment rate was 47.5% and the unemployment rate was 6% in 2012 (Ministry of Culture and Tourism, 2012). In the distribution of the population according to the main economic activity branches in Nevşehir province, the most important share belongs to the agriculture sector with 70%. In the relevant year, the service sector comes in second with 20%, followed by industry with 10%. Among the settlements within the National Park, Ürgüp and Avanos stand out in local wine production, and viticulture is common on slopes and hillsides. These settlements also contribute to the tourism sector with storage opportunities in rock-carved cool cellars in urban and rural building parcels. As a commercial sector, there were approximately 2000 storage businesses in the National Park area in 2010. In particular, storage activity is concentrated numerically in Uçhisar, Göreme and Ortahisar. The places with the highest visitor and vehicle density in the national park are the Göreme Open Air Museum and the area of fairy chimneys called Three Beauties. **The Göreme Open Air Museum in the center of the National Park and the tourism and industrial areas within the municipal boundaries of Ürgüp and Avanos place a very high ecological pressure on the National Park in the spatial sense (Figure 3).**

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Table 3. Population Development of the National Park Area and Its Surroundings (Url2, TÜİK Statistical Data Portal)

Affiliated Location			National Park		1990	2000	2010	2020	GHNP Long Term Development Plan Projection Population
	Province	District	Within	Partially					
Uçhisar	Nevşehir	Province Center	+	+	3159	3856	3717	3838	5740
Göreme	Nevşehir	Province Center	+		2425	2587	2200	2133	3680
Ortahisar	Nevşehir	Ürgüp Town Center	+	+	3543	3936	3564	2998	4790
Ürgüp	Nevşehir	Town Center	+		11040	14538	34372	35697	22080
Avanos	Nevşehir	Town Center		+	10010	11921	35145	32932	16050
Çavuşin	Nevşehir	Avanos Town Center	+		830	821	693	520	940
Aktepe/Zelve	Nevşehir	Avanos Town Center	+		135	115	73	51	90
Toplam GHNP Population					31142	37774	79764	78169	53370

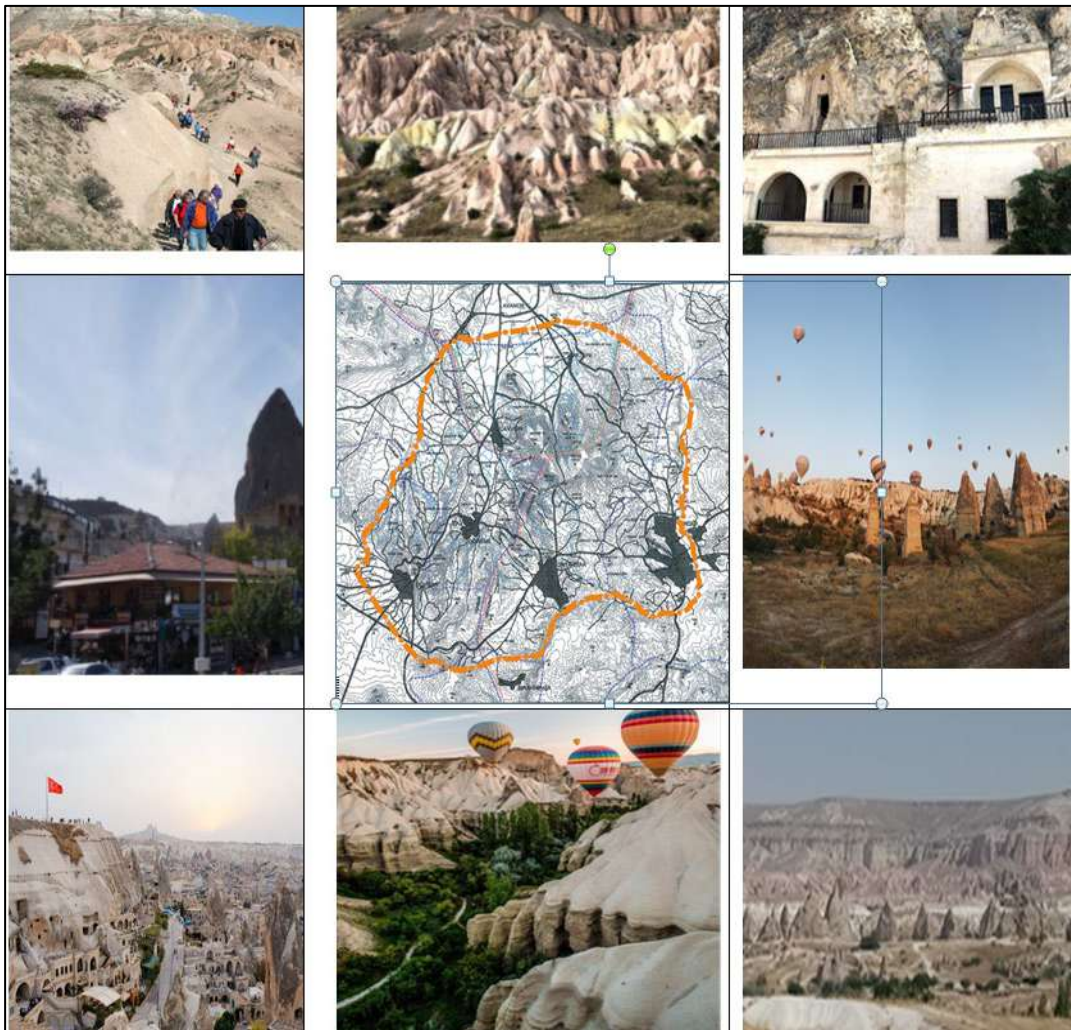


Figure 3. Cultural Landscape in Göreme Historical National Park (T.R. Ministry of Forestry, Department of National Parks, 2001)

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The most common tourism activities in GHNP are nature and cultural tourism, faith tourism, balloon tourism, horse tourism, convention tourism, wineries, discovery of authentic traditional handicrafts, gastronomic tourism, etc. As of 2016, there are 230 accommodation facilities with tourism operation certificates in the national park area, and 71 thousand 856 domestic and foreign tourists visited Göreme Open Air Museum. However, the lack of a holistic effective visitor impact management plan regarding the protection-use balance of each recreational activity for tourism purposes and the deficiencies highlighted in the UNESCO 2014 periodic report, such as the density of ATV vehicles, the dense distribution of base stations, the exceeding the visitor carrying capacity in the area at peak hours, the density of balloons used in balloon tourism, Tourism **has a very high ecological pressure on the National Park** due to visual and environmental pollution due to the lack of direction signs in the park and the poor accessibility in the area (Evci, A , Kuş Şahin, C, 2017).

In GTMP According to Technical infrastructure 2018 TUIK data, 93% of the population including Uçhisar, Ortahisar, Ürgüp, Göreme, Avanos, Çavuşini and Zelve have sewage facilities and 80% of the annual discharged wastewater is treated ([Url:3](#) Tüik Belediye atıksu İstatistikleri, 2018). Solid waste landfill facility is located in Sulusaray İçmece, 15 km from the national park. The drinking and tap water used from Nevşehir surface water is insufficient, and 33 wells throughout the province meet the water need as reinforcement (Nevşehir Valiliği, 2019). 15 industrial facilities in the region have individual treatment facilities. Renewable energy resources are predominantly used in the region, and SPP, Geothermal, HEPP facilities (7 units), and Natural Gas are dominant. The technical infrastructure **has a high ecological pressure on the National Park**.

In 1965, 75% of the population lived in rural areas and 25% lived in cities. Nearly half of the population living in cities is in Nevşehir. Other district centers were towns. In 1990, the rural population decreased to 61%, and the urban population started to increase in all districts. In 2015, while the rural population decreased to 25%, the urban population in the districts increased by 514 due to the tourism-related increase in the urban indicators (**Table 4**), (Karabacak, 2016). **With the increase in the rate of urbanization in the urban sedentary population, a high degree of ecological pressure has emerged on the anthropogenic origin National Park.**

Table 4. Rural-Urban Population Distribution in the National Park Area and Its Surroundings (1990-2015) (Karabacak, 2016).

	1990- Rural	%	1990- City	%	2015- Rural	%	2015- City	%
Center	34081	39	52719	61	32285	25	98713	75
Acıgöl	19559	75	6489	25	13455	70	5748	30
Avanos	29651	75	10010	25	19823	59	13505	41
Ürgüp	24648	69	11040	31	14262	41	20629	59
Derinkuyu	11463	57	8580	43	10294	49	10814	51
Gülşehir	26027	75	8499	25	9896	45	12222	55
Hacıbektaş	12749	61	8062	39	6007	54	5077	46
Kozaklı	18376	71	7556	29	6550	47	7487	53
TOTAL	176554	61	11955	39	112572	39	174195	61

Agricultural Areas are 83% of the total area throughout the province, and cereal production is in the first place (**Table 5**). In the second place, vegetable growing and viticulture are carried out. An important part of the National Park, Göreme Open Air Museum is surrounded by extensive vineyards. Vineyards are indispensable elements of the landscape, and without these vineyards the “soul of the place” would disappear in the museum space. Therefore, it is of great importance to encourage local people to continue this type of agriculture in rural areas of Cappadocia. 71% of agricultural lands are cultivated using pesticides. **The effect of agricultural activities on soil pollution also creates a high degree of ecological pressure on the anthropogenic origin National Park.**

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Table 5. Land Use Distribution Rate in the National Park Area and Its Surroundings (1990-2015) (Karabacak, 2016).

Land Use Types	Field Size			
	2000	2000	2018	2018
	Size in ha.	%	ha.	%
Residential area	11142,89	2,03	13562,43	2,47
Agricultural fields	451123,12	82,22	454578,83	82,85
Forest areas and semi-natural areas	83967,3	15,3	76962,04	14,03
Wetlands	441,32	0,08	639,34	0,12
Water nature	1782,93	0,32	2905,34	0,53
Total	548647,99	100	548647,98	100

Cultural and Natural Heritage Properties in the National Park

In the study of Bixio, Calio, and De Pascale (2011) on rock-cut settlements and rock structures on GTMP settlement typology, Site-specific typologies were proposed considering topographic features, spatial organizations and functional differences1) Settlements in fairy chimneys (Göreme), 2) Settlements on the slopes (Zelve, Tatlarin), 3) Settlements on large rock blocks and foothills (Ortahisar- Uçhisar castle settlements), 4) Settlement with a rock courtyard (Aynalı Church, Hallaç Monastery), 5) Rock-carved monasteries (Kaymaklı, Derinkuyu), 6) Rock carved churches, 7) rock tombs, 8) Dovecote (Guvercinlik Valley in Uçhisar) are approached in 8 different types. (Yıldırım, 2019'dan). A hotel in Uçhisar, which was put into operation with 27 rooms in 1997, has a restoration project of a unique church/bezirhane space (estimated to be 1500 years old), which reveals the historical uses and texture, as well as the intense construction in the area, with 52 rooms completed in 2010 and renovations (**Figure 4**). A wine cellar with thousands of bottles hidden inside the original rock-carved spaces, a part of the historical underground water tunnel that supplies water to the village, many terrace gardens where organic gardening activities are revived and other unique areas have been modernized and brought to daily life. The hotel still continues its construction activities with new room and common area restoration annexes. **There has been a high degree of ecological pressure on the anthropogenic origin National Park with the increase in the urban sedentary population and the rate of urban settlement.**



Figure4. Uçhisar settlement on large rock blocks and their foothills Example of "içinden köy geçen otel / the village with a reception desk"(Url: 4)

In the central plateaus of the GHNP area, there is a terrestrial-semi-desert climate zone effect with an annual average temperature of 10.7°C, the average precipitation amount is 422.9 mm, and the wettest month is May (59.3 mm) according to the precipitation measurements between 1960 and 2016. It is observed that the highest temperature value is 28.5°C in August, and the average lowest temperature value is -3.8°C in January.

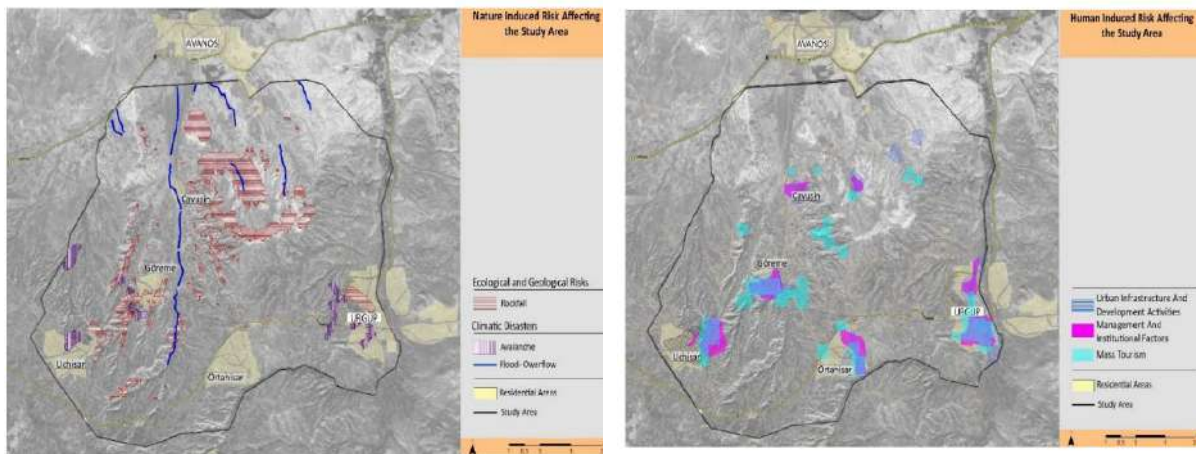
Göreme Hills has been designated as an “Important Plant Area (IPA)” by the World Wildlife Fund (WWF-Turkey). This area, where human settlements have been maintained since prehistoric times, has

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preserved important steppe plant communities that have survived to the present day, and the presence of approximately 650 taxon has been detected within the national park borders. Of these, 118 are endemic to Turkey. There are 23 rare plants nationwide in Goreme Hills IPA. In addition, this area is covered by the Iranian-Anatolian steppes among the “Endangered Habitats” under the Bern Convention. On the other hand, Göreme Hills IPA, which has been included in the World Heritage List, is also under protection as a National Park (Nevşehir Governorship, 2020). **However, habitat loss has occurred due to domestic, agricultural and industrial pollution and changes in the water regime, therefore, a high degree of anthropogenic ecological pressure has occurred on the National Park (Çiçek, E., et al. 2016).**

Experimental Comparison of Research Findings: Yıldırım and Çorakbaş's (2020) GIS-based risk maps for GTMP and rocky areas of Cappadocia

In his work on the GTMP, Yıldırım (2020) proves that all natural and cultural protection areas are **at risk of deterioration or destruction due to natural threats such as floods, fires, earthquakes or interventions to nature for human-oriented development and that risk maps** are a useful tool in establishing an effective disaster management process against the risks in these heritage areas (Figure 5).



1. GNHP risk map focused on natural threats

2. GNHP human-induced development based risk map

Figure 5. Yıldırım (2020) risk maps for the GNHP.

Experimental Comparison of Research Findings: GNHP Long Term Development Plan Decisions

In the GNHP Long Term Development Plan(2001), measures were introduced to restrict land use decisions for the purpose of protecting natural resources. Plan decisions, some of which are natural and anthropogenic, are summarized in **Table 6** (Figure 6).

Table 6. GNHP Long Term Development Plan Decisions (GNHP Long Term Development Plan 2001)

Ecological planning in relation to geomorphology and geological structure	In areas where fairy chimneys are dense, not allowing agricultural activities in order to allow a protective shell to form and reduce crumbling.
	Preparation of a tourist visitor management plan that will minimize the risk of tuff material crumbling on the structure and sightseeing routes caused by 600,000 tourist visits in 1999
	Controlling the risks of flooding, slipping of the rock blocks, rain water leakage on exterior and interior surfaces, traffic vibration, static weakness of the tuff floor, the use of abrasive structure and technical installation materials incompatible with the tuff material.
	GNHP plateau, which was shaped by lava flows of Erciyes (3.917m), Melendiz (2.935m) and Hasandağ (3.254m) volcanic mountains in prehistoric times, should be subject to construction control and protective measures against

	earthquake risk due to Derinkuyu (20km), Erciyes(20km) and Saltlake(80km) active fault lines.
Natural and cultural landscape protection-ecological planning	In the restoration of rock-cut areas, effective management should be ensured in architectural project acceptance and building inspection processes, since space expansion and excessive use density are incompatible with original, natural and cultural values.
	Taking measures to strengthen the ground statics as well as the natural and cultural landscape, primarily for the areas where the natural wonder Fairy Chimneys are located.
	Touristic facilities and social and technical structures in the national park area should be subject to intense building inspection with geomorphological and geological protection measures.
	Since air, water and soil source pollution, which deteriorates environmental quality and public health, will adversely affect the survival of the ecological system, it should be subject to intensive protection and inspection studies by official institutions.

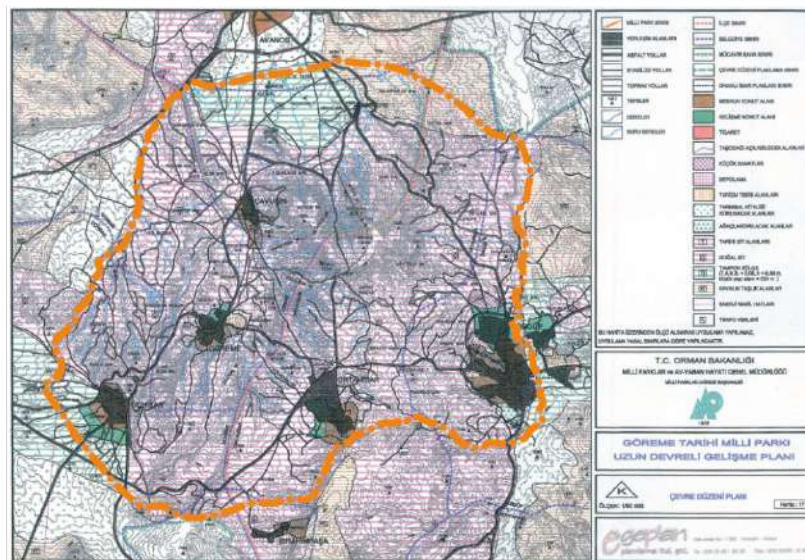


Figure 6. GHNP Long Term Development Plan (GHNP T. R. Ministry of Forestry, Department of National Parks, 2001)

CONCLUSIONS

Cappadocia and Goreme Historical National Park within Cappadocia, located in the former active volcanic region of the Central Anatolian plateau, have been subject to many planning studies, accompanied by national and international conservation laws, after being included in the UNESCO World Natural and Cultural Heritage list in 1985. The globalization-oriented transformations in urban and regional planning on an international scale have also affected our given wonderful area, which has sensitive vulnerabilities. The findings of this study, focused on ecological planning principles regarding land use, were compared with the evaluated scientific study in which risk maps related to the use of natural and cultural values specific to the area, and the plan decisions of the holistic GHNP Long Term Development Plan for the area. (Table 7). Our research findings, with previous scientific study data, confirm that study consistently, making the sensitivity of ecological planning integrated with today's economy-oriented approaches to the use of natural and cultural resources of GHNP risky. Since the plan projections of the GHNP Long Term Development Plan made in 2001 were exceeded and the plan period has ended, it is essential to carry out a new holistic conservation planning work that takes into account the balance of ecological protection and use of the natural and cultural landscape. Preparation of the Natural and Cultural Heritage Conservation Management Plan integrated with this plan during

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the planning, projecting and implementation process for the control of the construction in the area is also essential for the ecological sustainability of the area.

Table 7. Assessment of Ecological Planning Principles of the GHNP

Göreme National Park Components	Components Associated with Ecological Structure	Ecological Impact Factors	Ecological Degree				Pressure	Experimental Comparison: GIS Based Risk Maps for GHNP and Rocky Areas of Cappadocia by Yıldırım and Corakbas (2020)	Experimental Comparison: GHNP Long Term Development Plan Decisions (2001)
			Very High	High	Moderate	Low			
Settlements Within the National Park	Urban Areas	Population Development	X				Very High Risk Pressure	Moderate Ecological Pressure	
		Economic Structure-Tourism-Industry-Social Infrastructure	X				Very High Risk Pressure	Moderate Ecological Pressure	
		Technical Infrastructure, Air Quality, Water Quality -if Available Indicator of Ecological Health	X				Very High Risk Pressure	Moderate Ecological Pressure	
	Rural Areas	Population Development	X				Very High Risk Pressure	Moderate Ecological Pressure	
		Farming Areas	X				Very High Risk Pressure	Moderate Ecological Pressure	
		Natural Monuments-Fairy Chimneys	X				Very High Risk Pressure	Moderate Ecological Pressure	
		Climate, Flora/Fauna, Habitat, Pest Species	X				Very High Risk Pressure	Moderate Ecological Pressure	
	Cultural and Natural Heritage Assets	Natural Structure Landscape Examples	Terrestrial Ecology (Volcanic Tuff Landscape) e.g. Fairy Chimneys, Rocky places Vegetation and Fauna Habitat	X				Very High Risk Pressure	Moderate Ecological Pressure

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	Cultural Structure Landscape Examples	Urban texture Samples From Urban and Rural areas, Cut Rocks Shelters, Vernacular Architectural Structure Samples, Monumental Structures, Road and Street Textures	X				Very High Risk Pressure	Moderate Ecological Pressure
Open-Air Museum	Göreme and Zelve Open-Air Museums	Visitor Density and Ecological Limits	X				Very High Risk Pressure	Moderate Ecological Pressure

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