RESEARCH ARTICLE

Eurasian Journal of Medical and Biological Sciences
AN INTERNATIONAL JOURNAL
Eurasian J Med Biol Sci **4(2): 71-79**

Determination of the Situation of Antalya Province Kundu and Belek Tourism Region in 1985 and 2022 with Satellite Images of Vegetation Areas, Land Cover Type Distributions, Use Class, Usage Area and Occupation Status

Orhan Ünal[1], Nusret Demir[2], Gonca Koca Tezgören[1], Betül Ünal[3]

[1] *Department of Biology, Faculty of Science, Akdeniz University, Antalya, Türkiye.*
[2] *Department of Space Sciences and Technologies, Faculty of Science, Akdeniz University, Antalya, Türkiye.*
[3] *Department of Electrical and Electronics Engineering, Faculty of Engineering, Akdeniz University, Antalya, Türkiye*

Received : 05/11/2024 Revised : 08/12/2024 Accepted : 09/12/2024

ABSTRACT: In this study, the vegetation areas and land cover type distributions of the Kundu and Belek Tourism Regions, located in the eastern part of Antalya province, as well as the usage class, usage area, and occupation status of these regions between 1985 and 2022 were identified using satellite imagery. Analyses for 1985 were conducted using NASA's LANDSAT-5 satellite images, while analyses for 2022 were performed using OpenStreetMap data. The area sizes and construction rates in 1985 and 2022 were calculated as percentages based on satellite images. LANDSAT-5 images were subjected to a supervised classification process. Accordingly, a total of 45 sample points were identified in the Kundu and Belek Tourism Regions, and all pixels most similar to the collected pixel values were classified as vegetation areas. The total size of the selected area in the Kundu Tourism Region was 15.54 km², where only one or two buildings were observed in 1985, leading to its evaluation as an insignificant area. In contrast, the selected area in the Belek Tourism Region was 35.60 km², with the total building area in 1985 being less than 0.1%. In analyses conducted using OpenStreetMap data, the built-up area in the Kundu Tourism Region was calculated as 1.88 km², corresponding to 12% of the total area. The total building area in the Belek Tourism Region was calculated as 0.76 km², corresponding to 2% of the total area. This indicates that construction has been observed in both areas since 1985, predominantly in coastal regions. As a result, it was determined that the usage and occupation of the areas increased from 1985 to 2022. For the Kundu Tourism Region, the Park-Recreation area for 2022 was found to be 74.74 hectares (10.61%), while for the Belek Tourism Region, it was found to be 8.93 hectares (0.51%) in 2022. These findings reveal intensive construction in the Kundu and Belek Tourism Regions since 1985, with the most significant development observed in the Kundu Tourism Region.

Keywords: Antalya, Kundu Tourism Region, Belek Tourism Region, Vegetation.

INTRODUCTION

Due to humanity's indispensable dependence on water and the coasts serving as transition zones between land and water, the Mediterranean coasts have historically been inhabited by various civilizations. Turkey is one of the world's leading countries in terms of coastal length and touristic wealth. Antalya, located in southern Turkey, stands as the country's most prominent tourism center. The city boasts a coastline of approximately 640 km, but these coasts have been rapidly degraded in recent years due to construction. Particularly, the intense population pressure resulting from domestic and international tourism, the construction of secondary residences, hotels, and holiday resorts, and daily activities have severely impacted the natural beauty of the coasts (Özçelik, 2017).

Historically, Antalya is situated at the intersection of Pamphylia, Pisidia, and Lycia, at the southwestern edge of Pamphylia, where history and nature converge. The city has significant biological richness and a historical legacy, having been under the rule of Pisidia, Pamphylia, Lycia, Lydia, Pergamon, Rome, Byzantium, Seljuk, and Ottoman civilizations throughout history (Ceylan, 2021).

The Kundu and Belek tourism regions, the focus of this study, are located in the eastern part of Antalya, which has the longest coastline along the Mediterranean. These two regions are significant coastal areas enriched with natural and unique assets, including dune habitats, sandy beaches, rivers, vegetation, and protected areas.

The coastline of both regions predominantly consists of sand dunes. Koç and colleagues (2015) found, in their study of coastal hinterland sediments, that the average grain size at Konyaaltı Beach ranged from -3.50 ϕ to 0.82 ϕ, whereas at Lara Beach, it ranged from -0.43 ϕ to 1.81 ϕ. While Konyaaltı is a pebble beach, Lara Beach represents a mixed sand-pebble beach type. According to Dipova and Cangir (2017), the dominant ground type in the Lara-Kundu coastal area is compact sand, with clay, peat, and loose sand present in some sections.

From a botanical perspective, dune biotopes are critical ecosystems with high ecological diversity. However, these biotopes are increasingly threatened by urban development, recreation, environmental pollution, coastal erosion, and agricultural

* ounal@akdeniz.edu.tr

activities. Furthermore, some plants in this area are under anthropogenic pressure due to their use in nutrition, medicine, and industry. These ecologically sensitive and fragile regions require careful planning and conservation. Dune areas in Turkey are particularly rich in plant diversity, serving as dynamic ecosystems and unique habitats harboring genetic resources. Dunes typically feature undulating or slightly hilly topography, with very low water retention capacity. Additionally, they are exposed to winds carrying salt from the sea, resulting in specialized vegetation (Ekici, 2020).

Antalya is exceptionally rich in plant diversity. Göktürk (1994) identified the city's natural and cultural flora. Between 1992 and 1994, 2,350 plant specimens were evaluated in Antalya, resulting in the identification of 1,065 taxa. These include 130 families, 569 genera, and 1,023 species, of which 863 are natural, and 160 are cultivated. Seventy-five species (7.4%) are endemic. Among the 1,065 taxa, 75 were recorded for the first time in grid square C3.

The Lara Dune Forests and Lara Coastal Dunes in the Kundu Tourism Region hold ecological significance. However, the area is under intense settlement pressure. In 1992, the region was declared a second-degree natural protected area due to its dune characteristics and the endemic plant and animal species it hosts. Today, the area faces significant pressure from urbanization and tourism activities (Altuntaş et al., 2011).

According to the Important Plant Areas (IPA) Communication Network of Turkey (ÖBANET) (Web1 and Web2), the Lara-Perakende Dunes are designated as an Important Plant Area (IPA). Approximately 34 taxa, 9 of which are globally endangered, are under threat in this area. The region is the central distribution area for *Centaurea aegialophila* and *Ononis variegata* in Turkey. In some parts of the dunes, *Pinus brutia* and *Pinus pinea* dominate. Other plant species, such as *Vitex agnus-castus*, *Nerium oleander*, *Quercus coccifera*, and *Celtis australis*, are present as part of the maquis vegetation. Coastal dunes host *Pancratium maritimum* (Vuruşkan, 2009).

The Lara-Perakende dunes are significant for their richness in endemic and rare plant species. Dipova and Cangir's 2017 study highlighted the substantial natural resource potential of the area, investigating the dune biotopes of Antalya Lara-Perakende. Their study emphasized that the area lies on the historical "Pamphylia (Antalya) Plain," located along the seashore approximately 60 km east of Antalya. This plain extends 20 km northward, comprising low hills (approximately 100 m in height) and alluvial soils, and harbors significant habitats. The seaward side is bordered entirely by dunes. The dunes in the area preserved their natural and agricultural character until the 1990s, after which construction began, culminating in complete urbanization along the coastal strip by the 2010s. Approximately 40 km of the dunes have been designated as an Important Plant Area (IPA) (Figure 1). The healthiest dune vegetation within the IPA is located at the western and eastern extremes of the dune strip: the dunes east of Lara (stretching 15 km east of Beşgöz Stream) and the Perakende dunes (extending approximately 10 km from the Köprü Stream mouth to Karagöz Stream). The rich flora in the area consists almost entirely of taxa unique to the "Pamphylia Plain."

The Belek Special Environmental Protection Area, located in the Belek Tourism Region, encompasses a 29 km coastal area shaped by dunes. The region is rich in biodiversity, with dune and forest ecosystems. It is home to marine turtle species *Chelonia mydas* and *Caretta caretta*, as well as the endemic fish species *Aphanius anatoliae*. Dunes in the area also host *Pancratium maritimum*. Various habitats can be found, including forest habitats (*Pinus brutia, Quercus cerris var. cerris, Daphne sericea, Laurus nobilis, Olea europaea var. sylvestris*), rocky areas and maquis vegetation (*Quercus coccifera, Myrtus communis, Styrax officinalis, Cistus salviifolius, Cistus creticus*), stabilized dune and maquis habitats (*Erica manipuliflora, Echium angustifolium, Sarcopoterium spinosum*), semi-stabilized dune hill habitats (*Echium angustifolium, Sarcopoterium spinosum, Echinops viscosus, Polygonum maritimum*), active dune habitats (*Thymelaea hirsuta, Euphorbia paralias, Echium angustifolium, Pancratium maritimum*), seasonal wetland habitats (*Limonium gmelinii, Salicornia europaea, Juncus rigidus, Juncus littoralis, Cressa cretica*), permanent wetland habitats (*Typha latifolia, Juncus acutus, Cyperus longus*), and agricultural land habitats (*Crataegus monogyna, Pyrus serikensis, Anemone indica*). Of the region, 31% is allocated for residential, tourism, and settlement purposes, while 69% (7,764 hectares) is designated for conservation (Web4).

Rapid development and change in coastal areas driven by population growth have resulted in the destruction of habitats and vegetation. In Antalya, economic growth and restructuring based on tourism since the 1980s have led to significant population and workforce increases. Between 1985 and 2015, the population grew by 257%. During the same period, Antalya had the highest proportion of residents born in other provinces. The tourism workforce increased by 524% between 1980 and 2000. Tourism also impacted the settled foreign population in Antalya. By 2016, the number of foreigners registered in ADNKS (Address-Based Population Registration System) exceeded 60,000 due to residence or work permits, making Antalya the province with the highest foreign population proportion at 2.6% (Işık and Zoğal, 2017).

Rapid population growth has raised concerns about natural protected areas. Vuruşkan and Ortaçeşme's 2009 study found that natural protected areas in Antalya are confined within urban fabric due to intensive construction and urbanization and are heavily influenced by urban developments.

The rapid degradation has affected not only terrestrial ecosystems but also marine ecosystems. For instance, İçemer and Topaloğlu's 2020 study analyzed seawater samples from Konyaaltı and Lara beaches. They found high levels of microbial pollution in the seawater. Intestinal enterococci were detected at rates of 22% in Konyaaltı and 30% in Lara, while *E. coli* was found at rates of 14% in Konyaaltı and 6% in Lara.

MATERIALS AND METHODS

In this study, past satellite imagery of the Kundu and Belek Tourism Regions from 1985 to 2022 was examined. For this purpose, analyses of data from NASA's LANDSAT-5 satellite images were conducted for the year 1985. For 2022, OpenStreetMap data was used for analysis. Using the satellite imagery, the sizes of the areas and the percentage of urbanization rates in 1985 and 2022 were calculated.

Google Earth Engine (GEE) is a spatial data processing system that primarily allows for the analysis of satellite data. GEE enables global-scale analyses using big data while providing users with the ability to integrate their own data. Analyses on this platform are performed using the JavaScript programming language.

In the study, LANDSAT satellite images, produced under the joint operation of NASA and the USGS, were utilized. The Landsat program comprises a total of 9 satellites. The time periods during which these satellites provided imagery are presented in Table 1.

Table 1. *The date ranges in which the Landsat program, consisting of a total of 9 satellites, provides images*

Satellite	Date Range
Landsat 1	July 1972–January 1978
Landsat 2	January 1975–February 1982
Landsat 3	March 1978–March 1983
Landsat 4	August 1982–December 1993
Landsat 5	January 1984–May 2012
Landsat 6	Failed orbital launch
Landsat 7	January 1999–April 2022
Landsat 8	April 2013–Present
Landsat 9	October 2021–Present

In the study, Landsat images were used to obtain vegetation cover areas from 1985 imagery. The current status was derived from the OpenStreetMap platform, a citizen science-based mapping service. OpenStreetMap is created and maintained by a community of mappers who contribute and curate data about roads, trails, train stations, cafes, and much more worldwide. OpenStreetMap provides localized information. Contributors use aerial imagery, GPS devices, and low-tech field mapping to ensure that OSM is accurate and up-to-date.

Landsat 5 imagery was subjected to a supervised classification process. Accordingly, a total of 45 sampling points were defined across the Kundu and Belek Tourism Regions, and all pixels most closely resembling the collected pixel values were classified as vegetation cover. The Landsat 5 satellite has the spectral bands listed in Table 2.

Table 2. *Spectral bands of the Landsat 5 satellite*

Band No	Image
Band 1	Blue
Band 2	Green
Band 3	Red
Band 4	Infrared
Band 5	1.Short Wave Infrared
Band 8	2.Short Wave Infrared

Land use status for transition years was generated on the Google Earth Engine (GEE) cloud computing platform. Google Earth Engine is a versatile platform for analyzing remote sensing data, offering extensive functionality. It hosts a broad catalog of data, including satellite imagery (primarily Landsat and Sentinel), as well as datasets on climate, land, and atmosphere, which can be rapidly accessed, processed, and integrated with user-provided imagery. GEE employs the JavaScript programming language.

The Random Forest (RF) machine learning algorithm was applied as the classification method. Random Forest classification is an advanced form of the decision tree method. A decision tree method simply creates classes by splitting parameters into sets. For example, a pixel may initially be classified as water or not water. Then, the non-water class can be further divided into vegetation or non-vegetation, and this process continues iteratively. In the Random Forest classification method, a high number of decision sets are considered. Each decision set attempts to classify based on multiple parameters, and the class with the most votes is finalized.

In this study, the RF method was applied in GEE for 5 classes. Land use classes such as built-up areas, water bodies, bare land, and vegetation cover were defined. Noi Pan et al. (2020) evaluated land use changes in Mongolia over time using the RF method in GEE, achieving 85% accuracy (Phan, et. al. 2020). Similarly, Rudiastuti et al. (2022) applied the RF method in GEE

to detect urban areas with 90% accuracy in their study (Rudiastuti, Aninda W., et al. "Implementing random forest algorithm in GEE: Separation and transferability on built-up area in Central Java, Indonesia." JOIV: International Journal on Informatics Visualization 6.1 (2022): 74-82). Piao et al. (2021) conducted a study focusing on North Korea, observing changes in forest and urban areas (Piao et al. 2021). Similarly, Amini et al. (2022) examined the Isfahan region in Iran in their research (Amini et al. 2022).

As seen, recent literature frequently employs the RF method for observing urban dynamics and green area changes, and it is noted to achieve high accuracy. The analysis of satellite imagery resulted in the classification of vegetation areas and land cover type distributions in the Kundu and Belek Tourism Regions. Furthermore, land use classes, usage areas, and encroachment statuses of these regions were identified.

RESULTS AND DISCUSSION

The changes in the Kundu and Belek Tourism Regions, located east of Antalya, from 1985 to the present have been identified using satellite imagery. According to this analysis, the total area selected in the Kundu Tourism Region is 15.54 km², where only a couple of existing buildings were observed in 1985. This was evaluated as insignificant in terms of area. For the Belek Tourism Region, the selected area is 35.60 km², with the total building area for 1985 assessed to be less than 0.1% (Figure 1 and Table 3).

As of 2022, analyses conducted using OpenStreetMap data reveal that the built-up area in the Kundu Tourism Region is 1.88 km², corresponding to 12% of the total area. In the Belek Tourism Region, the total building area was calculated to be 0.76 km², accounting for 2% of the total area. Thus, it has been determined that both regions experienced construction from 1985 to the present, predominantly along the coastal areas. The most significant development was identified in the Kundu Tourism Region (Figure 2 and Table 3).

Table 3. *The status of construction in the Kundu and Belek Tourism Regions in 1985 and 2022*

Area	Size of the area	Construction in 1985	Construction in 2022
KunduTourism Region	15.54 km^2	No construction	%12
Belek Tourism Region	35.60 km^2	Below 1%	%2

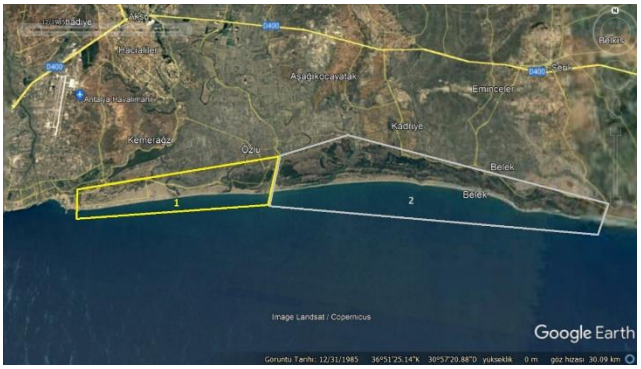


Figure 1. *Kundu (1) and Belek (2) Tourism Region in 1985.*

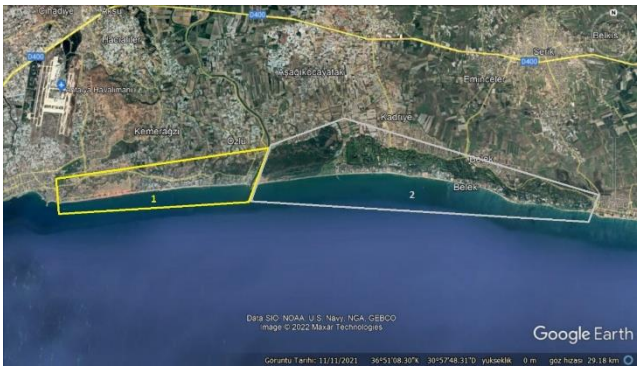


Figure 2. *Kundu (1) and Belek (2) Tourism Region in 2022.*

The vegetation areas for 1985, obtained as a result of the classification of the Kundu and Belek Tourism Regions, which were defined as a result of studies carried out on satellite images, are shown in Figure 3.

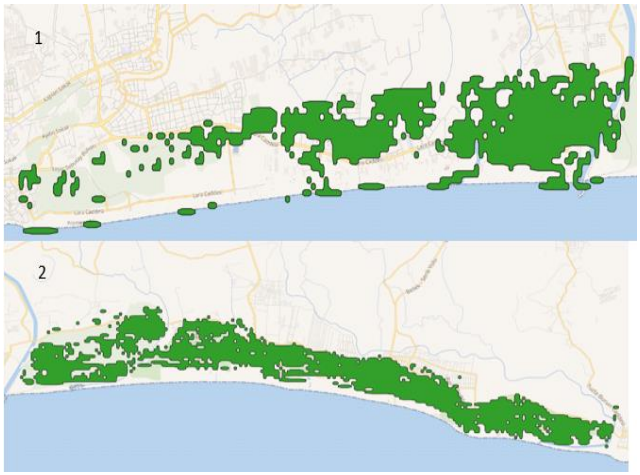


Figure 3. *Dense vegetation areas identified in Kundu (1) and Belek (2) Tourism Regions in 1985.*

As of 2022, the land cover type distributions in Kundu and Belek Tourism Regions in OpenstreetMap data are given in Figure 4.

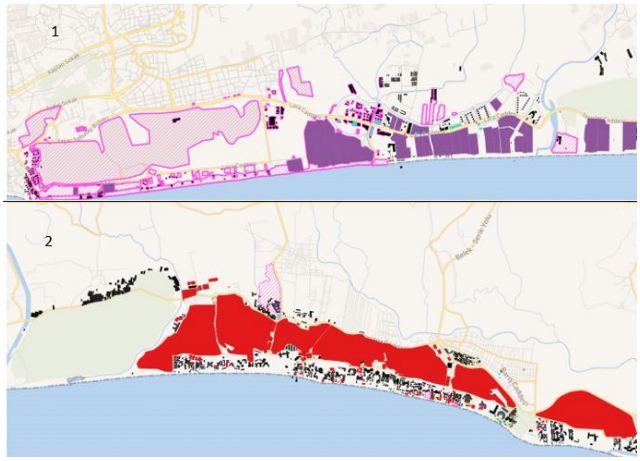


Figure 4. *Land cover type distributions in Kundu (1) and Belek (2) Tourism Regions in 2022 (Red sports areas, black buildings, pink striped recreation areas, purple hotels)*

Land cover type distributions for 2022 are shown in Table 4 for the Kundu Tourism Region.

Table 4. *Land cover type distributions for Kundu Tourism Region in 2022*

Usage Class	**Usage Area (hectare)**	**Occupation Percentage (%)**
Building	22.21	3.15
Sports field	0.36	0.05
Hotel	46.77	6.64
Park-Recreation	74.74	10.61
Shop	0.36	0.05

Land cover type distributions for 2022 are shown in Table 5 for the Belek Tourism Region.

Table 5. *Land cover type distributions for Belek Tourism Region in 2022*

Usage Class	Usage Area (hectare)	Occupation Percentage (%)
Building	41.63	2.40
Sports field	773.57	44.59
Hotel	2.90	0.17
Park-Recreation	8.93	0.51

The analysis of satellite imagery and field observations reveals that the most significant ecological damage in terms of vegetation has occurred in the coastal areas of the Kundu Tourism Region. A large portion of the plants growing in this region has been negatively affected by urbanization. Particularly, the protected *Pancratium maritimum* and the endemic *Centaurea aegilophila* and *Anthemis ammophila* populations are under threat. From a faunal perspective, sea turtles (*Caretta caretta* and *Chelonia mydas*), which come to these coastal areas to lay eggs, are adversely impacted by the urbanization. Although the preservation of parts of the Kundu forests and coastline seemingly mitigates anthropogenic pressures, rapid urban growth in the surrounding areas has led to the destruction of many natural habitats. Notably, the endemic species *Gypsophila pulifera*, *Stachys aleurites*, and *Stachys butlerii* found on the cliffs north of the area are endangered due to development.

In the Belek Tourism Region, the coastal area where the Köprüçay River meets the sea has become a hub for hotels. However, since the area east of the river is designated as a special environmental protection zone, it is relatively preserved. Nonetheless, daily tourism activities and certain landscaping practices in these areas harm coastal sand lilies (*Pancratium maritimum*) and sea turtles (*Caretta caretta* and *Chelonia mydas*). Agricultural activities in the interior regions also contribute to the loss of natural habitats. Endemic species such as *Centaurea pamphylica*, *Polygonum praelongum*, *Allium junceum subsp. tridentatum*, *Hyacinthella heldreichii*, *Petrorhagia pamphylica*, and *Glycyrrhiza asymmetrica* are among the most affected. The special environmental protection status of part of the Belek Tourism Region limits construction and human activities. However, as evidenced by satellite imagery from 1985 to the present, the destruction of natural areas has increased, confining these habitats to narrow regions. Additionally, forest fires, which occasionally occur in both regions, harm forested areas (*Pinus brutia* and *Pinus pinea*).

The western and northern parts of the Kundu Tourism Area are surrounded by tufa cliffs reaching heights of up to 40 meters. To the east of the coast lies the eastern section of the Belek and Aksu Plains. The average elevation of the areas open to development and agricultural lands in the region is approximately 3 meters above sea level, while the height reaches up to 15 meters in the coastal dunes (Dipova and Oğuz, 1998). The groundwater level is approximately 1 meter deep in this area. The soils of the Lara-Kundu coastal region were formed by sediments carried by the Aksu and Köprüçay rivers. Additionally, fine-grained materials have contributed to the formation of the Lara coastal strip. Coastal dunes have emerged in the region due to dominant winds from the sea and the low-sloping topography (Dipova, 2002). Layers or lenses of silt, clay, and peat can be observed within the sand, a result of increased clay and silt content in transported materials during geological phases or due to swampy or lacustrine deposits. Furthermore, a lagoon called the Yamansaz wetland has formed behind the coastal dunes. Recently, parts of Yamansaz have been drained through canal construction, leading to the emergence of "peat" soil in the area.

According to ÖBANET (Web1 and Web2), the Lara Coastal Strip was designated as a first-degree natural protected area on November 15, 1980, while Belek-Kumköy locality—between Aksu Stream and Beşgöz Stream—was declared a first-degree natural protected area on January 31, 1996. Additionally, the Lara Dunes and Forests were classified as a second-degree natural protected area on July 30, 1998. The region is located within the Southwest Anatolian Plant Diversity Center (SWA No. 16) and is identified as an Important Plant Area (IPA). The area hosts three species listed in Appendix I of the Bern Convention: *Trigonella arenicola*, *Alkanna pinardii*, and *T. polycarpa*. Endangered habitats identified by the Bern Convention in the region include:

- **16.2112**: Mediterranean embryonic dunes
- **16.2122**: Mediterranean white dunes
- **16.224**: Eastern Mediterranean stabilized dunes
- **16.227**: Annual sparse Gramineae dune communities
- **42.83C2**: Historic Pamphylia Region Stone Pine forests

The Belek Tourism Region is located 30 km east of Antalya Province. To the north of the area are the towns of Aşağıkocayatak, Kadriye, Belek, and Karadayı. The region features intensive agricultural and tourism activities, hosting 32 four- and five-star hotels, first-class resorts, and five golf clubs (Web3).

Satellite studies indicate that from 1985 to 2022, the urbanization rate in the Kundu Tourism Region increased from 0% to 12%, while in the Belek Tourism Region, it rose from below 1% to 2%.

An analysis of the vegetation cover and land cover distributions in Kundu and Belek Tourism Regions from 1985 to 2022 shows that natural areas have gradually diminished over time. Around the constructed structures, human-made landscaped areas have emerged. Furthermore, the examination of land-use categories, usage areas, and occupancy in both regions from 1985 to 2022 reveals an increase in the areas used and occupied.

In recent years, land use has increased along with population growth. Sünbül and Tonyaloğlu (2021) investigated changes and transformations in land use/land cover (LULC) in Antalya Province's Kaş District between 2000 and 2020, reporting a 2.5-fold increase in urbanization and greenhouse activities in coastal areas. The tourism sector in Turkey has developed significantly since the early 1980s, particularly along the Aegean and Mediterranean coasts, thanks to investments and incentives (Akengin and Dinç, 2020). This has led to an urbanization process driven by tourism. Similarly, the Belek and Kundu tourism regions have experienced significant development for tourism, agriculture, and settlement purposes.

Until the 1990s, the Kundu Region exhibited natural and agricultural characteristics, but in the following years, the area rapidly opened to urbanization. Construction activities, especially along the coastline, accelerated, and by the 2010s, the coastal strip had experienced rapid urbanization. The most significant issues with the structures in the area are differential settlement (tilting) or excessive settlement. Additionally, due to the presence of loose dunes, the liquefaction potential of the region's ground is high (Dipova and Cangir, 2017).

Satellite imagery analysis reveals an increase in urbanization in both the Kundu and Belek Tourism Regions (Tables 4 and 5). When comparing the two areas, Belek Tourism Region exhibits the most significant increase in buildings and sports areas, while the Kundu Tourism Region shows the largest increase in hotel areas and associated park-recreation areas. This is primarily because the areas outside the protected Lara Forest and Yamansaz in Kundu were opened to tourism development after 1985. Meanwhile, in the Belek Tourism Region, most coastal areas remain protected as special zones, though intensive urbanization continues in inland areas.

The proper management of natural areas and their preservation for future generations is essential. The sustainability of tourism and recreation activities depends on transferring these areas' natural and cultural characteristics to future generations (Mansuroğlu and Dağ, 2020). While tourism is influenced by seasonal conditions, the presence of biodiversity and ecosystems directly correlates with the attractiveness of tourism centers. Biodiversity, in particular, plays a primary role in the sustainable growth of tourism. Therefore, unplanned tourism activities pose a significant threat to biodiversity and ecosystems (Deniz, 2019). In this context, it is crucial to ensure that tourism activities in the Kundu and Belek tourism regions are conducted without harming nature and to protect the natural areas.

Tourism should not only bring to mind sand and sun but also flora and fauna. With the rise of eco-tourism in recent years, people have become more sensitive and respectful towards the natural environment. This form of tourism involves activities that promote the social and economic development of regional communities through nature-based experiences. People engage in learning about cultural artifacts and discovering nature, vegetation, fauna, and habitats (Üzümcü and Koç, 2017). Therefore, preserving the natural beauty of the Kundu and Belek tourism regions and passing it on to future generations is highly important. Additionally, utilizing these features in eco-tourism is believed to significantly contribute to the tourism sector.

Turkey has a rich cultural and human heritage as well as a geographical structure suitable for rural tourism. Increasing demands in rural tourism can be met with these existing characteristics. Protecting natural areas is vital to ensure the health and well-being of human life. It is necessary to preserve natural areas and their associated animal and plant species along with their habitats. The tourism sector depends entirely on natural resources for its products and services. However, tourism investments and developments often pose a threat to natural resources. To prevent such negative impacts, it is crucial to engage in planned and eco-friendly activities (Atik et al., 2006).

CONCLUSION

In conclusion, intense urbanization has occurred in the Kundu and Belek tourism regions since 1985, with the most significant urbanization observed in the Kundu Tourism Region. The Belek and Kundu Tourism Regions, with their natural beauty and biodiversity, must be preserved, and their sustainable use should be ensured.

ACKNOWLEDGEMENTS

None

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

REFERENCES

Akengin, H., Dinç, Y. (2020). The effects of tourism sector on urbanization: The case of Manavgat. International Journal of Geography and Geography Education (IGGE), 41, 199-220.

Altuntaş, A., Benliay, A. Ortaçeşme, V. (2011). Antalya Kentsel Gelişiminin Lara Kumul Ormanları Üzerine Etkileri. I. Ulusal Akdeniz Orman ve Çevre Sempozyumu. Kahramanmaraş. 122-128.

Amini, S., Saber, M., Rabiei-Dastjerdi, H., Homayouni, S. (2022). Urban land use and land cover change analysis using random forest classification of landsat time series. Remote Sensing, 14(11), 2654

Ceylan, H. (2021). Antalya Manzarası. Bilim Armonisi, 4(1), 7-7.

Deniz, T. (2019). Turizm ve Biyoçeşitlilik. Safran Kültür ve Turizm Araştırmaları Dergisi, 2(3), 323-339

Dipova, N., Cangir, B. (2017). Lara - Kundu (Antalya) Düzlüğünün Sıvılaşma Şiddeti İndeksi'ne (LSI) Dayalı Sıvılaşma Haritası. Jeoloji Mühendisliği Dergisi, 41(1), 31-46.

Dipova, N. (2002). Antalya kıyı düzlüklerinin oluşumu ve mühendislik özellikleri, IV. Kıyı. IV. Kıyı Mühendisliği Ulusal Sempozyumu, 24-27 Ekim 2002, Antalya, Bildiriler Kitabı, 429-442.

Dipova, N., Oğuz, C. (1998). Lara (Antalya) kumulları ve kıyı alanı. Türkiye'nin Kıyı ve Deniz Alanları II. Ulusal Konferansı Bildiriler Kitabı, 22-25 Eylül, ODTÜ, Ankara.

Ekici, B. (2020). Kumul biyotoplarının haritalanması, Kurucaşile (Bartın) örneği. Turkish Journal of Forestry, 21(2), 188-194.

Göktürk, R.S. (1994). Antalya Şehir Florası Üzerinde Bir Araştırma. Akdeniz Üniv. Fen Bil. Enstitüsü Yüksek Lisans Tezi. 225 syf.

Işık, S., Zoğal, V. (2017). Turizm Kentleşmesi Kavramı: Antalya Örneği. Ege Coğrafya Dergisi, 26(2), 71-94.

İçemer, G. T., Topaloğlu, A. 2020. Antalya Kent Plajlarının Yüzme suyu ve Plaj Kumu Mikrobiyolojik Kalitesinin Değerlendirilmesi ve Halk Sağlığı Riskleri. Türk Hijyen ve Deneysel Biyoloji Dergisi, 77(EK-4), 77-82.

Koç, K., Koşun, E., Karaman, M.E. 2015. Kıyı Sedimentlerinde Tane Boyunu Etkileyen Faktörler: Antalya Körfezi'nde Konyaaltı ve Lara Plajlarının (Antalya) Karşılaştırılması. Türkiye Jeoloji Bülteni. 58(2), 85-102.

Mansuroğlu, S., Dağ, V. (2020). Antalya'daki Korunan Alanlarda Turizm ve Rekreasyon Etkinliklerine Bağlı Kullanım Sorunları: Köprülü Kanyon Milli Parkı Örneği. Peyzaj Araştırmaları ve Uygulamaları Dergisi, 2(2), 85-95.

Özçelik, M. (2017). Belek Kıyısı (Antalya) İçin Kıyı Kenar Çizgisinin Önemi. Türkiye Jeoloji Bülteni, 60(3), 331-346.

Phan, T. N., Kuch, V., Lehnert, L. W. (2020). Land cover classification using Google Earth Engine and random forest classifier—The role of image composition. Remote Sensing, 12(15), 2411. https://doi.org/10.3390/rs12152411

Piao, Y., Jeong, S., Park, S., Lee, D. (2021). Analysis of land use and land cover change using time-series data and random forest in North Korea. Remote Sensing, 13(17), 3501. https://doi.org/10.3390/rs13173501

Sünbül, V., Tonyalıoğlu, E.E. (2021). Antalya İli Kaş İlçesi Örneğinde Alan Kullanım /Arazi Örtüsü Değişim Tespiti. Uluslararası Doğu Anadolu Fen Mühendislik ve Tasarım Dergisi, 3(2), 376-387.

Üzümcü, O.O., Koç, B. (2017). Ekolojik Turizm Kavramı: Fethiye Örneği. Tarım Bilimleri Araştırma Dergisi, 10(1), 14-19.

Web1. (2022). http://obanettr.org/default.asp?baslik=laraperakende_kumullari&page=2&a=83&b=1&c=83. Access Date: 05.06.2022

Web2. (2022). http://obanettr.org/images/pdf/64.pdf. Access Date: 08.06.2022

Web3. (2022). http://www.belek.info. Access Date: 14.10.2022

Web4. (2022). https://ockb.csb.gov.tr/belek-ozel-cevre-koruma-bolgesi-i-2759. Access Date: 14.10.2022

Vuruşkan, A., Ortaçeşme, V. (2009). Antalya Kentindeki Doğal Sit Alanlarına İlişkin Sorunların İrdelenmesi. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 22(2), 179-190.

Vuruşkan, A. (2009). Antalya Kentindeki Doğal Sit Alanlarına İlişkin Sorunların İrdelenmesi. Akdeniz Üniversitesi Fen Bilimleri Enstitüsü Peyzaj Mimarlığı Anabilim Dalı Yüksek Lisans Tezi, Antalya, 134 s.