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Sustainable Tourism in Protected Areas: The Case of Divjakë-Karavasta National Park

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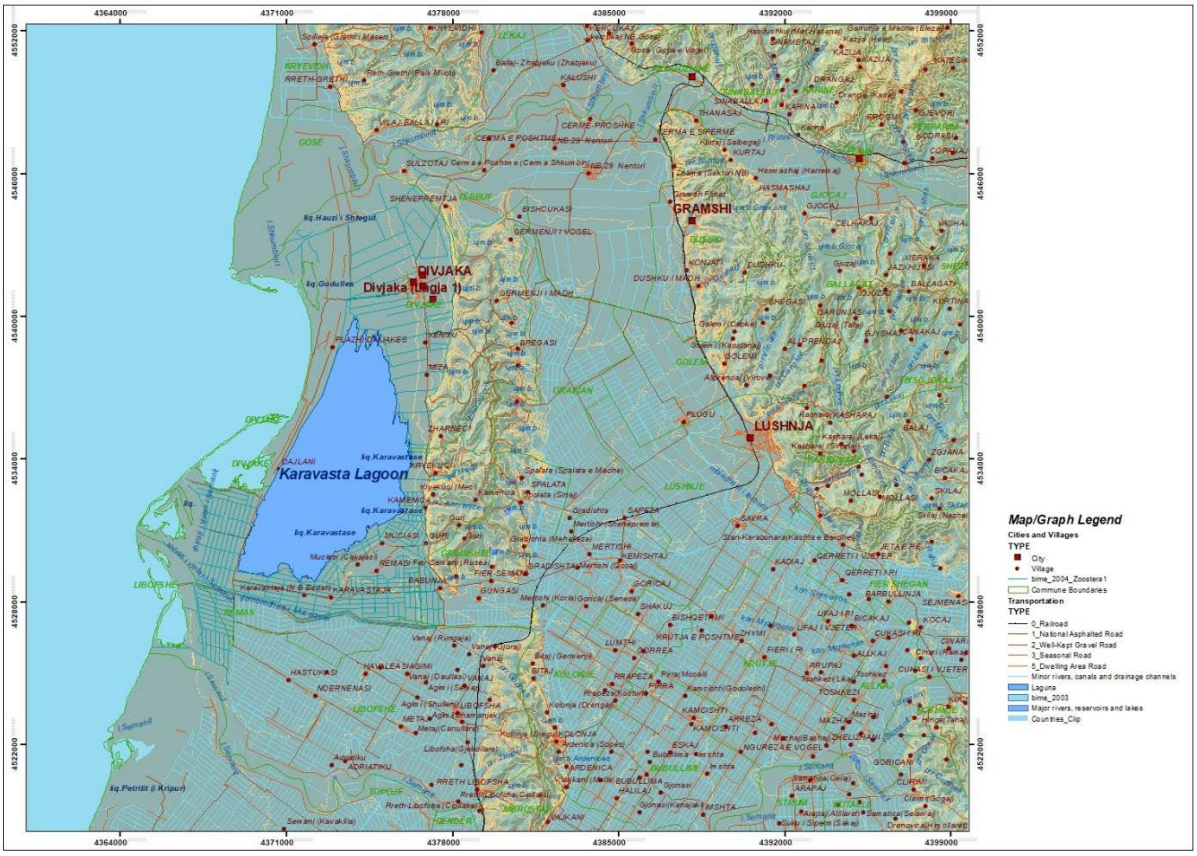
Abstract

Divjakë-Karavasta National Park is located in the western part of Albania, between the cities of Divjakë and Fier, covering an area of approximately 22,389 hectares. The Park is one of the most important biodiversity hotspots in Albania and is part of the Ramsar Convention for the protection of wetlands. Its rich biodiversity, natural landscapes, and the tranquility the area offers are valuable resources with great potential for various forms of tourism such as ecotourism, rural tourism, scientific tourism, and more. Tourism is a rapidly growing sector in the park, especially during the summer season, when thousands of local and foreign visitors explore the area's natural beauty and rich biodiversity. The park's center is located near Divjakë Beach, approximately 1.2 km southwest of the park entrance, and most services are concentrated there. Divjakë Beach is a 15 km long stretch of white sand bordered by a pine forest, making it a popular beach destination for thousands of tourists and day visitors, mainly from south-central Albania.Considering this wide range of values and with the goal of promoting long-term sustainable tourism, the development of quality accommodation infrastructure, diversification of services, and their integration can create real potential for growth in the tourism sector. This development allows the implementation of a broad range of activities that incorporate nature, ecology, local culture, and tradition. Through field data analysis, interviews with local stakeholders, and review of policy documents on protected area management, a clear overview of the current situation and opportunities for improvement is presented. However, interventions such as road construction or upgrades can have significant environmental consequences, particularly for forest ecosystems. Negative impacts include habitat fragmentation, soil degradation through erosion, disruption of ecological corridors for wildlife, spread of invasive species, and increased pollution (acoustic, atmospheric, and hydrological). Investments in environmentally friendly infrastructure, educating the local population on sustainable natural resource management, and promoting responsible tourism help create a balance between economic development and biodiversity conservation. In those conditions, it is recommended to develop and implement a sustainable tourism management plan that balances the conservation of natural values with economic development, turning Divjakë-Karavasta National Park into a successful model of coexistence between people and nature.

Keywords: sustainable tourism, protected area, tourism infrastructure, biodiversity

1 Introduction

The Divjakë-Karavasta National Park, with a total area of 22,389 hectares, is a protected area along Albania's coastal zone, composed of complex ecosystems that are exceptionally rich in biodiversity and natural resources. Classified as one of the country's most valuable sites in terms of nature and biodiversity, and part of the Ramsar Convention for the protection of wetlands, the primary aim of this study is to assess the opportunities and challenges for sustainable tourism development in the Divjakë-Karavasta National Park and to propose a viable development scenario that encourages activities balancing ecosystem conservation with the need to maintain the pace of tourism growth in the region. One of the specific objectives of this study is to analyze the park's natural tourism potential while simultaneously identifying the current and potential impacts of tourism on the environment and the protected area, with particular emphasis on involving local stakeholders and the community in both conservation and promotional activities, as a best practice for advancing sustainable tourism development. The park is composed of several key environments, including the Karavasta Lagoon, the surrounding wetlands, the old and new riverbeds of the Shkumbin and Seman rivers, the Tërbufi and Myzeqe water basins, reservoirs, agricultural lands, riparian forests along the Shkumbin and Seman rivers, Mediterranean pine forests, and the forests of the Divjakë hills.



Map 1: Physico-Geographical Conditions of the Divjakë-Karavasta National Park

Source: Sonila Xhafa Sinjari; Bujar Drishti

Today, the park is one of the most attractive destinations along Albania's sandy coastline, offering opportunities for marine tourism, ecotourism, recreation, as well as scientific research and study. From a physico-geographical perspective, the Divjakë-Karavasta National Park represents a low coastal plain characterized by alluvial soils and flat terrain.

The Karavasta Lagoon, which constitutes the core of the park, is one of the largest in the Mediterranean, with an average depth ranging from 0.7 to 1.5 metres (NAPA, 2025). The park's topography also includes dense pine forests along the coastal zone, which play a crucial role in protecting inland ecosystems from erosion and the intrusion of saline waters. A distinctive feature of the park is the presence of sand dunes, which create a rare landscape and shield the lagoon areas from the direct influence of the sea. These formations are also vital for maintaining the ecological stability of the park. The park is particularly renowned for its population of Dalmatian pelicans (*Pelecanus crispus*), a rare and endangered species that finds an ideal refuge within the park's wetland habitats. Tourism has developed primarily around day visitors, and local cuisine is centered on fish products, for which the area is widely recognized throughout the country.

2 Literature Review

Divjakë-Karavasta National Park is located in the western part of Albania, between the towns of Divjakë and Fier, covering an area of approximately 22,389 hectares (DMC, 2022). The park lies in the central and western coastal region of Albania and is bordered to the north by the Shkumbin River, to the east by the Divjakë hills, to the south by the Seman River, and to the west by the Adriatic Sea. Conceptually, sustainable tourism is rooted in the principles of sustainable development, emphasizing the need to balance resource conservation with socio-economic benefits. According to Bramwell and Lane (2011), sustainable tourism requires integrated planning, participatory governance, and continuous monitoring to ensure that tourism growth remains within ecological boundaries. The "*triple bottom line*" framework, environmental, social, and economic sustainability, remains a widely used analytical lens for evaluating tourism impacts (Elkington, 1997; UNWTO, 2013). The literature shows that these areas are highly sensitive to human pressures such as habitat degradation, waste deposition, and wildlife disturbance (Eagles et al, 2002). Research from Mediterranean coastal wetlands underscores the importance of adaptive management due to the vulnerability of lagoon ecosystems and their high attractiveness for tourism (Papayannis & Salathé, 2010).

Sustainable tourism development relies on a multidimensional set of indicators that assess the long-term viability of natural and human systems. Environmental indicators evaluate the condition of habitats, forests, and aquatic ecosystems, offering insights into tourism-induced pressures (UNEP, 2005). Social indicators emphasize community perceptions, levels of participation, and the distribution of tourism benefits (Nicholas et al, 2009). Economic indicators focus on employment, income diversification, and the contribution of tourism to local development (Sharpley, 2020). Institutional and management indicators, particularly those based on carrying capacity, examine governance effectiveness and the implementation of visitor management strategies (Eagles et al, 2002). Environmental indicators are among the most critical, encompassing the state of habitats, forest ecosystems, and aquatic ecosystems, all of which shape the ecological resilience of a destination.

These indicators help determine how tourism activities interact with biodiversity, ecosystem functions, and the overall environmental balance. Monitoring such parameters is essential for identifying pressures on natural resources and guiding strategies that promote conservation while allowing responsible visitor use. Social, economic, and institutional indicators complement the environmental dimension by offering a holistic understanding of sustainability outcomes. Social indicators, particularly local community perceptions, capture the degree of support, involvement, and benefit distribution among residents, highlighting tourism's social legitimacy. Economic indicators assess the contribution of tourism to local livelihoods, employment, and income diversification. Institutional and management

indicators, especially those grounded in the carrying capacity of the territory, evaluate the effectiveness of governance structures and planning mechanisms in ensuring that tourism growth remains within ecological and socio-spatial limits. These indicators provide an integrated framework for sustainable tourism management.

3 Methodology

The methodological framework of this study combines survey-based data collection with advanced geospatial analysis in order to comprehensively assess sustainable tourism conditions within the Divjakë-Karavasta Protected Area.

This mixed-methods approach enabled the integration of socio-demographic indicators, community perceptions, and spatial environmental assessments, thereby providing a multidimensional understanding of both human and ecological dynamics in the study area. The selection of survey respondents followed a purposive sampling strategy, ensuring that only permanent inhabitants of the protected area were included. The targeted administrative units were: Divjakë, Tërbuf, Rremas, Gradishtë, Grabian

The determination of the required sample size was based on the widely applied Yamane (1967) formula: n = N / 1 + N (e)2

Where:

n => sample size

N => population of the study

e => margin error

Based on this formula, N= 34,254 (number of residents in Divjaka Municipality) and e= 0.05.

n = 34,254 / 1 + 34,254 (0.05)2 = 399 surveys. First period of the realization of the questionnaires was September-November, for urban area with 270 questionnaires and second period was November – December in rural area with 129 questionnaires.

The questionnaire was designed to support future initiatives for innovative protected area governance, ensuring full anonymity and maintaining confidentiality in compliance with ethical guidelines. The collected responses provided essential insights into the awareness, attitudes, and involvement of local residents regarding the protection of the Divjakë-Karavasta ecosystem. The demographic structure of the sample reflected a diverse community: the majority of respondents belonged to the 20-30 age group (45%); 56% had completed secondary education, 24% basic education, and 20% higher education. Most participants (85%) were native to Divjakë, while the remaining 15% were newcomers to the area.

In addition to the survey component, the study employed geospatial technologies to monitor environmental conditions and assess land cover changes relevant to sustainable tourism management. Geographic Information Systems (GIS), remote sensing (RS), UAV imagery, and satellite data from Albania 1 and Albania 2 were used to analyze spatial patterns and detect ecological pressures across the protected area.

Land cover classification was conducted through a supervised classification approach using the Maximum Likelihood Algorithm, which is recognized for its high precision in differentiating built-up areas, vegetation, and water bodies. Classification accuracy was evaluated using a confusion matrix based on reference points collected from high-resolution Google Earth imagery and field observations. The analysis achieved an overall accuracy

exceeding 87% and a Kappa coefficient of 0.82, confirming the reliability and robustness of the classification results.

A central element of the geospatial analysis was the computation of the Normalized Difference Built-up Index (NDBI), an RS-derived index widely used for identifying built-up surfaces in urban and peri-urban environments. The NDBI was calculated using Landsat 8/9 imagery according to the formula:

$$NDBI = (SWIR - NIR) / (SWIR + NIR)$$

Where:

SWIR (Shortwave Infrared) and NIR (Near Infrared) bands were extracted respectively from Band 6 and Band 5 of Landsat 8/9.

4 Results and Discussions

4.1 Environmental Indicators: Habitats, Forest Ecosystems, Aquatic Ecosystems

Divjakë-Karavasta National Park represents one of the most important and sensitive ecosystems among protected areas in Albania. The park's topography reflects a natural division of habitats: the central area is dominated by the expansive Karavasta Lagoon, while along the coastline, a wide strip of sandy dunes separates the lagoon from the Adriatic Sea (AKZM, 2025). Divjakë-Karavasta National Park is recognized as a key biodiversity hotspot in the entire Mediterranean region, particularly for its lagoon ecosystems, coastal pine forests dominated by Stone Pine (*Pinus pinea*) and Aleppo Pine (*Pinus halepensis*), sandy dunes, wetlands, and reed beds. Karavasta Lagoon, considered the heart of the park, is one of the largest in the Mediterranean, with an average depth ranging from 0.7 to 1.5 meters. The lagoon comprises a network of channels and deltas formed by the Shkumbin River and its tributaries, providing a rich habitat for both flora and fauna. Spanning approximately 41.8 km² between the mouths of the Seman and Shkumbin Rivers, it plays a critical role in supporting regional biodiversity (Academy of Sciences of Albania, 1991). Notably, it hosts the only nesting site in Albania for the Dalmatian Pelican (*Pelecanus crispus*).

The Godullë Lagoons both Great and Small are located in close proximity to Karavasta Lagoon, with the Great Lagoon covering 8.5 km² and reaching a maximum depth of 3.8 meters. (ASH, 1991) In addition to lagoons, the Shkumbin and Seman rivers influence sediment distribution and delta formation, creating vital habitats for migratory birds and aquatic species. Kular Island, located near the Shkumbin River delta at 0.5 m above sea level, was formed by alluvial deposits and provides habitat for waterbirds, notably the Dalmatian Pelican. Pelican Island, a geomonument in the region, is surrounded by reedbeds, where halophytic herbaceous vegetation predominates, and serves as a nesting site for Dalmatian Pelicans. The Godullë, a hydro-monument situated in the northwest of the Divjakë forest, is surrounded by forested areas and dune systems with shrubs and pine trees.

The park is distinguished by diverse endemic and sub-endemic flora and fauna and serves as a major wintering ground for waterbirds, hosting on average 37,000 individuals during the International Waterbird Census (1993-2021). It is also a critical breeding site, supporting approximately 12,000 breeding pairs as of 2017, and provides habitats for about 200 species of migratory birds, including 85 species listed in Annex I of the EU Birds Directive (EU, 2013). Another significant biomonument is the Aleppo Pine in the Divjakë oasis, aged approximately 410 years. The park contains eight officially designated Natural Monuments (DMC, 2022) including four geomonuments, one hydro-monument, and three biomonuments.

4.2 Social Indicators: Local Community Perception

The Divjakë-Karavasta area represents a socio-economic space of considerable natural, scenic, and economic value, supported by significant human capital, contributing to regional and national development. Divjakë Municipality, largely rural except for its central urban area, encompasses the city of Divjakë and 36 surrounding villages, with a total population of 24,882 as recorded in the 2023 Censusm (INSTAT, 2023). Human activities within this territory, aimed at providing infrastructure and services for local communities, are often associated with the loss of forested areas and environmental degradation, including soil, water, and air pollution. Unplanned urbanization, construction, intensive agriculture, and pollution further exacerbate the degradation of forest and coastal habitats. Given the ecological importance of the park, educational institutions and environmental organizations actively engage in awareness-raising initiatives, promoting biodiversity conservation and sustainable development.

Awareness and understanding

Although 90% knew that Divjakë-Karavasta is a protected area, 10 % were unaware of this fact. Understanding of the term *"protected area"* was often superficial, 37.4 % associated it mainly with "*state or legal protection*", while only small shares linked it to biodiversity the Ramsar Convention or environmental conservation.

Table 1: Understanding of the local population on the term "protected area"

Understanding/associations	**Responses (%)**
Protection by the state/institution/law"	37.4
Prohibition of certain activities	16.6
Protection from natural disasters and human-caused hazards	10.9
Protection under the Ramsar Convention	8.2
Preservation of biodiversity	7.8
Implementation of specific management practices	5.7
Designation as a National Park	4.6
Environmental conservation	2.9
Preservation of cleanliness	2.8
Protection from pollution	1.6
Designation as an untouchable area	1.5
Total	100

Source: Survey results

Importance of protected area preservation

Conservation is viewed as a high priority, 56.4 % rated it *"extremely important"* and 28.3% *"very important".* The mean score (4.38/5) reflects strong environmental awareness among locals.

Table 2: Importance of the preservation of forests in Divjaka-Karavasta protected area

Level of the perceived importance	Evaluation (%)
Not important at all	2.3
Slightly important	4.2
Moderately important	8.8
Very important	28.3
Extremely important	56.4
Mean score	4.38

Source: Survey results

Perceived benefits of area preservation

The main perceived benefits include improved air quality and health (90.2%), tourism development (70.2%), and increased employment (53.7%). Other cited benefits include psychological well-being and protection from floods/erosion and biodiversity conservation

Table 3: Main benefits of forest preservation in Divjaka-Karavasta protected area according to the local population

Benefits	Citation frequency (%)
Better air quality and physical health	90. 2
Tourism development	70.2
Increased employment opportunities	53.7
Increased psychological well-being	25.0
Protection from floods and erosion	25.0
Improvement of local climate	13.9
Preservation of biodiversity	13.9

Source: Survey results

Main threats to protected areas

Fires were identified as the most damaging factor (68.2%), followed by deforestation (12.8%), human expansion through construction and agriculture (10%), and uncontrolled tourism (6.6 %).

Table 4: Most damaging activities and events for the forests of Divjaka-Karavasta protected area

Activities/events	Citation frequency (%)
Fires	68.2
Deforestation	12.8
Increased human activity for agriculture and turistic pourpose	10
Uncontrolled tourist activities	6.6
Other	2.4
No answer	0

Source: Survey results

In summary, the local community demonstrates a strong sense of importance toward forest conservation but still faces gaps in knowledge, engagement, and institutional coordination.

Increasing education, community involvement, and sustainable management efforts are key to ensuring the long-term protection and health of the Divjakë-Karavasta forests. Findings indicate that while the Divjakë community maintains a strong connection with Divjakë-Karavasta National Park, understanding of the protected area concept remains fragmented. Most residents associate protection primarily with governmental institutions and legal frameworks, with fewer recognizing the fundamental objectives such as biodiversity conservation or sustainable management. Approximately 10% of residents are unaware that the area is protected, highlighting significant information gaps. Nonetheless, the majority value forest conservation highly, linking it to tangible benefits such as improved air quality, tourism development, and job creation. Furthermore, local institutions and organizations are seen as critical in implementing concrete measures, enhancing monitoring, promoting sustainable practices, and actively involving citizens, particularly youth. These insights underscore that integrating institutional efforts, educational initiatives, and community engagement is essential for ensuring the long-term protection of Divjakë-Karavasta National Park, fostering a model of coexistence between development and nature conservation.

4.3 Economic Indicators

The rich biodiversity, natural landscapes, and tranquility offered by the Divjakë-Karavasta area constitute significant resources with high potential for various types of tourism, including ecotourism, rural tourism, and scientific tourism. Currently, tourism-related economic activities are concentrated primarily around Divjakë Beach, catering mainly to day visitors, with summer attendance reaching approximately 10,000 tourists. Tourism represents a rapidly growing sector within the park, particularly during the summer season, when thousands of domestic and international visitors explore the area's natural beauty and rich biodiversity. Residents of the municipality, living in the vicinity of the park, benefit directly from economic activities such as tourism and fishing.

The park's central facilities are located near Divjakë Beach, approximately 1.2 km southwest of the main park entrance, making the central area the hub for services. Divjakë Beach, a 15 km stretch of white sand bordered by a pine forest, is a popular destination for thousands of day visitors, primarily from southern and central Albania. The sandy shore lies approximately 250 meters from the pine forest boundary along the coastline, and during peak season, this separation allows for relative privacy along the beach. Divjakë-Karavasta National Park, one of Albania's most important ecosystems and part of the internationally significant network of protected areas, faces considerable pressures from tourism, especially over the past decade, as visitor numbers have increased substantially. While tourism is recognized as a driver of economic development and a promoter of natural values, it has caused both direct and indirect damage to this sensitive ecological area.

The most visible impacts include habitat disturbances due to informal construction of tourism infrastructure such as restaurants, unregulated roads, and accommodation facilities often developed without environmental impact assessments. (Bego, 2018). These interventions have contributed to landscape fragmentation and the reduction of Mediterranean pine forest areas, disrupting the natural balance of the region. Pollution represents another significant challenge, as increased urban and plastic waste from visitors has directly affected lagoon water quality and the health of wildlife, particularly waterbirds such as the Dalmatian Pelican (*Pelecanus crispus*), an internationally protected species (BirdLife International, 2021). Additionally, the growth of recreational fishing and motorized watercraft use within the lagoon has disturbed bird breeding periods and reduced reproductive success (Kociu, 2020). Mass tourism has also generated acoustic and visual pressures, undermining the natural serenity essential for the proper functioning of the lagoon ecosystem. Although tourism is

often argued to raise environmental awareness, the lack of sustainable management and spatial planning has allowed the negative impacts to outweigh the benefits (UNDP, 2019). In this context, a reorientation toward sustainable tourism is urgently required. This includes implementing visitor quotas, strict controls on construction, investments in environmental education, and active engagement of local communities in park management. Such measures are critical to achieving a balance between biodiversity conservation and tourism utilization, ensuring that Divjakë-Karavasta National Park remains a living national and international asset for future generations.

4.4 Institutional and Management Indicators based in Carrying Capacity of the Territory

The management of Divjakë-Karavasta National Park falls under the jurisdiction of the National Agency of Protected Areas (AKZM), in collaboration with local institutions and environmental organizations. The legal status of the park, with all its associated restrictions and benefits, represents a direct effort to safeguard its ecological integrity against threats such as urbanization, pollution, human interventions, deforestation, unregulated construction, and illegal hunting. Divjakë-Karavasta National Park is divided into three management and protection subzones:

a) *Central subzone* - covering an area of 9,220.57 ha. This subzone encompasses the primary forest habitats (high forests, undergrowth, and shrublands) and is designated as a zone of high and rare natural and biodiversity value. It implements the highest level of protection, ensuring a largely undisturbed territory (VKM No. 59, 26.01.2022). Within this subzone, scientific research and the development of low-impact ecotourism activities in nature are permitted.

b) *Traditional use and sustainable development subzone* - covering 12,939.06 ha. This subzone includes forested lands, agricultural areas, pastures, and aquatic/wetland territories where traditional human activities are allowed to continue. A second level of protection is applied here, which allows controlled economic, social, agribusiness, recreational, sports, and ecotourism activities. Infrastructure development is permitted in accordance with urban and tourism development plans, ensuring minimal environmental impact (VKM No. 59, 26.01.2022).

c) *Recreation subzone* - covering 229.45 ha. This area includes portions of forest and aquatic habitats and applies a third level of protection, permitting low-impact tourism activities such as nature walks and controlled tourism services. All activities are designed to respect the ecological functions and natural landscape values of the protected area, supporting urban and spatial planning studies (VKM No. 59, 26.01.2022).

This zonation system allows for differentiated management approaches, balancing strict conservation in ecologically sensitive areas with sustainable use and recreational opportunities in less sensitive zones, thereby enhancing the park's administrative capacity to manage human activities effectively while preserving biodiversity.

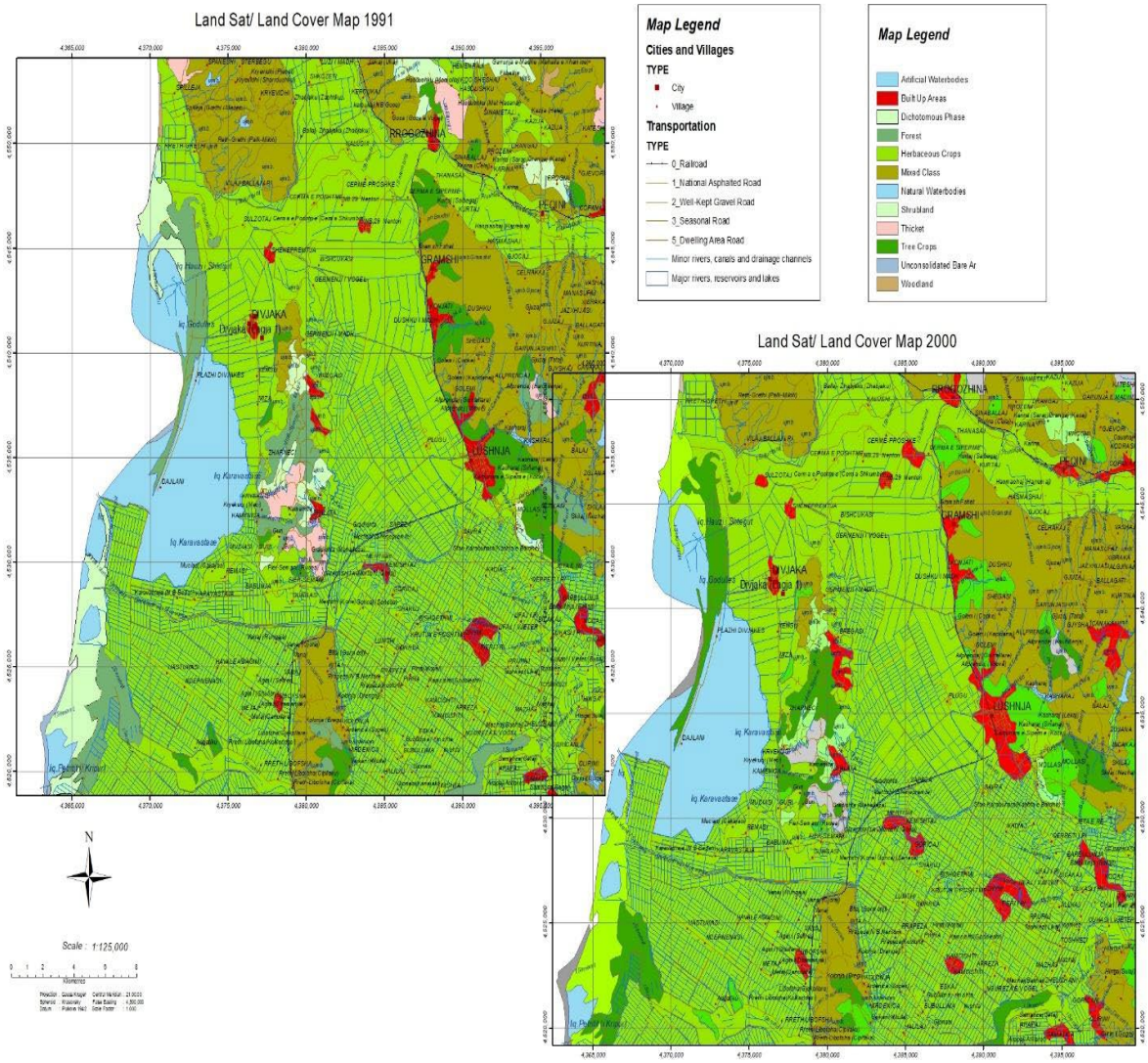
Table 5: Internal Zoning of the Park

Zoning	Area (ha)	Percentage (%)
Central Zone	9220.57	41.18
Traditional Use and Sustainable Development Zone	12939.06	57.79
Recreation Zone	229.45	1.03
Total	***22389.08***	***100.00***

Source: VKM No. 59, dated 26.01.2022

According to the latest data from the Institute of Statistics (INSTAT, 2023) the Divjakë-Karavasta National Park was visited by a total of 609,000 tourists during 2023, of which 400,000 locals and 209,000 foreigners. Compared to the data reported for the period before 2020, this represents an increase of over 300% in the number of visits, placing Divjakë-Karavastan among the 5 most visited parks in Albania. (INSTAT, Tourism and Environment Statistics Report, 2023). These figures confirm a significant increase in tourist frequency compared to the pre-pandemic period and position the park among the most frequented natural tourism destinations in Albania.

The ecosystem of Divjakë-Karavasta National Park is threatened by a range of factors related both to human pressure and to climate change. Among the most significant stressors are intensive agricultural activities, uncontrolled urban interventions, informal construction, and the increasing presence of mass tourism, often without adequate infrastructure to protect the natural environment. Geospatial technologies are crucial to monitor environmental conditions and assess land cover changes relevant to sustainable tourism management. In this study are used satellite images a from Albania 1 and Albania 2 local stations covered by ASIG (Albanian Authority for geospatial Information) for analysing spatial patterns and detect ecological pressures across the protected area. Land cover classification was conducted through a supervised classification approach using the Maximum Likelihood Algorithm, which is recognized for its high precision in differentiating built-up areas, vegetation, and water bodies. The analysis achieved an overall accuracy exceeding 87% and a Kappa coefficient of 0.82, confirming the reliability and robustness of the classification results.



Map 2: Land cover changes during the period 1991–2001

Source: Sonila Xhafa Sinjari; Bujar Drishti

During the period 1991-2001, built-up areas expanded significantly, reflecting rapid urbanization primarily around Divjakë and Lushnja, as well as an expansion of internal agricultural lands at the expense of forested areas and the loss of shrublands along the canals, which were converted into agricultural land. According to ArcGIS Pro Change Detection Matrix analyses, in the Divjakë–Karavasta area, forested areas were generally preserved in some western and southern zones of the map, near the lagoon and the Divjakë forest. Approximately 1.2% of woodland areas were converted into agricultural land (herbaceous crops), and 0.8% were converted into built-up areas. Around 2.0% of the land that was herbaceous in 1991 was transformed into orchards, while bare areas were reduced, with portions converted to agricultural or built-up land.

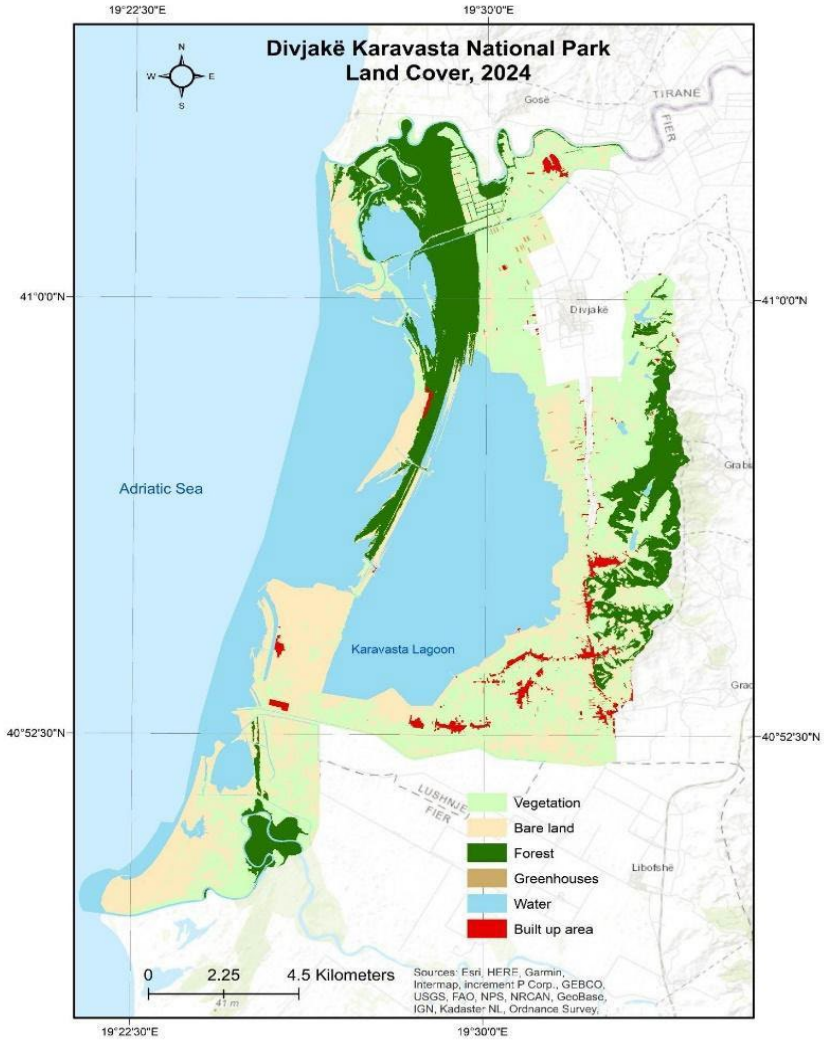
In the context of the latest developments in sustainable tourism governance after 2020, these land-use transformations are increasingly linked to the challenges of managing overtourism in protected areas and to the need for implementing integrated frameworks such as the Limits of Acceptable Change (LAC) and Visitor Experience and Resource Protection (VERP) models. These approaches have been applied in several Mediterranean national parks to balance tourism development with the preservation of ecological integrity and to ensure a

sustainable visitor experience. Within this framework, community-based tourism has gained particular relevance, fostering local participation in the governance of natural resources and mitigating environmental pressures through a more equitable distribution of socio-economic benefits. Based on satellite imagery data from 2024, processed in ASIG (Albanian Authority for geospatial Information) (Albanian Authority for geospatial Information), the land cover in Divjakë-Karavasta National Park is categorized as follows:

Table 6: Area of the National Park, Classified by Land Cover

Cover Types	**Area (ha)**	**Percentage (%)**
Agricultural land	6204.13	27.71
Forested areas	2321.11	10.37
Heterogeneous agricultural areas	1256.72	5.61
Inland water bodies	42.15	0.19
Marine water areas	7768.73	34.70
Wetlands	2265.4	10.12
Sparse vegetation areas	693.48	3.10
Pastures	78.92	0.35
Shrublands	1344.47	6.01
Urban areas	249.82	1.12
Total	22389.08	100

Source: VKM No. 59, dated 26.1.2022



Map 3: Land cover map, 2024

Source: Authors

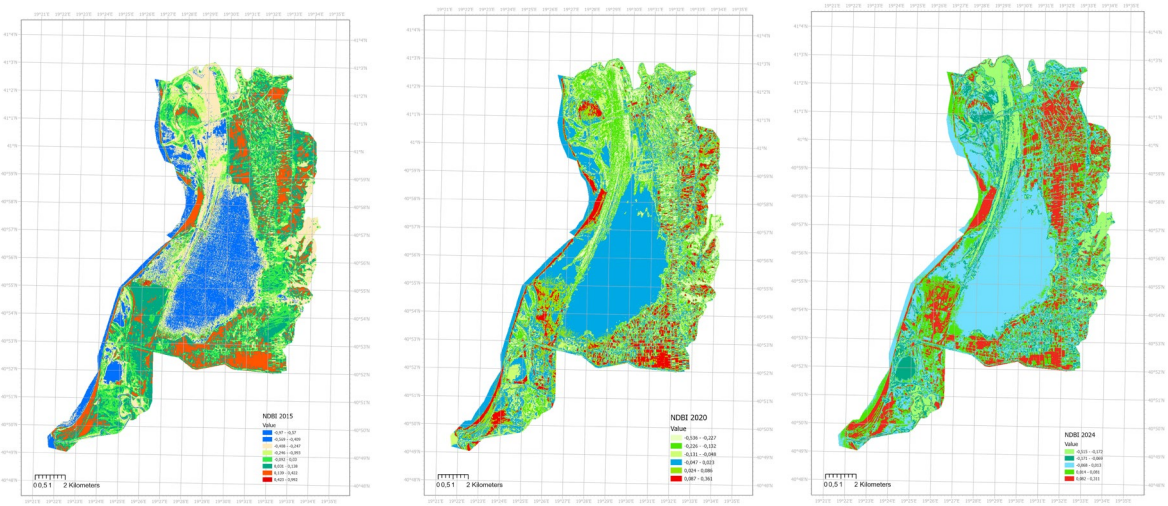
However, the park faces numerous challenges, including anthropogenic pressures (urbanization, road infrastructure, pollution, and habitat fragmentation) and fisical factors (erosion, drought, soil salinization, fires, floods, and climate change).

The Normalized Difference Built-up Index (NDBI) is a remote sensing (RS) index particularly useful for identifying and monitoring built-up areas in urban and peri-urban environments. The NDBI index maps for the years 2015, 2020, and 2024 were generated using Landsat satellite imagery, acquired from the Landsat 8 OLI/TIRS sensor for the years 2015 and 2020, and Landsat 9 OLI-2/TIRS-2 for the year 2024. These sensors provide a spatial resolution of 30 meters, which is adequate for analyzing land-cover and built-up changes at regional scales. The images were collected during summer months (June-August) to minimize seasonal vegetation effects and ensure cloud-free conditions. The NDBI (Normalized Difference Built-up Index) was calculated using the formula:

NDBI = (SWIR - NIR) / (SWIR + NIR)
where SWIR (Shortwave Infrared) and NIR (Near Infrared) bands were extracted respectively from Band 6 and Band 5 of Landsat 8/9.
Pixel values of NDBI were then classified into categories representing land cover types:

- High built-up areas (NDBI > 0.2)
- Moderate built-up areas (0.1 – 0.2)
- Low built-up / mixed surfaces (0 – 0.1)
- Non-built areas (NDBI < 0)

The classification process was based on a supervised classification approach using the Maximum Likelihood Algorithm, which allows precise separation between built-up, vegetation, and water surfaces. The classification accuracy was evaluated using a confusion matrix based on reference points from high-resolution Google Earth imagery and field data. The results showed an overall accuracy above 87% and a Kappa coefficient of 0.82, confirming the reliability of the classification.



Map 4: NDBI Index map in 2015,2020,2024

Source: Authors

The resulting maps show a progressive increase of built-up surfaces from 2015 to 2024, particularly in the coastal and peri-urban zones of Divjakë, illustrating urban expansion and land-use pressure over the protected area. During the period 2015-2024 the Build Up area is increased and this is an ongoing threat to the ecosystem of the park. The LAC approach helps identify acceptable changes that can occur in the environment without harming sustainability.

Table 7. Assessment of Environmental Aspects Based on the Limits of Acceptable Change (LAC) Framework in Divjakë–Karavasta National Park

Aspect	Current Condition	Acceptable Limit	Assessment
Forest habitats (Sinjari. et al , 2025); (Kociu, 2020)	1.2% reduction (1991–2001) due to construction activities	≤5% per 10 years	Within limit but at risk
Biodiversity (waterbirds) (International, 2021)	Decline in breeding success of *Pelecanus crispus*	≤10% deviation	Seasonal exceedance
Noise and anthropogenic pressure (Bego, 2018); (Coccossis, 2020)	Increased pressure in coastal areas	≤20% from baseline	Temporary exceedance

The Divjakë-Karavasta National Park currently experiences seasonal anthropogenic overcapacity, indicating the urgent need for comprehensive management interventions. These should include tourist flow regulation, strict control of unplanned construction, and the

development of a long-term visitor monitoring system to maintain environmental integrity and support sustainable tourism practices. Evidence suggests that the park has reached a threshold of seasonal anthropogenic saturation, reflecting the imbalance between tourism intensity and ecosystem resilience. Immediate policy actions are required to reduce visitor pressure, mitigate informal land-use expansion, and establish a permanent monitoring mechanism to guide adaptive management strategies. Geographic Information Systems (GIS), Remote Sensing (RS), and Unmanned Aerial Vehicles (UAVs) has revolutionized protected area monitoring and management. These technologies enable the identification of species, assessment of ecosystem health, and prevention of negative phenomena such as illegal logging and forest fires, thereby ensuring more effective protection. Research findings emphasize that expanding the application of GIS, RS, and drones for monitoring forests and natural resources in protected areas represents a major step toward more sustainable environmental management.

5 Conclusion

Infrastructure within Albania's protected areas represents a vital component for enabling access, promoting sustainable tourism development, and highlighting the natural and cultural values of these territories. However, the expansion of tourism infrastructure, construction near the coast, and interventions in natural habitats compromise the ecological integrity of the park. These pressures additionally threaten forested and coastal habitats by causing habitat fragmentation, soil degradation through erosion, disruption of ecological corridors for wildlife, the spread of invasive species, and increased pollution (acoustic, atmospheric, and hydrological). The sustainability of Divjakë-Karavasta National Park requires a transition from a mass tourism scenario, characterized by increasing visitor numbers without management measures, toward a balanced destination where biodiversity, local economy, and community involvement develop in harmony. Sustainable tourism strategies should be closely linked to limiting visitor flows within the park through tourism flow controls and investments in green infrastructure, while activating additional services and initiatives such as:

- Diversification of tourism products shifting from mass beach tourism toward nature-based, cultural, and educational tourism.
- Development of nature- and biodiversity-based activities birdwatching, water sports, eco-accommodation, agritourism, and traditional gastronomy, creating opportunities for a more sustainable sector growth.
- Promotion of "Stay with locals" initiatives offering visitors the chance to stay in traditional homes.
- Creation of tourist packages for observing the Dalmatian pelican and other lagoon birds, guided by trained local guides.
- Ecological trails and cycling paths in the pine forests and around the lagoon, with informational signage on biodiversity.
- Modernization and digitalization of information in visitor centers with exhibits and educational activities for students and tourists.
- Organization of traditional events such as the Pelican Festival and local gastronomy fairs.
- Engagement of local residents as tour guides, in electric bike transport services, and co-management of park facilities.
- Establishment of a small research and educational campus → for universities and researchers to facilitate studies and environmental education.

These measures aim to balance tourism development with ecological conservation, ensuring that Divjakë-Karavasta National Park remains a sustainable, resilient, and educational model for integrating local communities, biodiversity protection, and nature-based economic opportunities.

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