

# Transition Towards Sustainable Ecotourism In Bouira Province, Algeria: An Environmental And Spatial Approach

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Received: 12/08/2025

Accepted : 02/02/2026

Published: 30/04/2026

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## **Abstract**

*Sustainable ecotourism has emerged over recent decades as one of the most significant contemporary development paradigms aimed at balancing economic growth with the conservation of natural resources, particularly in environmentally and spatially sensitive areas. The mountainous and forested landscapes of Bouira Province constitute some of Algeria's most valuable natural assets, possessing diverse environmental and tourism potentials that make the region a promising destination for the development of sustainable ecotourism.*

*This study aims to analyze the current state of ecotourism in Bouira Province and evaluate its natural and spatial resources while highlighting the major environmental challenges that hinder sustainable tourism development. Furthermore, the study proposes practical strategies for transitioning toward a sustainable tourism model based on ecosystem conservation and local development.*

*The research adopts a descriptive-analytical and spatial approach, combined with Geographic Information Systems (GIS) techniques and SWOT analysis to assess the strengths, weaknesses, opportunities, and threats associated with ecotourism development in the study area. A set of environmental and spatial indicators was also employed to evaluate tourism carrying capacity and the sustainability of tourism activities.*

*The findings reveal that Bouira Province possesses significant natural and tourism assets, including extensive forest cover, rich biodiversity, abundant water resources, and mountainous landscapes with high tourism attractiveness. However, the region faces several environmental challenges, including inadequate environmental infrastructure, pollution, seasonal human pressure, and deficiencies in sustainable management practices. The study recommends the adoption of integrated environmental planning, the strengthening of environmental governance, the involvement of local communities, the development of green infrastructure, and the incorporation of sustainable development principles into local tourism policies.*

**Keywords:** Sustainable Ecotourism; Sustainable Development; Spatial Approach; Geographic Information Systems (GIS); Environmental Planning; Bouira Province.

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## **1. INTRODUCTION**

Over the past decades, the tourism sector has undergone significant transformations due to the growing global concern for environmental issues and sustainable development. Sustainable tourism has emerged as one of the most important contemporary approaches aimed at balancing economic development with the conservation of natural and cultural resources. The rapid expansion of conventional tourism activities has led to numerous environmental problems, including ecosystem degradation, pollution of natural resources, and increasing pressure on environmentally sensitive areas. Consequently, international organizations and researchers have called for the adoption of more sustainable development models within the tourism sector (UNWTO, 2023).

Sustainable ecotourism is defined as a form of tourism activity based on the rational use of natural and cultural resources while ensuring the conservation of ecosystems and generating sustainable economic and social benefits for local communities (Fennell, 2020). Ecotourism is considered one of the most effective approaches for achieving a balance between environmental protection and local economic development,

particularly in environmentally sensitive areas, as it contributes to the conservation of natural resources and promotes sustainable community development (Honey, 2008). Furthermore, the United Nations Environment Programme (UNEP) and the United Nations World Tourism Organization (UNWTO) emphasize that sustainable tourism represents a key mechanism for achieving the Sustainable Development Goals (SDGs), particularly those related to the protection of terrestrial ecosystems, the promotion of a green economy, and the enhancement of local development in natural and mountainous regions (UNEP & UNWTO, 2022).

Mountainous and forested areas have increasingly become strategic spaces for ecotourism development due to their rich natural diversity and high ecological value. Several recent studies have indicated that the success of tourism development in mountain regions depends on respecting environmental carrying capacity, implementing effective tourism planning, and involving local communities in the management of tourism resources (Weaver, 2013). Likewise, Rasoolimanesh et al. (2020) highlighted that tourism sustainability indicators have become essential tools for evaluating the effectiveness of modern tourism policies and their contribution to sustainable development objectives.

In the same context, Bahaire and Elliott-White (1999) emphasized the importance of Geographic Information Systems (GIS) in sustainable tourism planning, particularly in mountainous areas characterized by environmental fragility and spatial disparities. Similarly, Mansour et al. (2019) demonstrated that multi-criteria spatial analysis can effectively identify areas most suitable for ecotourism development while minimizing environmental pressures on natural resources.

In Algeria, ecotourism has received increasing attention within contemporary development policies, particularly through the Tourism Development Master Plan (SDAT 2030), which aims to valorize natural and cultural resources and promote sustainable tourism development in mountainous and forested regions (Zeraib, Kouba, & Berghout, 2022). Despite Algeria's considerable natural potential, several studies have pointed out persistent shortcomings related to inadequate environmental planning, limited tourism infrastructure, and weak environmental governance in natural tourism destinations (Larkeche & Khujah, 2021).

Bouira Province represents one of Algeria's most important mountainous tourism regions due to its location within the Djurdjura Mountain Range and its inclusion of highly valuable natural areas such as Tikjda and the Djurdjura National Park. The province is characterized by significant environmental and geographical diversity, including dense forests, abundant water resources, mountainous climatic conditions, and rich biodiversity, making it a promising destination for sustainable ecotourism development.

However, these assets face several environmental and spatial challenges, including environmental pollution, seasonal human pressure, forest fires, inadequate environmental infrastructure, and the lack of sustainable tourism planning in certain environmentally sensitive areas. Furthermore, the concentration of tourism activities in a limited number of locations, particularly in Tikjda, has increased environmental pressures and disrupted ecological balances within the tourism landscape.

Accordingly, this study seeks to analyze the current state of sustainable ecotourism in Bouira Province through an environmental and spatial approach, relying on Geographic Information Systems (GIS) and SWOT analysis to evaluate natural assets and environmental challenges associated with tourism activities. The study also aims to propose practical strategies for transitioning toward a sustainable tourism model that ensures the protection of natural resources while promoting local development.

The study is guided by the following main research question:

**How can the transition toward sustainable ecotourism be achieved in Bouira Province in light of the current environmental and spatial challenges?**

This main question is further divided into the following sub-questions:

- What are the main natural and spatial assets that Bouira Province possesses for ecotourism development?
- What are the major environmental challenges associated with tourism activities in the region?
- How can environmental and spatial approaches contribute to achieving sustainable tourism development?

The study hypothesizes that Bouira Province possesses significant natural and spatial assets that can support the development of sustainable ecotourism. However, inadequate environmental planning and increasing human pressures constitute major obstacles to tourism sustainability. The study also assumes

that the use of spatial analysis tools and Geographic Information Systems can contribute to improving tourism planning and achieving a balance between tourism development and environmental conservation. The objectives of the study are to:

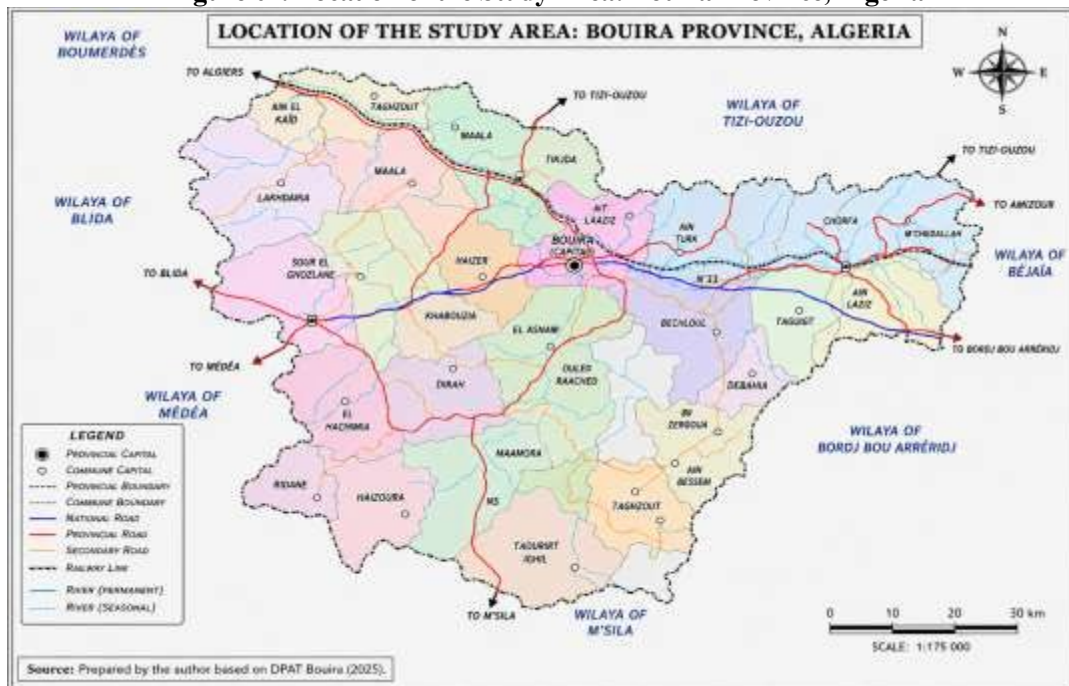
- Identify the environmental and spatial tourism assets of Bouira Province;
- Analyze the environmental challenges associated with tourism activities;
- Assess the current state of sustainable ecotourism in the region;
- Propose practical strategies for facilitating the transition toward sustainable tourism.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Bouira Province is located in northern Algeria within the Tell Atlas region, approximately 120 km southeast of Algiers, the national capital. It covers an area of about 4,456.28 km<sup>2</sup>. The province is bordered by Tizi Ouzou and Boumerdès Provinces to the north, Médéa and M'Sila Provinces to the south, Béjaïa and Bordj Bou Arréridj Provinces to the east, and Blida and Médéa Provinces to the west. (As illustrated in Figure 01), Bouira occupies a strategic geographical position linking the coastal zone with the High Plateaus, which enhances its economic and tourism importance within northern Algeria.

**Figure 01. Location of the Study Area: Bouira Province, Algeria**



The province is characterized by remarkable natural and spatial diversity, including the Djurdjura and Bibans mountain ranges, extensive forested areas, plains, and inland plateaus. It also enjoys a Mediterranean mountain climate characterized by cold and humid winters and mild summer temperatures, providing favorable conditions for the development of ecotourism and mountain tourism. The Tikjda region and the Djurdjura National Park are among the most prominent natural tourism destinations in the province due to their dense forest cover, rich biodiversity, scenic landscapes, and mountain trails that attract an increasing number of visitors annually. In addition, Bouira possesses diverse water resources, including rivers, dams, and natural springs, which further enhance its environmental and tourism attractiveness.

The main tourism forms that can be developed in the province include:

- Ecotourism,
- Mountain tourism,
- Winter tourism,
- Rural tourism,
- Sports tourism.

Despite these significant natural and territorial assets, the tourism sector in Bouira faces several environmental challenges, including seasonal tourism pressure, environmental pollution, forest fires, unplanned urban expansion, and inadequate sustainable tourism infrastructure. These factors directly affect the sustainability of natural resources within the tourism area.

## 2.2 Research Methodology

The study adopted a multi-methodological approach combining descriptive, spatial, and prospective analyses in order to examine the current state of sustainable ecotourism in Bouira Province and assess the potential for transitioning toward a more sustainable tourism model.

### a. Descriptive-Analytical Approach

The descriptive-analytical approach was employed as one of the most widely used methods in geographical and environmental studies, as it enables the description of phenomena and the analysis of relationships between human activities and natural resources (Creswell, 2014). This approach contributed to examining the natural and tourism characteristics of the study area, analyzing environmental challenges associated with tourism activities, and interpreting the impacts of human pressures on ecosystems in tourism destinations.

### b. Spatial Approach

The study also relied on the spatial approach, which focuses on analyzing geographical space through the examination of the distribution of natural and human resources as well as tourism infrastructure within the study area. This approach facilitates the identification of spatial disparities in tourism activities and the delineation of areas most exposed to environmental pressure, making it a fundamental method in sustainable tourism planning studies (Butler, 2019).

### c. Prospective Approach

The prospective approach was applied through the development of a set of future scenarios and strategic recommendations aimed at achieving the transition toward sustainable ecotourism based on the analysis of current environmental and spatial indicators. This approach helps anticipate future prospects for sustainable tourism development in mountainous and environmentally sensitive areas.

## 2.3 Data Collection

The study relied on a variety of secondary and field data sources to ensure the comprehensiveness and accuracy of the analysis.

### a. Secondary Data

Secondary data included:

- Reports from the Algerian Ministry of Tourism and Handicrafts;
- Reports from the Ministry of Environment and Quality of Life;
- The Tourism Development Master Plan (SDAT 2030);
- Population and tourism statistics from the National Office of Statistics (ONS);
- Academic studies and research related to sustainable tourism;
- Topographic maps;
- Satellite imagery.

In addition, recent studies on ecotourism, sustainable development, and mountain tourism analysis were consulted, particularly those dealing with the application of Geographic Information Systems (GIS) in sustainable tourism planning (Bahaire & Elliott-White, 1999; Mansour et al., 2019).

### b. Field Data

Field data were collected through:

- Field observations of tourism sites;
- Documentation of pollution and environmental degradation;
- Observation of tourism activities and human pressures;
- Photography of natural and tourism sites;
- Assessment of the state of environmental infrastructure in tourism areas.

Fieldwork contributed to obtaining accurate information on the current situation of tourism destinations and the environmental challenges associated with them.

## 2.4 Analytical Tools

### a. Geographic Information Systems (GIS)

Geographic Information Systems (GIS) were employed as one of the most important modern tools for spatial analysis and sustainable tourism planning (Yedou & Boukhari, 2021). GIS enables the production of accurate maps and the analysis of the spatial distribution of natural resources, infrastructure, and environmental pressures within tourism areas (Bahaire & Elliott-White, 1999).

Spatial analysis tools contributed to:

- Mapping the distribution of tourism sites;
- Analyzing topographic characteristics;
- Identifying areas of tourism pressure;
- Assessing accessibility to tourism sites;
- Identifying environmentally sensitive areas.

Several recent studies have emphasized the importance of multi-criteria spatial analysis in identifying the most suitable areas for ecotourism development while minimizing negative impacts on natural ecosystems (Mansour et al., 2019).

### b. SWOT Analysis

SWOT analysis was applied to assess the state of ecotourism in Bouira Province through the identification of:

- Strengths;
- Weaknesses;
- Opportunities;
- Threats.

This analysis is considered an essential tool in strategic planning and sustainable tourism development studies, as it helps to understand the realities of tourism areas and identify potentials and challenges related to tourism development in natural regions.

### c. Environmental and Spatial Indicators

A set of environmental and spatial indicators was employed to evaluate the sustainability of tourism activities, including:

- Forest cover density;
- Tourism pressure level;
- Environmental carrying capacity;
- Infrastructure density;
- Accessibility;
- Environmental pollution level.

These indicators are among the most widely used tools for assessing sustainable tourism development and measuring the impacts of tourism activities on natural environments, particularly in ecologically sensitive mountainous areas (Rasoolimanesh et al., 2020).

## 2.5 Spatial and Temporal Limits of the Study

The spatial scope of the study covers Bouira Province, with particular focus on mountainous and forested areas characterized by high tourism activity, notably:

- Tikjda;
- The Djurdjura Mountains;
- Forested areas surrounding tourism sites.

The temporal scope of the study extends from **2015 to 2024**, a period marked by increasing interest in ecotourism and sustainable development in Algeria, alongside growing environmental pressures associated with tourism activities in mountainous regions.

## 3. RESULTS

### 3.1 Natural and Environmental Tourism Potentials in Bouira Province

Bouira Province is characterized by significant natural and environmental diversity, making it one of the most promising areas for the development of sustainable ecotourism in Algeria. This potential stems from its location within the Tell Atlas mountain range and its inclusion of an important part of the Djurdjura Mountains, which possess high environmental and tourism value.

Forests constitute one of the province’s most important natural assets, covering extensive mountainous areas, particularly in the Tikjda region and the Djurdjura National Park. These forest ecosystems provide a favorable natural environment for ecotourism and mountain tourism activities. Moreover, they contribute to maintaining ecological balance, conserving biodiversity, and mitigating the impacts of climate change (UNEP & UNWTO, 2022).

The province also exhibits considerable topographical diversity, as illustrated in **Table 01**.

**Table 01. Main Natural Tourism Potentials of Bouira Province**

No.	Tourism Potential	Location	Natural Characteristics	Tourism Importance
01	Tikjda	Northeast of the Province	Dense forests, mountains, snow cover	Ecotourism and mountain tourism
02	Djurdjura National Park	Northern Province	Biodiversity and forests	Ecotourism
03	Errich Forest	Bouira	Green spaces and dense forest cover	Recreation and leisure
04	Tilesdit Dam	Eastern Province	Aquatic landscape	Leisure tourism
05	Djurdjura Mountains	North	Mountainous terrain	Hiking and sports activities
06	Oued Sahel	Central and Northern Areas	Natural watercourse	Scenic attractiveness
07	Lakhdaria Forests	West	Mediterranean forests	Green tourism
08	Assoul Mountain Area	Southeast	Panoramic landscapes	Rural tourism

**Source:** Prepared by the author based on data from the Directorate of Tourism of Bouira (2024).

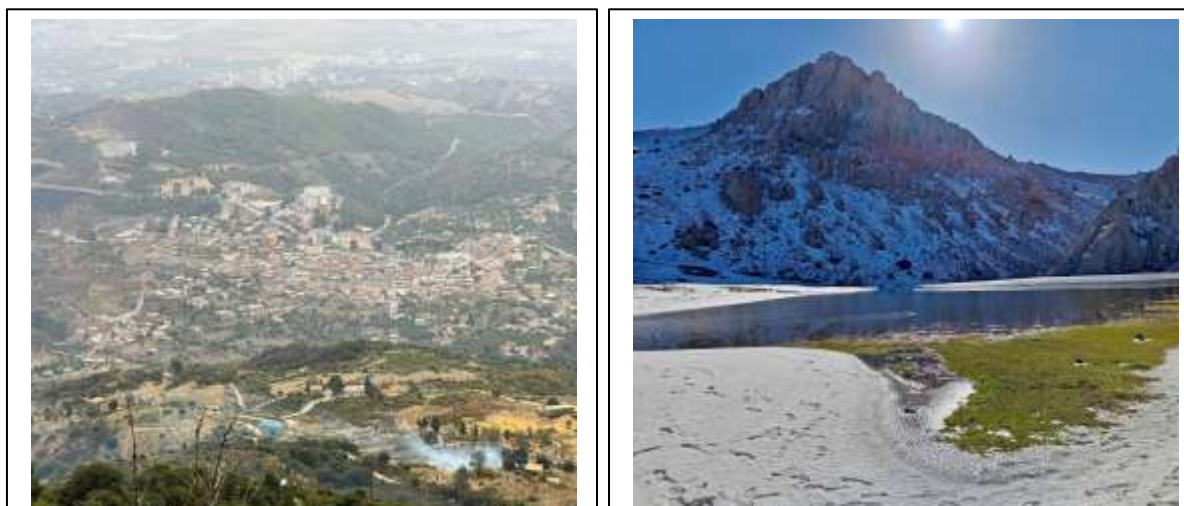
This diversity offers substantial opportunities for the development of various tourism activities, including:

- Mountain hiking;
- Camping;
- Sports tourism;
- Winter tourism.

Several studies have emphasized that mountainous regions are among the most attractive destinations for ecotourism due to their high ecological and scenic value (Lee & Jan, 2022; Khanra et al., 2021).

The Tikjda area represents one of the most important natural tourism hubs in the province owing to its dense vegetation cover, moderate mountain climate, and natural hiking trails that attract an increasing number of visitors annually (**see Figure 02**), particularly during winter seasons and holiday periods. In addition, the area's relative proximity to major cities in northern Algeria enhances its accessibility and tourism attractiveness (Medjitna, 2022).

**Figure 02. Natural Landscapes of the Tikjda Area**



**Source:** Photograph taken by the researcher during fieldwork in Tikjda, Bouira Province, 2024.

Figure 02 highlights the aesthetic and environmental value of the Tikjda area, where dense forests are interwoven with mountainous terrain and open natural landscapes. These characteristics make Tikjda one of the most prominent destinations for the development of ecotourism and mountain tourism in Bouira Province.

The image illustrates the richness of the natural environment, characterized by extensive forest cover, diverse ecosystems, and scenic mountain landscapes that contribute significantly to the area's tourism attractiveness. Such environmental assets provide favorable conditions for outdoor recreational activities, including hiking, nature observation, mountain sports, and environmental education.

### **3.2 Environmental Challenges Associated with Tourism Activities**

Despite the significant natural assets available in Bouira Province, the tourism sector faces several environmental challenges that directly affect the sustainability of natural resources within tourism destinations.

The main environmental challenges include:

- Environmental pollution;
- Accumulation of solid waste;
- Forest fires;
- Seasonal tourism pressure;
- Unregulated urban expansion.

Field observations revealed a considerable increase in household and plastic waste within several tourist sites, particularly during peak tourism seasons. This situation negatively affects the aesthetic quality of the natural environment and threatens the ecological balance of mountainous areas.

Forest fires also represent one of the most serious environmental threats facing the tourism sector in the province due to their direct impact on vegetation cover and biodiversity. Recent studies indicate that the increasing occurrence of forest fires in natural areas is associated with a combination of factors, including climate change, rising temperatures, and growing human pressure on fragile ecosystems (Tedim et al., 2021).

Furthermore, the high concentration of tourism activities in the Tikjda area has intensified environmental pressure on natural resources, especially during tourism seasons, resulting in increased transportation flows, waste generation, and water resource consumption within the tourism landscape.

Recent research has shown that the absence of effective environmental planning and inadequate management of tourism carrying capacity can lead to the degradation of ecosystems in environmentally sensitive areas (Butler, 2019).

The study also revealed significant spatial disparities in the distribution of tourism infrastructure. Most tourism facilities and services are concentrated in a limited number of locations, while other rural and mountainous areas suffer from insufficient tourism development and infrastructure. This imbalance restricts the effectiveness of sustainable and balanced tourism development throughout the province.

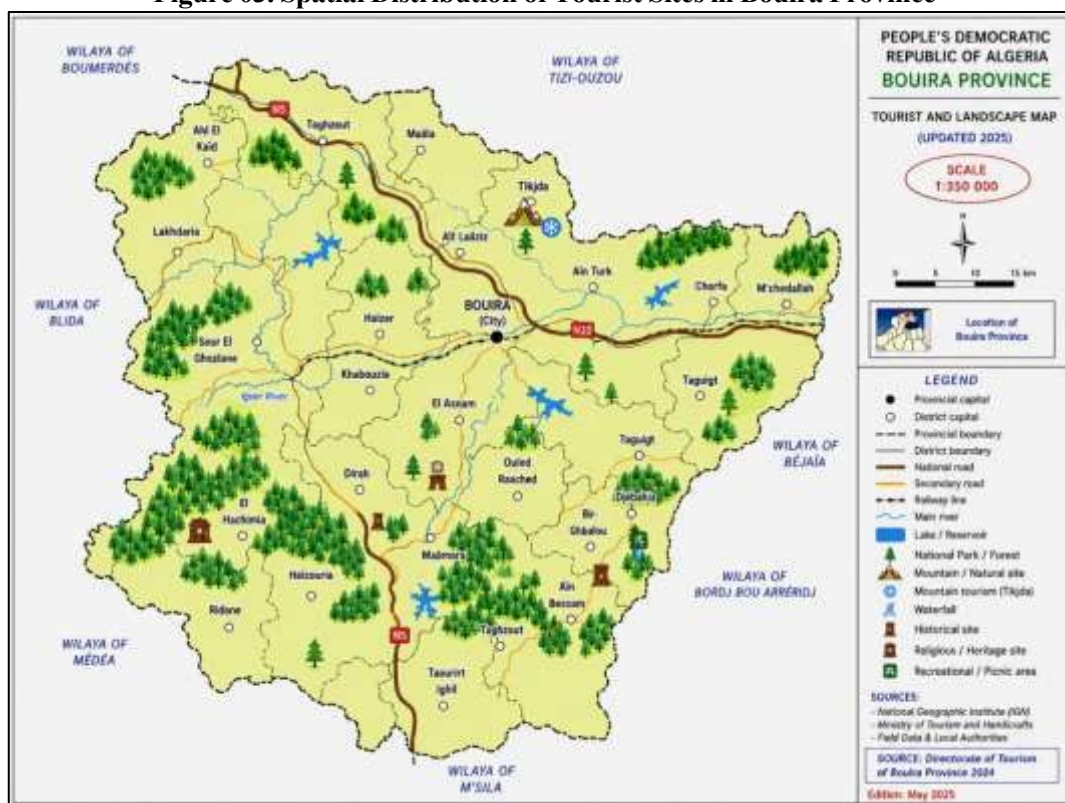
### **3.3 Spatial Analysis of Tourism Distribution**

Spatial analysis using Geographic Information Systems (GIS) revealed significant disparities in the distribution of tourism activities across Bouira Province. Tourism activities are highly concentrated in mountainous and forested areas characterized by strong natural attractiveness, particularly in the Tikjda area and the Djurdjura National Park (see Figure 03).

The spatial analysis enabled the identification of:

- Major tourist attraction areas;
- Areas most exposed to environmental pressure;
- Highly accessible tourism zones;
- Areas with untapped tourism potential.

**Figure 03. Spatial Distribution of Tourist Sites in Bouira Province**



The spatial distribution map (Figure 03) illustrates the location of the main tourist sites in Bouira Province, highlighting the concentration of tourism attractions within mountainous and forested areas, particularly in the Tikjda region and the Djurdjura National Park. The map also reveals the relationship between tourist sites and the main transportation networks, which directly influences accessibility and the level of tourism pressure within the study area.

The analytical maps indicate that the proximity of certain tourist destinations to major road networks has contributed to an increase in visitor numbers and intensified human pressure on the natural environment. In contrast, several other mountainous areas continue to suffer from inadequate accessibility and insufficient tourism infrastructure, limiting their tourism development potential.

The analysis further revealed that the growth of tourism activities during recent years has generated various environmental pressures affecting the natural balance of the region. These pressures have led to an increase in the volume of solid waste disposed of in natural and forested areas, negatively impacting landscape quality and the aesthetic value of tourism sites.

In addition, the intensive movement of visitors within environmentally sensitive areas contributes to vegetation degradation and soil erosion due to trampling and the frequent use of unofficial paths outside designated trails. These environmental impacts are clearly illustrated in **Figure 04**, which presents examples of pollution and environmental degradation observed in the Tikjda area, reflecting the magnitude of the challenges facing sustainable tourism development.

Therefore, preserving the region's natural resources requires the adoption of effective environmental management mechanisms, the strengthening of environmental awareness and education programs, and the development of adequate infrastructure for waste collection and treatment. Such measures are essential to ensuring a balance between tourism development objectives and environmental conservation.

**Figure 04. Environmental Pollution in Djurdjura National Park (Tikjda Area)**



**Source:** Photograph taken by the researcher during fieldwork in Tikjda, Bouira Province, 2023.

Many recent studies have emphasized the importance of employing Geographic Information Systems (GIS) and multi-criteria spatial analysis in identifying the most suitable areas for sustainable tourism development, particularly in mountainous and forested regions (Mansour et al., 2019).

### **3.4 SWOT Analysis of Sustainable Ecotourism in Bouira Province**

The SWOT analysis revealed that Bouira Province possesses significant strengths that support the development of sustainable ecotourism. The most notable strengths include:

- Rich natural and environmental diversity;
- Extensive forest cover;
- Strategic geographic location;
- Diverse topography and climatic conditions.

The analysis also highlighted several promising opportunities, including:

- Growing demand for ecotourism;
- Increasing governmental commitment to sustainable development;
- The implementation of the Tourism Development Master Plan (SDAT 2030);
- The potential integration of digital technologies and Geographic Information Systems (GIS) into tourism planning.

Conversely, the analysis identified several weaknesses that may hinder sustainable tourism development, namely:

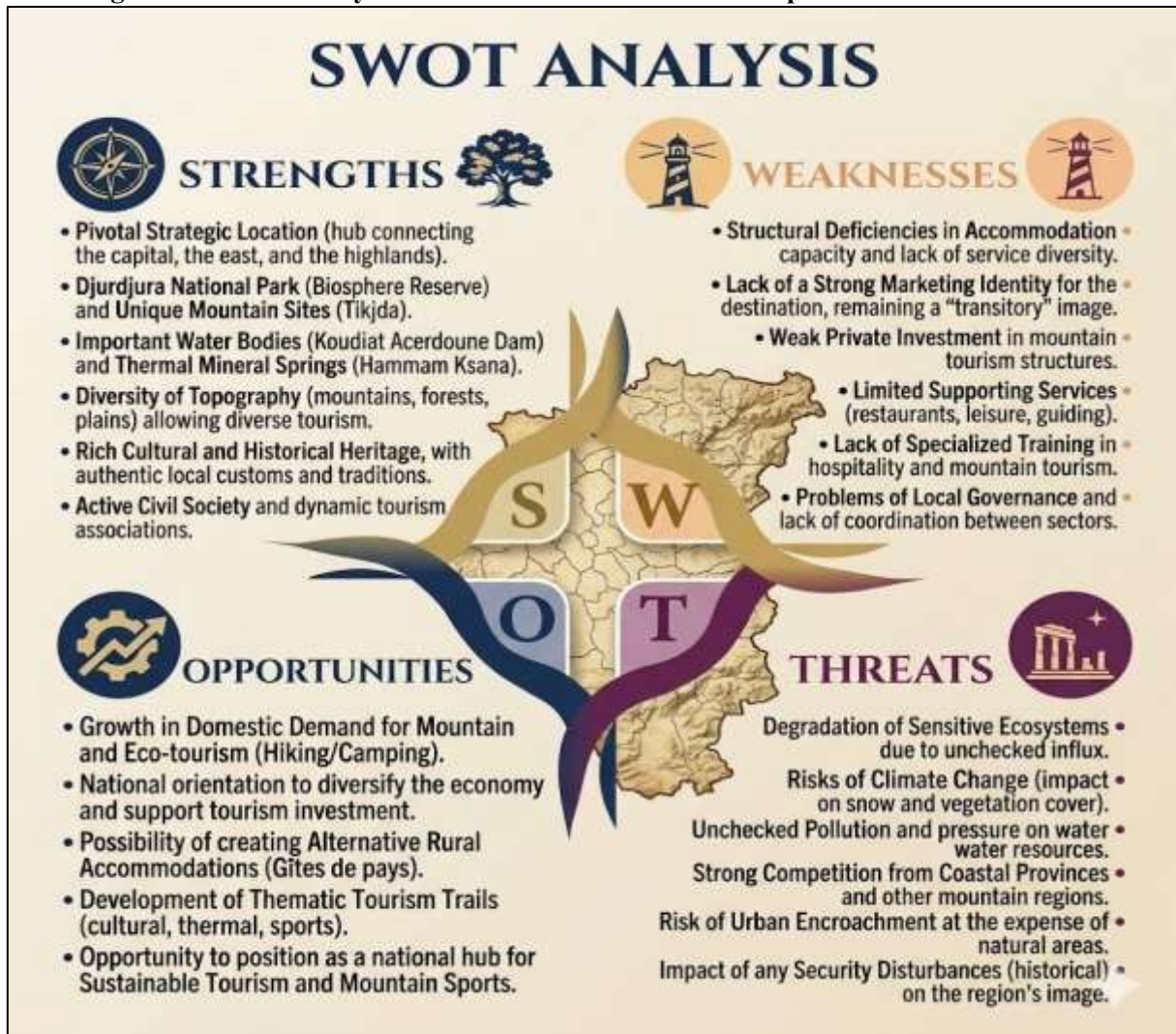
- Inadequate environmental infrastructure;
- Insufficient sustainable tourism facilities and development programs;
- Limited environmental investment;
- Weak waste management systems within tourist sites.

The main threats identified include:

- Climate change;
- Forest fires;
- Unregulated tourism pressure;
- Degradation of natural resources in environmentally sensitive areas.

The results of the SWOT analysis are summarized in **Figure 05**, which presents the principal strengths, weaknesses, opportunities, and threats influencing the development of sustainable ecotourism in Bouira Province.

**Figure 05. SWOT Analysis of Sustainable Ecotourism Development in Bouira Province**



The SWOT analysis presented in **Figure 05** highlights the main internal strengths and weaknesses, as well as the external opportunities and threats influencing the development of sustainable ecotourism in Bouira Province. The results indicate that the province possesses significant natural and spatial assets that can support the expansion of sustainable tourism activities. However, achieving sustainable tourism development remains closely linked to improving environmental infrastructure and strengthening governance mechanisms, as well as the sustainable management of natural resources.

These findings are consistent with the conclusions of several recent studies on sustainable tourism in mountainous regions, which emphasize that the success of tourism development largely depends on the effectiveness of environmental planning and the implementation of sustainable governance practices in natural areas (Weaver, 2013).

#### 4. DISCUSSION

The findings of this study reveal that Bouira Province possesses considerable natural and spatial assets that qualify it for the development of sustainable ecotourism, particularly due to its diverse topography, environmental richness, and the presence of mountainous and forested areas of high ecological value, such as Tikjda and the Djurdjura National Park. These findings are consistent with recent studies emphasizing that mountainous and forested regions are among the most attractive destinations for ecotourism because of their rich natural resources and high ecological and scenic value (Lee & Jan, 2022). The study also demonstrated that forest cover and biodiversity constitute major tourism attraction factors within the province, enhancing the attractiveness of the tourism landscape and providing favorable conditions for environmental, recreational, and sporting activities. According to the United Nations

World Tourism Organization, natural resources and environmental diversity are fundamental components of sustainable tourism development in mountainous and natural areas (UNWTO, 2023). However, the results also highlighted several environmental challenges that directly affect the sustainability of tourism activities in the province. These include environmental pollution, waste accumulation, seasonal tourism pressure, forest fires, and inadequate environmental infrastructure in tourist destinations. These findings support the conclusions of Butler (2019), who emphasized that the absence of effective tourism carrying-capacity management leads to increased environmental pressure and ecological degradation in environmentally sensitive tourist areas.

Furthermore, the spatial analysis revealed a strong concentration of tourism activities in a limited number of locations, particularly in the Tikjda area. This situation creates spatial disparities in tourism development benefits across the province and reflects weaknesses in balanced tourism planning, as well as the underutilization of numerous natural areas with promising tourism potential. These results corroborate the findings of Berreghioua and Khalfallah (2022), who argued that many Algerian tourist destinations possess significant natural and tourism resources, yet insufficient planning and inadequate exploitation of local potentials limit the effectiveness of sustainable tourism development.

The spatial analysis conducted using Geographic Information Systems (GIS) demonstrated the effectiveness of this technology in examining the spatial distribution of tourism activities and identifying areas exposed to environmental pressure and ecological vulnerability. These findings are in line with those of Bahaire and Elliott-White (1999), who highlighted the importance of GIS in supporting sustainable tourism planning and improving decision-making processes in natural tourism destinations.

Moreover, multi-criteria spatial analysis enabled the identification of the most suitable areas for ecotourism development while considering environmental characteristics and ecological fragility. Similar conclusions were reached by Mansour et al. (2019), who demonstrated that GIS-based spatial analysis contributes to reducing the negative environmental impacts associated with tourism activities in mountainous regions. These findings are also consistent with the study of Chinoune and Rabhi (2025), which emphasized that the valorization of natural and geological heritage in environmentally sensitive areas constitutes a key approach to promoting sustainable tourism and enhancing environmental awareness among local communities.

The study further showed that the lack of adequate environmental infrastructure remains one of the major obstacles to sustainable tourism development in Bouira Province, particularly regarding waste management, environmentally friendly transportation systems, and sustainable tourism facilities. Several recent studies indicate that successful ecotourism development depends on the existence of green infrastructure capable of balancing economic growth with environmental conservation (Weaver, 2013). In addition, the study highlighted the importance of involving local communities in the management and development of tourism activities, as local populations play a crucial role in protecting natural resources and promoting sustainable development. These findings are consistent with contemporary sustainable tourism research, which identifies community participation as a key determinant of successful ecotourism projects (Rasoolimanesh et al., 2020).

The study also demonstrated that the Algerian Tourism Development Master Plan (SDAT 2030) provides an important strategic framework for promoting sustainable tourism. Nevertheless, the effectiveness of these policies remains dependent on the implementation of environmental governance principles and coordination among local and institutional stakeholders.

The findings further indicate that the transition toward sustainable ecotourism in Bouira Province requires the adoption of a comprehensive approach based on:

- Sustainable environmental planning;
- Development of green infrastructure;
- Forest conservation and protection;
- Regulation of tourism pressure;
- Integration of digital technologies and GIS;
- Strengthening environmental governance and local participation.

These findings are aligned with the objectives of the United Nations Sustainable Development Goals, particularly those related to the protection of terrestrial ecosystems, the promotion of a green economy, and the achievement of sustainable local development in natural and mountainous regions (United Nations, 2023).

Based on the above, it can be concluded that the success of sustainable tourism development in Bouira Province depends on the ability of local policies to balance the valorization of natural resources with the preservation of environmental equilibrium, thereby ensuring the long-term sustainability of the tourism landscape for future generations.

## **5. Sustainable Tourism Development Strategies in Bouira Province**

In light of the study findings, achieving the transition toward sustainable ecotourism in Bouira Province requires the implementation of a set of integrated strategies that take into account the environmental and spatial characteristics of the tourism landscape while ensuring a balance between economic development and natural resource conservation.

### **5.1 Sustainable Environmental Planning**

Sustainable environmental planning is considered one of the fundamental mechanisms for achieving sustainable tourism development in natural and mountainous areas, particularly in ecologically sensitive regions. The results revealed that inadequate environmental planning and the absence of integrated management contribute significantly to increasing environmental pressure on tourist destinations, especially in the Tikjda area.

Recent studies indicate that the effectiveness of sustainable tourism development depends on the integration of environmental considerations into local tourism policies and the adoption of sustainable spatial planning tools (UNWTO, 2023). Butler (2019) further argues that respecting the environmental carrying capacity of tourism destinations is a prerequisite for protecting natural ecosystems and reducing the negative impacts of tourism activities.

Accordingly, environmentally oriented tourism development plans should be established based on:

- Delineation of environmental protection zones;
- Regulation of land use within tourism areas;
- Control of tourism pressure;
- Directing investments toward less environmentally fragile areas.

### **5.2 Development of Green Infrastructure**

Green infrastructure represents one of the most important contemporary approaches to achieving sustainable tourism development in mountainous and natural environments. The study findings indicate that insufficient environmental infrastructure constitutes one of the main challenges facing ecotourism development in Bouira Province.

Recent research suggests that green infrastructure helps reduce environmental pressure and improve the quality of tourism destinations through environmentally friendly solutions in transportation, energy, and natural resource management (Weaver, 2013).

The development of green infrastructure in tourism areas should include:

- Establishing ecological hiking and cycling trails;
- Promoting sustainable tourism transportation systems;
- Adopting renewable energy sources in tourism facilities;
- Improving waste collection and treatment networks;
- Rationalizing water consumption.

Furthermore, ecological construction techniques and environmental engineering approaches can be integrated into tourism facilities to ensure compatibility with the natural and mountainous characteristics of the region.

### **5.3 Strengthening Environmental Governance**

Environmental governance is one of the key determinants of sustainable tourism success, as it contributes to improving coordination among stakeholders and ensuring the enforcement of environmental regulations in natural tourism areas.

The study findings indicate that weak institutional coordination and limited environmental monitoring contribute to increasing environmental pressures in tourist destinations. These results are consistent with recent studies emphasizing that effective environmental governance is a fundamental component of sustainable tourism development (Rasoolimanesh et al., 2020).

Therefore, it is necessary to:

- Strengthen coordination among local authorities and institutions;
- Enhance environmental monitoring and control mechanisms;
- Enforce regulations related to environmental protection;
- Encourage environmentally responsible investments.

Achieving tourism sustainability also requires the adoption of a participatory approach involving all local and institutional stakeholders.

#### **5.4 Community Participation in Sustainable Tourism**

Numerous recent studies have demonstrated that local community involvement is among the most influential factors determining the success of ecotourism and sustainable development projects (UNEP & UNWTO, 2022). The findings of this study indicate that local populations can play a central role in protecting natural resources and promoting the environmental and cultural heritage of tourism destinations.

Accordingly, efforts should focus on:

- Supporting rural and community-based tourism;
- Encouraging traditional crafts and local products;
- Creating green employment opportunities;
- Enhancing environmental awareness among residents and visitors.

Community participation contributes significantly to improving the relationship between tourism activities and the natural environment while reducing environmental pressures associated with the uncontrolled exploitation of tourism resources.

#### **5.5 GIS and Smart Environmental Management**

Digital technologies and Geographic Information Systems (GIS) have become essential tools for sustainable tourism planning and the management of environmentally sensitive natural areas. The results of this study demonstrated the effectiveness of GIS in analyzing the spatial distribution of tourism activities and identifying areas subjected to environmental pressure.

Several studies have emphasized the importance of spatial analysis and digital data in improving tourism decision-making processes and developing more sustainable strategies for mountainous regions (Bahaire & Elliott-White, 1999).

GIS can be utilized for:

- Developing digital tourism maps;
- Monitoring environmental changes;
- Assessing the carrying capacity of tourism sites;
- Identifying environmentally vulnerable areas.

The adoption of smart environmental management practices can significantly enhance tourism management efficiency and reduce the negative environmental impacts affecting natural and tourism landscapes.

### **6. CONCLUSION**

The findings of this study demonstrate that Bouira Province possesses significant natural and spatial assets that qualify it for the development of sustainable ecotourism. This potential is largely attributed to its diverse topography and environmental richness, as well as the presence of mountainous and forested areas of high ecological value, notably the Tikjda region and the Djurdjura National Park. The analysis revealed that forest cover, biodiversity, mountainous climate conditions, and water resources constitute fundamental elements that enhance the attractiveness of the province's tourism landscape.

The study also showed that tourism activities in the province face several environmental and spatial challenges that affect the sustainability of natural resources. The most significant challenges include environmental pollution, waste accumulation, seasonal tourism pressure, forest fires, and inadequate environmental infrastructure in tourism destinations. These findings are consistent with contemporary approaches emphasizing that the absence of environmental planning and carrying-capacity management contributes to ecosystem degradation in environmentally sensitive tourism areas (Butler, 2019).

Furthermore, the spatial analysis conducted using Geographic Information Systems (GIS) confirmed the effectiveness of this technology in examining the spatial distribution of tourism activities and identifying areas most exposed to environmental pressure. These results are consistent with numerous recent studies highlighting the importance of spatial analysis in sustainable tourism planning within natural and mountainous environments (Mansour et al., 2019).

The study further concluded that the successful transition toward sustainable ecotourism in Bouira Province depends on the adoption of a comprehensive approach based on:

- Sustainable environmental planning;
  - Development of green infrastructure;
  - Strengthening environmental governance;
  - Enhancing community participation;
  - Integrating digital technologies and Geographic Information Systems (GIS) into tourism management.
- These orientations are fully aligned with the Sustainable Development Goals, which advocate the protection of natural ecosystems, the promotion of a green economy, and the achievement of sustainable local development in natural and mountainous areas (United Nations, 2023; UNWTO, 2023).

Based on these findings, it can be concluded that achieving sustainable tourism development in Bouira Province requires balancing the valorization of natural resources with the preservation of environmental equilibrium, thereby ensuring the long-term sustainability and attractiveness of the tourism landscape for future generations.

## 7. Recommendations

Based on the findings of this study regarding the natural tourism potential and the environmental challenges affecting tourism development in Bouira Province, a **Green Infrastructure Model** is proposed (see **Figure 06**) to achieve a balance between tourism resource utilization and the conservation of local ecosystems. This model is designed within the framework of a sustainable ecotourism approach and aims to promote environmentally responsible tourism development while preserving the ecological integrity of the region.

**Figure 06. Proposed Green Infrastructure Model for Sustainable Tourism Areas in Bouira Province**



**Source:** Proposed by the author based on the findings of the study, 2024

Figure 06 illustrates the main components of the proposed green infrastructure model, which is based on the protection of natural resources, improved waste management systems, sustainable transportation development, renewable energy adoption, and the strengthening of environmental governance and community participation. These elements collectively contribute to achieving sustainable tourism development in the mountainous areas of Bouira Province.

In light of the study results, the following practical recommendations are proposed to enhance sustainable ecotourism development in Bouira Province:

1. Develop environmentally oriented tourism planning schemes based on sustainability principles and the environmental carrying capacity of tourism destinations.
2. Strengthen the protection of forests and environmentally sensitive natural areas through enhanced wildfire prevention programs and reforestation initiatives.
3. Improve green infrastructure in tourism destinations, particularly in relation to environmentally friendly transportation, renewable energy systems, and sustainable waste management.
4. Adopt Geographic Information Systems (GIS) and environmental digitalization tools in tourism planning and environmental monitoring of tourism areas.
5. Enhance waste management systems and reduce pollution levels in highly visited tourism destinations.
6. Encourage investment in sustainable ecotourism projects and support environmentally responsible tourism initiatives.
7. Strengthen environmental governance and improve coordination among local authorities and institutions involved in tourism development.
8. Promote rural and community-based tourism and encourage local community participation in tourism planning and management processes.
9. Expand environmental awareness and education programs targeting both residents and visitors in order to protect natural resources and reduce environmentally harmful behaviors in tourism areas.
10. Encourage scientific research and applied studies related to ecotourism and sustainable development in Algerian mountainous regions.

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