Towards sustainable tourism development in El Tarf: mapping suitability through GIS

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Abstract. The region of El Tarf boasts a rich array of natural, geographical, and historical tourist resources, including mountainous areas, coastal zones, as well as diverse tourist sites and development potential. This study aims to assess and map tourist suitability zones in the region, with a focus on the ecologically sensitive "El Kala National Park", designated and protected under the UNESCO Man and the Biosphere (MAB) Programme. To achieve this, we employed a Multi-Criteria Evaluation (MCE) approach integrated with a Geographic Information System (GIS). We considered criteria including land use/cover, topography (elevation, slope), and accessibility (proximity to tourist sites and services, distance from roads). Each criterion was reclassified and weighted on a scale ranging from highly suitable (10) to not suitable (1). The results provide a detailed mapping of the region's tourist potential, thus facilitating the planning and management of local tourism development.

Key words: suitability; tourism; development; environment; El Tarf.

[ES] Hacia un desarrollo turístico sostenible en El Tarf: análisis de la aptitud territorial mediante SIG

Resumen. La región de El Tarf posee una amplia diversidad de recursos turísticos naturales, geográficos e históricos, que incluyen zonas montañosas, áreas costeras, así como numerosos sitios y potencialidad de desarrollo. El presente estudio tiene como objetivo evaluar y cartografiar las zonas de aptitud turística de la región, con especial atención al Parque Nacional de El Kala, un espacio ecológicamente sensible, clasificado y protegido por el programa Hombre y Biosfera (MAB) de la UNESCO. Para ello, se empleó un enfoque de Evaluación Multicriterio (EMC) integrado en un Sistema de Información Geográfica (SIG). Se consideraron diversos

criterios, entre ellos el uso y cobertura del suelo, la topografía (altitud y pendiente) y la accesibilidad (proximidad a los sitios y servicios turísticos, y distancia a la red viaria). Cada criterio fue reclasificado y ponderado en una escala que va desde muy apto (10) hasta no apto (1). Los resultados obtenidos permiten una cartografía detallada del potencial turístico regional, lo que facilita la planificación y gestión del desarrollo turístico local.

Palabras clave: aptitud; turismo; desarrollo; medio ambiente; El Tarf.

1. Introduction

The rational and sustainable management of natural resources, particularly land, are widely recognized as a cornerstone of economic development (Jie el al., 2023; Yang, Z. & Solangi, Y. A., 2024). Rapid population growth and increasing population mobility necessitate the creation of new spaces to meet essential needs, especially within urban areas (Kakderi et al., 2021). However, such expansion frequently results in the conversion of natural environments, including forests, pastures, and wetlands, into urban or industrial zones, often through unsustainable practices (Akıncı, 2013; Tilahun et al., 2022; Mir et al., 2025). This underscores the imperative for land use planning stakeholders to balance natural resource conservation with the planned and sustainable utilization of these resources in accordance with their potential (Novakowski, 2008; Kiesz, 2010; Gomes et al., 2024).

Recent advances in geospatial technologies have demonstrated the potential of GIS-based multi-criteria decision analysis methods, particularly the Analytic Hierarchy Process (AHP), for supporting sustainable land use and tourism planning (Chaudhary et al., 2022; Withanage et al., 2024). Spatial suitability analysis represents one of the most powerful applications of Geographic Information Systems (GIS), extensively employed in land use planning research to enhance decision-making and mitigate territorial management conflicts among stakeholders (McHarg, 1969; Hopkins, 1977; Brail & Klosterman, 2001; Collins et al., 2001; Malczewski, 2004).

Within the field of land suitability assessment, it is crucial to distinguish between site selection and site search processes (Cova & Church, 2000; Malczewski, 2004). This analytical framework has been applied across diverse contexts, including ecological evaluations (Store & Kangas, 2001), assessments of agricultural land potential (Wang, 1994; Kalogirou, 2002), and regional planning research (Janssen & Rietveld, 1990). These approaches enable the integration of diverse spatial factors such as accessibility, topography, infrastructure, and environmental sensitivity, into a single analytical framework, thereby providing a more objective and transparent basis for decision-making.

The year 2020 marked one of the most severe crises in the history of global tourism (Masclanis, 2020; Pech & Diaf, 2022). Social distancing, health barriers, the drastic restriction of mobility, the expansion of teleworking, and the rise of digital capitalism have profoundly affected the tourism sector during the COVID-19 pandemic (Briant et al., 2020; Martin & Ricci, 2020; Bourlon, 2021). Yet, this unprecedented crisis also offered an opportunity to rethink tourism and its

contribution to humanity and the planet. It created momentum for rebuilding a more sustainable, inclusive, and resilient tourism model that ensures broad and equitable access to its benefits (UNWTO, 2021).

Building on this strategic orientation in tourism development, the El Tarf region stands out as one of Algeria's most ecologically significant areas due to its geographic location, climatic conditions, numerous lakes, and the presence of El Kala National Park, which extends over 76,438 hectares (Marre, 1992). Owing to these characteristics, El Tarf Province possesses exceptional natural tourism potential arising from the juxtaposition of diverse ecosystems, including marine, lacustrine, marshy, and forested environments. Consequently, a wide range of tourism types can be developed in this area, including coastal, ecotourism, thermal, mountain, and transit tourism to and from Tunisia. Nevertheless, in the absence of a coherent national tourism policy, the province has failed to capitalize on these assets. Investment in the sector remains weak, despite its considerable potential for employment creation and wealth generation. This limitation can be attributed to several factors, notably land use conflicts and development-related disputes among key stakeholders.

Accordingly, the main objective of this study is to develop a tourism suitability map of the El Tarf region by integrating Geographic Information Systems (GIS) and the Analytic Hierarchy Process (AHP). Specifically, the study seeks to (1) identify the key spatial and environmental criteria influencing tourism suitability; (2) evaluate and weight these criteria through the AHP method; and (3) produce a spatially explicit map to guide future tourism investment and planning decision by addressing the following research question: Which areas within the El Tarf region are most suitable for sustainable tourism development when considering environmental, infrastructural, and accessibility constraints? By responding to this question, the study aims to provide local stakeholders with a decision-support tool for optimizing land use in tourism planning while preserving the region's natural assets.
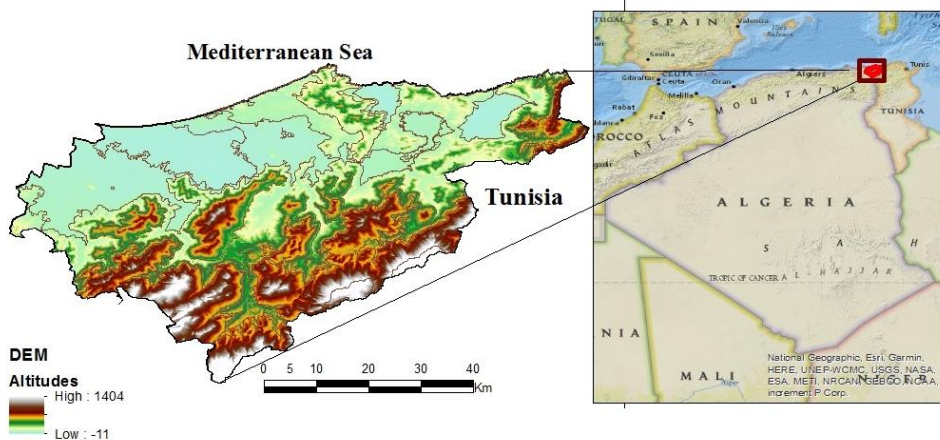
2. Data and methods

2.2. Case study: why El Tarf Region?

The El Tarf region is located in the extreme northeast of Algerian territory, covering an area of 2,885 km². It stretches along the Mediterranean Sea with a coastline of over 90 km and runs along the Algerian-Tunisian border for about a hundred kilometers to the south (Figure 1). It harbors numerous natural, geographical, and cultural tourism resources and potential. Throughout the region, from east to west and from north to south, a diversity of competitive tourism advantages has been identified (Diaf, 2019).

The regions consists of 43% coastal plain and 57% mid-altitude mountainous area, which reaches 1200 meters in the Bougous mountain area (Chebira and Sarrazin, 2015). Some areas are covered by Aleppo pine and Mediterranean oak forests, that protect the mountains from erosion. At the same time, this area is protected for heritage conservation purposes, which has led to the designation of the area as El Kala National Park. The park was created in July 1983 and designated as a UNESCO Man and the Biosphere (MAB) Reserve in 1990 (Grimes, 2005; Pech, 2022). El Kala National Park is the largest protected area in northern Algeria and boasts exceptional biodiversity. Specificall, it hosts a diversity of ecosystems, including forests and wetlands, forming a unique complex in the Mediterranean

basin. The flora is characterized by a significant number of endemic, rare, and very rare species (De Belair, 1990). Its fauna is also remarkable, with 189 bird species recorded, including 21 raptors (Benyacoub & Chabi, 2000). The globally renowned wetlands are particularly noteworthy, with five sites listed under the Ramsar Convention.

Figure 1. Location of the study area.

Source: Own ellaboration based on on Digital Elevation Model (DEM) and spatial data from GADM (https://gadm.org/).
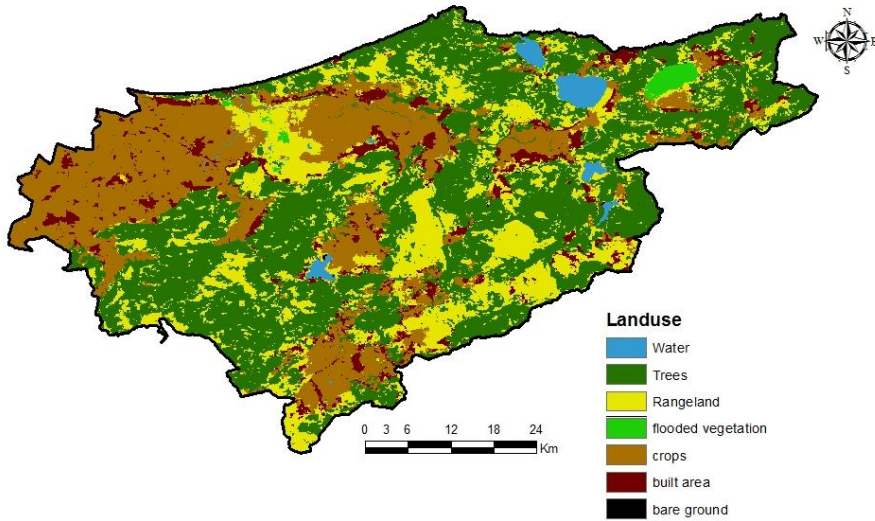
2.3. Materials

This study employed a combination of spatial and non-spatial data derived from multiple sources. The primary spatial datasets included are: land use/land cover data obtained from the USGS Landcover database (2023); topographic data from the Shuttle Radar Topography Mission (SRTM); transportation network data from OpenStreetMap (OSM); and tourism infrastructure data collected from local tourism authorities.

In this study, the land use map (Figure 2) has been a fundamental resource, as the main obstacles to tourist development identified are related to ownership of public lands, under the management of the Forestry Department and the Agricultural Services Department, as well as the presence of lakes in the El Kala National Park. These elements required particular consideration in the classification of this criterion for our tourist suitability analysis. The detailed mapping of land use has allowed us to understand the current distribution of land and natural resources, thereby facilitating the identification of potentially available areas for tourist development and the planning of appropriate strategies to overcome challenges related to land ownership and environmental conservation.
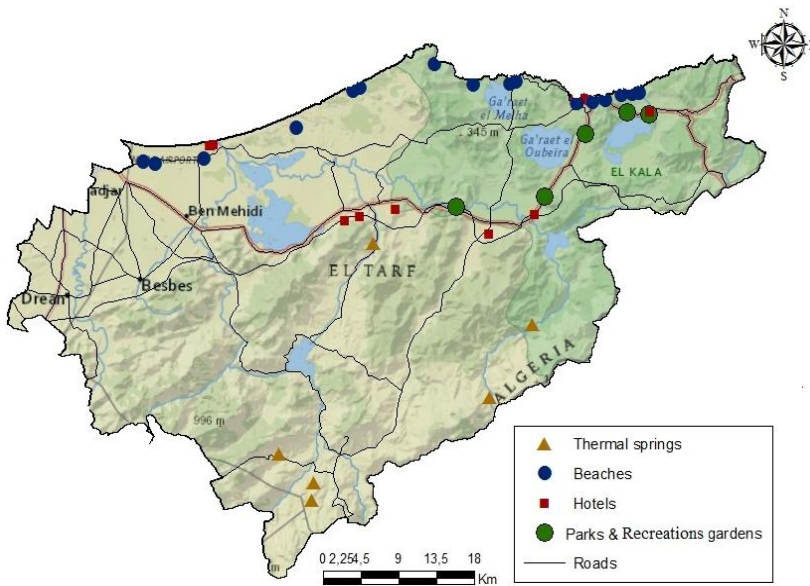
The next step consisted of identifying and mapping the key target factors related to tourism development in the El Tarf region. These factors included thermal springs, beaches, tourist infrastructure, parks and gardens, and the road network (Figure 3). Each factor was spatially represented to evaluate its contribution to overall tourism suitability.

Figure 2. Land use map of the El Tarf Region.

Source:.own elaboration based on data from ESRI atlas.

Figure 3. Criteria used for the multi-criteria evaluation process: thermal springs, beaches, hotels, parks and recreational gardens, roads and slopes.

Source:own elaboration based on data from tourism department, forest department and PNEK department

2.4. **Methods**

The evaluation aims to guide the optimal land use planning by providing information on the opportunities and constraints associated with a specific area (Bandyopadhyay et al., 2009; Mokarram and Aminzadeh, 2010). For this assessment, the choice of the most suitable land use type is based on land suitability analyses that consider land characteristics and user needs (Akbulak, 2010; Amiri and Shariff, 2012). A crucial step in this process is to identify the criteria that influence this suitability (Lardon, 2005). The multiplicity and diversity of criteria make land suitability analysis increasingly complex because, to ensure long-term use without deterioration, it is necessary to consider aspects such as costs as well as socio-economic and environmental implications, in addition to the intrinsic characteristics of the plot (Duc, 2006; Bandyopadhyay et al., 2009). Indeed, given that there is no specific standard defining the number of criteria to include in the evaluation of tourist suitability, the criteria used in similar studies are generally chosen from those available. These studies often focus on the topographic characteristics of the land, land use, and existing infrastructure (Niknejad, 2014; Fernando, 2017).

The use of two topographic criteria, namely slopes and altitudes, as well as land use, allows us to distinguish agricultural and forested areas, supporting appropriate natural resource management. Additionally, the evaluation of five tourist criteria, including beaches, hotels, parks and leisure facilities, thermal springs, and the road network, provides insight into the tourism potential of the region. The selection of criteria was developed in close collaboration with key actors in local development, including investment officials and tourism sector experts from the tourism department of the El Tarf region, ensuring comprehensive consideration of socio-economic and environmental issues.

The evaluation process was based on a raster-based multi-criteria analysis, in which each criterion was represented as an independent raster layer classified into ten levels on a uniform spatial resolution grid. A standardized scal-e from 1 to 10 was adopted to facilitate comparison and ensure the consistency of spatial relevance assessments among different environmental and tourism-related factors. Each raster layer was normalized using that continuous scale: a score of 10 was assigned to the most favorable areas, while a score of 1 corresponded to the least suitable areas. The significance of each value varied according to the intrinsic characteristics of the criterion, whether attractive (e.g., proximity to beaches or parks) or restrictive (e.g., steep slopes or large distances from infrastructure).

For instance, in the case of proximity to recreational parks and gardens, areas located close to these attractions were assigned higher suitability scores (7–10), while distant areas received lower values (1–3). This classification approach allows the model to reflect more accurately the spatial logic of tourism attractiveness and accessibility. The "Euclidean Distance" tool was used to compute distance surfaces for each proximity-based criterion, followed by reclassification using the "Reclassify" function in ArcGIS. The resulting raster maps, normalized on a scale of 1–10, were then overlaid to assess the relative spatial compatibility of tourism sites.
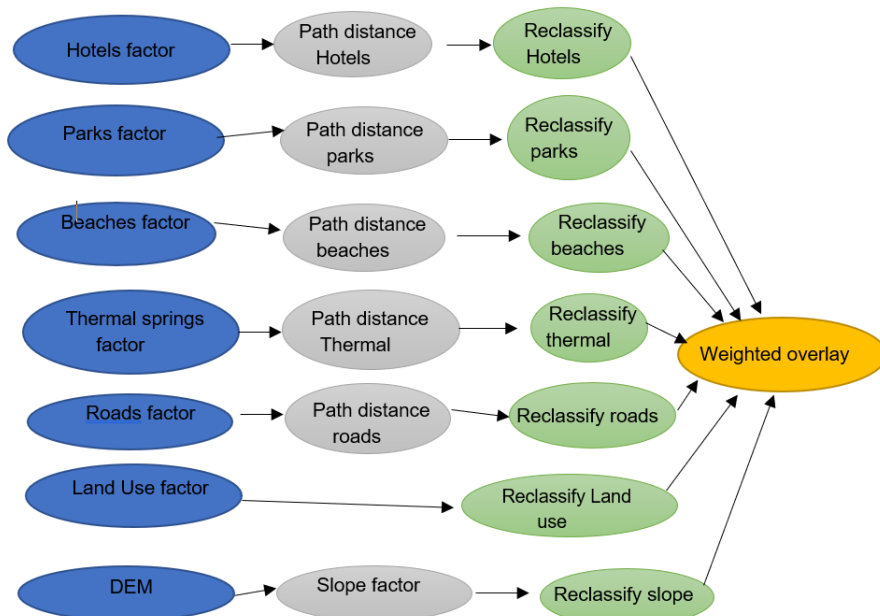
Once all criteria were standardized, a "Weighted Sum" method was applied to aggregate them into a composite tourism suitability map. The weighting process was based on expert consultation with stakeholders from the Directorate of Tourism, the El Kala National Park (PNEK), the Directorate of Forests, and the Directorate of Environment, ensuring that local territorial priorities were accurately reflected (Table 1).

Table 1. Factors, assigned weights, and data sources.

FACTORS	WEIGHTS	SOURCES
Slope	13%	Directorate of tourism
Land Use	15%	Directorate of tourism, of Forest , PNEK and directorate of environment
The beaches	15%	Directorate of tourism
Hotels	10%	Directorate of tourism
Parks and recreational gardens	20%	Directorate of tourism, of Forest and of environment
The thermals springs	12%	Directorate of tourism
Road network	15%	Directorate of tourism

To achieve this objective, a robust methodological framework was established, combining detailed analyses of topographic parameters, land use characteristics, and tourism potential through the integration of Geographic Information Systems (GIS) and the Analytic Hierarchy Process (AHP) (Figure 4). The AHP, developed by Thomas L. Saaty in the 1970s, is a multi-criteria decision-making approach that facilitates the resolution of complex problems by decomposing them into a hierarchical structure of interrelated elements. Decision-makers perform pairwise comparisons among these elements to express their relative importance, thereby translating qualitative judgments into quantitative weights (Chakrabarty, 2011)

Figure 4. Methodological framework followed to carry out the multi-criteria evaluation.

Source: own ellaboration.

3. **Results**

After nearly a decade, the tourism sector in the region appears to face persistent obstacles despite advances in planning and project studies since 2015. Recent data from the tourism department reveals a state of stagnation, if not regression, with approximately 80% of projects remaining either frozen or fully cancelled. This situation contrasts with the development aspirations articulated during the initial registration of these projects, reflecting a significant gap between intentions and tangible achievements. This stagnation is also evident in the hotel sector, where the number of establishments has indeed increased, rising from 19 to 25 between 2015 and the present day. However, the accommodation capacity remains relatively limited, with only 896 rooms and 2264 beds available. Despite the programming of 17 urban tourism infrastructure projects in 2015, the implementation of these projects remains pending, as do envisaged ecotourism initiatives, such as natural and cultural circuits.

Regarding beaches, the total number of beaches in the region has remained unchanged since 2015, with a total of 28 beaches and only 17 authorized for swimming in 2023. These figures suggest a lack of momentum in implementing new projects and a potential underutilization of existing infrastructure. Similarly, ecological development initiatives, such as recreational areas and forest reserves, also appear to be experiencing slow progress. Out of the four planned recreational areas, only one has been completed, and among the eight scheduled forest reserves, only four have been opened to the public, with a recorded number of visitors in 2023 totaling 112,840. This situation raises questions about the local authorities' capacity to stimulate tourism activity while preserving the region's natural ecosystems. Despite these challenges, it is essential to highlight the untapped potential of the region for tourism.

Table 2. Assessing Beach and Hotel Attendance.

YEARS	BEACH ATTENDANCE	HOTEL INFRASTRUCTURE ATTENDANCE	
		ARRIVALS	OVERNIGHT STAYS
2014	2.254.390	34.197	46.329
2015	3.843.610	27.486	36.956
2016	3.288.065	26.828	39.297
2017	4.641.675	27.756	38.975
2018	2.602.165	23.300	30.911
2019	2.584.305	24.840	31.170
2020	1.375.850	6414	7186
2021	1.123.100	11.600	13.874
2022	3.577.215	23.695	68.563
2023	2.111.515	24.589	32.681

The analysis of beach attendance data and hotel infrastructure over the indicated period reveals significant flows and marked fluctuations, particularly in coastal tourism. A notable observation is the sustained growth in beach attendance until 2017, followed by a slight decrease in 2018 and 2019, and then a more pronounced drop in 2020 and 2021, likely attributable to the COVID-19 pandemic. Furthermore, the recovery observed in 2022 suggests potential for a post-pandemic return to

normalcy, underscoring the importance of proactive tourism management to support economic recovery.

Given the stagnant tourism development situation in the region, despite its undeniable tourism potential, it becomes crucial to explore new opportunities by identifying sites conducive to tourism development. In this regard, we propose utilizing a mapping approach based on a tourism suitability map. This map would precisely pinpoint areas most suitable for tourism development while taking into account previously identified obstacles and constraints. By identifying these promising sites, we could catalyze tourism development in the region and draw the attention of decision-makers and investors to these areas, thereby offering new prospects for economic growth and the promotion of local natural and cultural heritage.

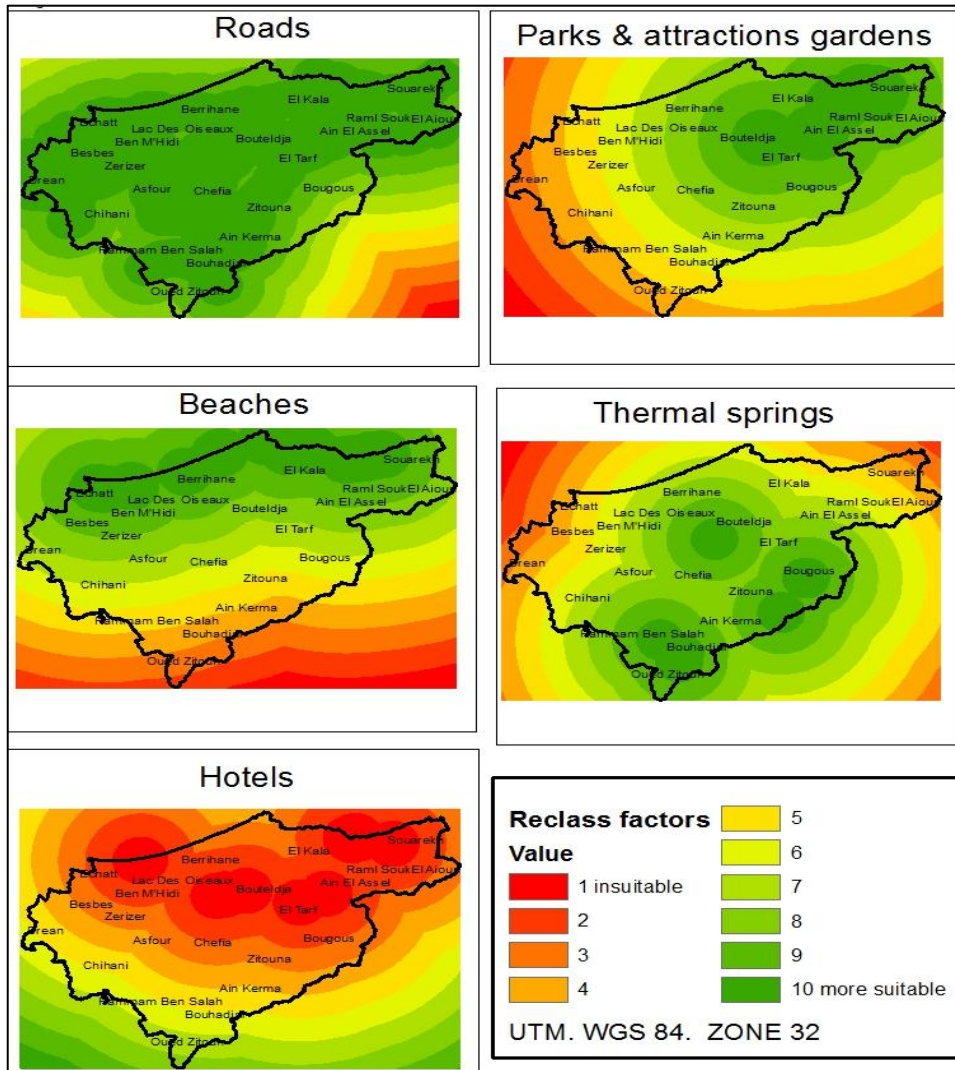## 3.1. Analysis of tourism suitability criteria

Figure 5 shows the maps obtained after calculating the distance of each criterion in this analysis and after reclassifying these distances according to the scale we chose from 10 (most suitable, green color) to 1 (least suitable for tourism, red color).

The road network shows high suitability along the northern and central parts of the region, indicating well-developed transportation infrastructure that enhances accessibility to key tourist sites. The parks and recreational gardens exhibit greater suitability in the northern and northeastern sectors, particularly around El Kala and Lac des Oiseaux, reflecting the concentration of natural and recreational green areas. Regarding the beaches, the most suitable zones are concentrated along the Mediterranean coast, confirming the dominance of coastal tourism potential in the region. The thermal springs display localized suitability patterns mainly in the central and eastern areas, coinciding with the distribution of hydrothermal resources. Finally, the hotel infrastructure presents limited suitability overall, with only a few high-suitability clusters near urban areas such as El Kala and Ben Mhidi, highlighting the shortage of accommodation facilities across much of the territory.

These preliminary results emphasize the spatial heterogeneity of tourism potential in the El Tarf region and provide the foundation for the subsequent integration of criteria in the composite suitability analysis. After combining all weighted criteria, a tourist suitability map was obtained from the weighted overlay of all selected criteria using the AHP approach. The map is made up of 9 classes, ranging from areas of excellence to areas not suitable for tourist activity (Figure 6).

The resulting map highlights a heterogeneous spatial distribution of suitability levels across the study area. The highest suitability classes (8–9) are concentrated in the central and southern parts of the region, particularly around Bouhadjar, Oued Zitoun, Ain Kerma, and Bouguous. These areas combine favorable topography, accessible land use categories, and proximity to road networks, making them highly suitable for the development of ecotourism and inland recreational activities. The moderately suitable zones (5–7) extend across the central corridor, including Bouteldja, El Tarf, and Chefia, where tourism infrastructure and environmental resources coexist but remain underdeveloped. In contrast, the northern coastal strip, encompassing El Kala, Raml Souk, Berrihane, and Ben Mhidi, shows lower suitability values (1–4). This is primarily due to the combination of land-use restrictions related to protected areas, limited available land for development, and environmental sensitivity of the coastal ecosystems.
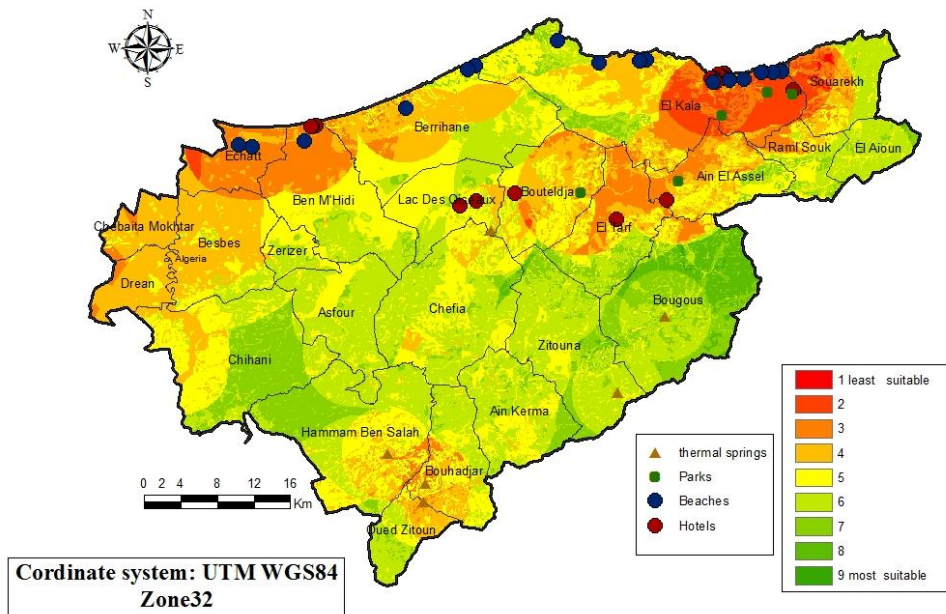
Figure 5. Spatial suitability maps of each factor of analysis

Source:own ellaboration.

Although the northern coastal areas, particularly around El Kala and Ben Mhidi, remain valuable for conservation and limited tourism development due to their already high concentration of facilities and environmental sensitivity, the central and southern sectors of the region present greater potential for sustainable tourism expansion. These inland areas, characterized by the presence of thermal springs, diverse landscapes, and less anthropogenic pressure, offer suitable conditions for promoting ecotourism and inland tourism initiatives. This spatial contrast highlights the need to redirect future tourism planning toward the southern zones, where development can be achieved with lower environmental impact and stronger integration of local natural and cultural assets.

Figure 6. Final map showing the multi-criteria evaluation of tourism potential for El Tarf region.

Source:own elaboration.

Table 3 shows the distribution of land areas by tourist suitability class for the El Tarf region. The data show a significant variation in land areas among the nine suitability classes. The class of moderate suitability occupies the largest area (2157 km², 74.76%). This somewhat limits the availability of land offering significant tourist attractions in this category. The class of very good to high suitability for tourist attraction also presents a considerable area (366 km², 12%), indicating the presence of attractive natural, cultural, or recreational features for tourists. Conversely, the classes of poor tourist suitability (zones 1, 2, and 3) occupy smaller areas totaling 366 km². These classes represent areas with less favorable characteristics or potential challenges for tourist development, such as environmental issues, land tenure problems, economic activity, or the presence of significant tourist infrastructure, as is the case in the municipality of El Kala. Analyzing these data underscores the importance of understanding the spatial distribution of tourist suitability in the El Tarf region to effectively guide tourism development planning and management. Areas with large areas in the moderate and high suitability classes can be targeted for investments to enhance their tourist appeal, while specific strategies may be needed to overcome challenges associated with low tourist suitability areas.

Aiming to simplify the selection for tourism stakeholders and territorial managers, a specific map showing only areas of suitability levels 7 (good), 8 (very good), and 9 (excellent) was created (Figure 7). These zones indicate areas conducive to tourism development. Additionally, in a second map, we have included the intermediate class, representing areas of moderate suitability, combined with the other classes, to provide more options to managers and investors (Figure 7). This approach offers a clear and precise strategic vision for the planning and development of tourism in the various studied zones.
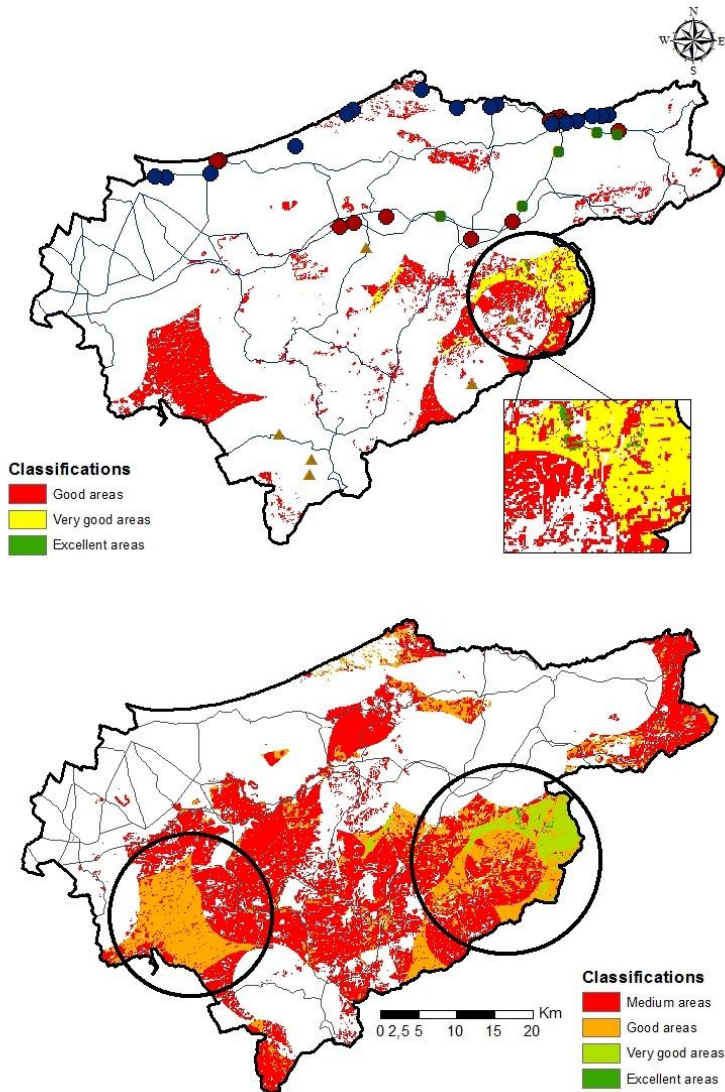
Table 3. The distribution of land areas by tourist suitability class.

AREAS IN DEGREE OF SUITABILITY	AREA (KM²)	SURFACE AREA OF SUITABILITY CLASSES	% RELATIVE TO THE PROVINCE
1 (low)	2	362	12,55% of areas with low suitability for tourism
2 (low)	81		
3 (low)	279		
4 (medium)	548	2157	74,76% of areas with medium suitability for tourism
5 (medium)	748		
6 (medium)	861		
7 (high)	308	366	12,69% of areas with high suitability for tourism
8 (high)	57		
9 (high)	1		
Total	2885	2885	

After carefully analyzing the areas conducive to tourism development and excluding those that were not suitable, a predominant observation emerges: the majority of suitable zones are located in the southern region. It is crucial to consider the specific context of the northern part of the region, which is largely dedicated to forest resources. More specifically, the northeastern region is distinguished by the presence of the El Kala National Park, as well as the three large lakes protected by Ramsar agreements and listed as UNESCO World Heritage Sites. This area is therefore subject to strict regulations regarding development and environmental protection, thus limiting opportunities for tourism development. Furthermore, the municipality of El Kala hosts a significant number of hotel facilities, further reducing investment opportunities in this region.

Furthermore, the northwest region is characterized by predominant agricultural activity, especially in the municipalities of Drean, Besbes, Asfour, and Ben Mhidi, where irrigated perimeters are extensively utilized. Agricultural lands, whether private or state-owned lands managed by agricultural services, are primarily used for agricultural purposes. Due to potential conflicts related to land use and development priorities, it has been deemed prudent to avoid these areas to minimize the risks of project implementation blockages and associated land disputes. Thus, the suitability map has primarily selected the southern region as a preferred development zone. Despite its underutilized tourist potential, this area offers an environment conducive to various activities, notably ecotourism. The thermal springs present in this region constitute an additional attraction, enhancing its potential for the development of environmentally friendly tourism, in harmony with its unique topographic characteristics. However, these agricultural zones also present significant potential for the development of agroecological tourism, which integrates agricultural practices with tourism activities in a sustainable manner. By promoting farm visits, local product tasting, and educational experiences related to sustainable agriculture, these areas could diversify the region's tourism offer while supporting rural livelihoods and environmental stewardship. Integrating agroecotourism into regional planning could therefore enhance the value of these agricultural landscapes without compromising their primary productive functions.

Figure 7. Areas oh high (above) and medium (below) suitability for tourism development in El Tarf, according to the multi-criteria analysis that has been carried out.

Source:own ellaboration.

4. Conclusions

This research addressed a highly relevant theme in territorial planning for tourism development in the El Tarf region by evaluating spatial suitability and identifying potential sites for tourism development. The application of GIS technology proved instrumental, offering advanced methods and tools for spatial analysis. GIS facilitated the management, analysis, and visualization of diverse spatial data

relevant to tourism activities, thereby supporting informed decision-making through the production of detailed maps.

The study employed GIS-based analysis as a central method for evaluation and decision-making, enabling the accurate and generalized representation of real geographical phenomena. Advanced techniques were applied in the analytical process, including the determination of criterion weights. The weighted overlay method, implemented within a multi-criteria analysis framework using the Analytic Hierarchy Process (AHP), integrated reclassified and normalized values to assign a single suitability score to each location. This process considered all input criteria and their relative importance, culminating in a final suitability map identifying areas most appropriate for tourism development.

The results reveal a heterogeneous spatial distribution of tourism suitability across the El Tarf region. The highest suitability classes (8–9) are concentrated in the central and southern parts of the region, particularly around Bouhadjar, Oued Zitoun, Ain Kerma, and Bouguous. These areas combine favorable topography, accessible land-use categories, and proximity to road networks, making them well suited to the development of ecotourism and inland recreational activities. Moderately suitable zones (5–7) are found along the central corridor, including Bouteldja, El Tarf, and Chefia, where tourism infrastructure and environmental resources coexist but remain underdeveloped. In contrast, the northern coastal strip encompassing El Kala, Raml Souk, Berrihane, and Ben Mhidi shows lower suitability (1–4) due to land-use restrictions related to protected areas, limited available land, and the environmental sensitivity of coastal ecosystems.

Overall, the analysis indicates that the central and southern sectors of El Tarf present the greatest potential for sustainable tourism expansion. These inland areas, characterized by thermal springs, diverse landscapes, and lower anthropogenic pressure, provide suitable conditions for ecotourism and inland tourism initiatives. In contrast, the northern coastal zones, while valuable for conservation and limited tourism, require careful management due to their ecological sensitivity and existing concentration of facilities. Based on these findings, the study recommends clear guidelines for sustainable tourism development in the El Tarf region. These include prioritizing inland areas for ecotourism expansion, preserving natural habitats, integrating local communities in tourism planning, and minimizing environmental impacts through appropriate infrastructure and management strategies. By directing development toward the most suitable areas, the region can achieve sustainable tourism growth while safeguarding its natural and cultural heritage

Acknowledgements and conflict of interest statement

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