

Developing a framework for planning recreational areas using recreation opportunities spectrum

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ABSTRACT

The Recreation Opportunities Spectrum (ROS) framework is a method used to manage visitor recreational areas by determining and allocating spaces based on a spectrum of recreational opportunities tailored to the environment, as well as the needs and preferences of the community. This research applied the ROS to develop a recreational land-use plan for the Gorgan watershed in Iran. To begin, the study assessed the region's capacity to identify available recreational opportunities and preferences. It estimated the demand for these opportunities and prioritized them accordingly. Next, a weighted linear combination of recreational areas was identified using a multi-criteria evaluation method. Following this, the ROS framework was revised to create new categorizations based on local conditions and guidelines, including the land's recreational potential, available opportunities, and community needs. This updated framework, ROS2, consists of eight categories: natural, semi-natural, non-motorized, semi-natural motorized, slightly developed rural, developed rural, culturally disjointed, and urban or adjacent urban areas. The final zones proposed for recreational planning and development were based on ROS2. The findings of this research, utilizing a systematic framework for land recreational planning, can help achieve a desirable recreational experience, meet the community's needs, protect the environment, and minimize the ecological impacts of recreational development. Moreover, this framework can serve as a guide for planning and tourism management in similar areas.

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1. Introduction

Parks and recreational areas have been shown to reduce stress, enhance cognitive function, promote relaxation, improve mental health, and foster social interactions (Galdavi et al, 2023; Sun et al, 2024). So, creating, developing, and maintaining recreational and tourist areas is essential to build a healthy and constructive society. This is necessary for sustained economic development and growing public demands. As these recreational areas, especially natural ones, become more popular, the number of visitors will continue to rise (Salimi Dehkordi et al, 2024). Tourism is the third largest industry

in the world (Ucgun and Sahin, 2023). For countries like Iran, which boasts numerous tourist attractions, effective tourism planning and management are crucial for revitalizing this sector and preserving its natural resources for the future. An analysis of factors related to recreational demand in the country indicates that this demand is rapidly increasing. However, as unmanaged use of parks and recreational areas grows, the quality of these spaces declines. This deterioration not only affects community recreational demand and leisure activities but also diminishes the overall value of these areas



as resources for recreation (Movahed, 2006). Therefore, the ecological land evaluation through the regulation of human relationship with nature and by providing the possibility of appropriate development in harmony with nature is a crucial step toward creating a sustainable development program. At the same time, achieving the dual goals of conservation and tourism requires establishing a balanced relationship between human activities and natural habitats. Numerous studies have shown that landscapes should contribute to the overall well-being of individuals in their daily lives. Everyone should have access to healthy landscapes at home, at work, and during leisure time. People, as the main users of these sites, play a crucial role in the development, conservation, and management of landscapes during various stages of planning and monitoring. Understanding the types of leisure activities that interest them and ensuring these activities are provided in appealing locations is essential for effective planning and management. This approach not only satisfies the public but also caters to their recreational preferences (Priskin, 2001). Many studies have demonstrated that recreational activities in different regions align with the land characteristics that attract visitors. Makhdoum (2016) categorizes these activities into two main groups:

A: Intensive outdoor recreation: Intensive outdoor recreation emphasizes activities that depend on developing and providing recreational facilities, including camping, picnicking, and various team sports.

B: Extensive outdoor recreation: Outdoor recreation activities fall into two categories: those that require minimal facilities and equipment, and those that do not require any at all. Examples of this type of recreation include walking, hiking, climbing, fishing, and hunting. These activities primarily depend on the natural features of the resort.

Therefore, recreational planning is necessary, considering recreational activities related to recreational resources that are interesting for people in each region (Groot, 2011). Attracting visitors while ensuring a high-quality recreational experience is essential. Effective recreational land use planning is crucial for achieving optimal, long-term results. This planning must balance the need to protect the natural environment with the community's recreational needs. As a result, frameworks

have been developed for managing visitors in recreational areas. One effective method for visitor management is the Recreation Opportunities Spectrum (ROS) framework. This framework helps identify and allocate recreational areas based on various recreational opportunities, aligning environmental conditions with visitors' needs (Sun et al, 2024).

1- ROS framework: The ROS framework is a land-based survey that considers individuals' environmental criteria, preferences, and recreational experiences to explore the relationships among environments, activities, and those experiences. By integrating these elements, the framework can be utilized for various recreational management goals (Birkemose, 2015). It was developed by researchers for the US Forest Service and the Land Management Office in response to increasing recreational demand and growing conflicts over limited resources (Lu, 2023). By integrating recreational activities, environments, and experiences through the methods of planners and managers, the Recreational Opportunity Spectrum (ROS) can help individuals pursue their preferred activities and gain valuable experiences (Wearing and Atcher, 2003; Ormsby et al., 2004). This framework has been employed to design recreational resources that ensure long-term maintenance and provide high-quality experiences for people across various regions (Clark and Stankey, 1979; Parkin et al., 2000; Martin et al., 2009; Sarbanes, 2011; Groot, 2011; United States Department of the Interior Bureau of Land Management, 2014; Zeng et al., 2021; Lukoseviciute et al., 2023; Lu, 2023; Sun et al., 2024; Bimbao and Ou, 2024; Luo et al., 2024). For instance, the U.S. Land Administration Office (2014) applied the ROS framework in a study on managing travel and recreation in the Glade Run recreation area.

Their goal was to manage recreational resources and determine transport routes in the area to access government lands. They aimed to create areas for a wide range of motorized and non-motorized recreational activities and to develop recreational infrastructure to enhance visitors' experiences while using state land. They emphasized that various factors should be considered in planning travel and leisure management. These factors include diverse landforms, visitors' interests, weather conditions, transport structures, recreational facilities, and resource limitations. In a study by

Birkemose (2015), visitor satisfaction with the implementation of the Spectral Recreational Opportunity Spectrum (ROS) framework was assessed at Fulufjallet National Park. Using a questionnaire and an online survey, Birkemose evaluated how satisfied visitors were with the ROS framework, the recreational activities, and the facilities available in the area. The results indicated that visitors expressed high satisfaction with their experiences there.

Numerous studies indicate that implementing recreational planning frameworks, such as the Recreation Opportunity Spectrum (ROS), can significantly enhance the management and utilization of recreational areas. This is especially true for the northern forests in the country. Visitors have diverse recreational experiences, and the Recreation Opportunities Spectrum (ROS) framework offers various opportunities tailored to different visitor groups. This framework considers the unique needs and preferences of visitors within the park management process. A review of studies indicates that the ROS framework is a practical tool, encouraging managers to approach management from three key perspectives: 1) Protection of resources, 2) Opportunities for public use, and 3) The organization's ability to meet these conditions. Additionally, this process can be seamlessly integrated with regional objectives by considering resource inventory. Ultimately, it ensures a wide range of recreational opportunities for the public (Zeng et al., 2021). The use of this framework offers valuable insights into recreational areas and supports the integrated management of these spaces by considering the country's capabilities, as well as the recreational needs and preferences of the public. To ensure the long-term sustainability of recreational areas while meeting the needs and preferences of users, it is essential to provide high-quality recreational experiences. In this context, the Recreation Opportunity Spectrum (ROS) can significantly contribute to the effective management of these areas. However, the ROS framework has primarily been applied to existing recreational sites. It is commonly used to categorize these areas into six defined classes and to identify, design, and assess recreational opportunities (Groot et al., 2011).

This study utilized the Recreation Opportunity Spectrum (ROS) framework for planning land use in the Gorgan watershed of Iran. This area possesses significant potential for outdoor

recreation, thanks to its mountainous terrain, forests, and water resources. However, the absence of effective management can lead to the gradual degradation of these natural spaces. By applying the ROS framework, this research aims to facilitate recreational land planning that preserves environmental quality while ensuring a positive recreational experience for visitors. A notable strength of this study compared to previous research is the tailored development and formulation of ROS classes based on the specific conditions of the study area, as well as the incorporation of local preferences in recreational land planning within each designated ROS category.

2. Material and Methods

2.1. Study area

The study was conducted in the Gorgan watershed, located in Golestan province, Iran. This basin spans an area of 112702 hectares and is located in the geographic coordinates of 32° 36' to 2° 37' north latitude and 12° 54' to 58° 54' east longitude and includes a large part of the Gorgan County (Fig. 1). The study area is characterized by two distinct regions: the mountainous southern region and the plains to the north. Gorgan, one of the northern cities of the Alborz mountains, serves as the primary residential area. Notably, the village of Ziarat, located in the southern part of Gorgan, is one of the important villages in this area.

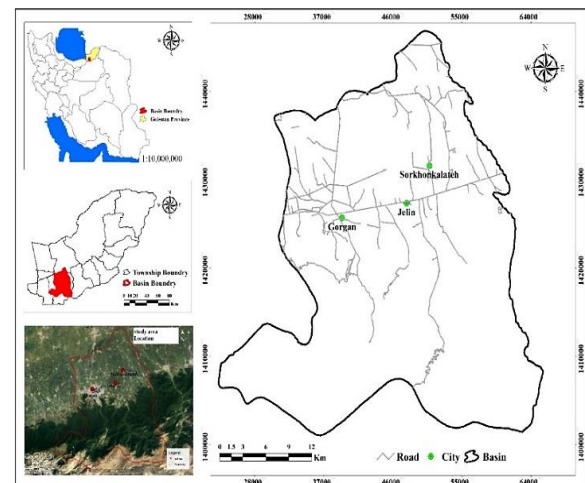


Fig. 1. Location of the study area.

According to Fig. 1, the forest area is located in the southern part of the region. This area's recreational facilities include forest lands, mountains, rivers, and waterfalls. These diverse

recreational resources have attracted tourists, created jobs, and generated income for residents, which is why this area has been chosen for research. Regarding land use, approximately 61378.57 hectares of the area can be examined for recreational development, encompassing forest lands, mountains, rivers, and rangelands. The remaining land is designated for agricultural, residential, and industrial purposes.

2.2. Research method

In this research, the Recreation Opportunity Spectrum (ROS) Framework was utilized for recreational planning by allocating various types of recreational activities. A multi-criteria evaluation method, specifically the linear weighting method, was employed to identify suitable recreational areas. Final zones for recreational planning were selected based on each area's Zonal Land Suitability (ZLS). Next, suitable recreational areas were identified using the ROS framework. After determining the ROS classes in the region, a range of recreational opportunities was established based on environmental capability. Additionally, the results of questionnaires were analyzed to assess the demand and recreational needs for each class in the area. In this study, criteria related to the characteristics of the ROS classes were first used to identify these classes. Subsequently, a new classification named ROS2 was created, considering the existing conditions and characteristics of the area.

2.3. Prioritizing recreational activities

In this section, we surveyed visitors about their recreational activities, considering the capacity of the region and the various opportunities related to forests, mountains, and water resources in the study area. A comprehensive questionnaire was developed for this purpose. The validity of the questionnaire was confirmed by experts. To assess its reliability, 30 questionnaires were randomly distributed in the studied regions, and Cronbach's alpha coefficient was calculated using SPSS software. The Cronbach's alpha coefficient for this questionnaire was 0.85, indicating good reliability. Ultimately, 400 questionnaires were completed, and the collected data were analyzed using SPSS software. The statistical population for this study comprised both

residents of the city and visitors to Alangdare Forest Park and Naharkhoran Forest Promenade during the spring and summer of 2015. 400 questionnaires were randomly distributed among park visitors, regardless of their social status or area of expertise, at various times on holidays and weekdays in both recreational and urban areas. In the questionnaire, participants were asked to rate their willingness to engage in different activities on a scale from 1 to 5, with 1 indicating the least willingness and 5 indicating the most. To determine which recreational activities were prioritized by the community, these scores were standardized on a scale from 0 to 1. The activities were then categorized into three priority levels: high priority (scores greater than 0.7), moderate priority (scores between 0.5 and 0.7), and low priority (scores less than 0.5).

2.4. Recreational opportunities spectrum (ROS) framework implementation

In this research, as mentioned above, the ROS Implementation Guide (ROS Application Guide, 1987) was used for planning recreational planning. This framework is divided into six categories of land management in a range from "pristine" to "urban" on land (Table 1).

According to Table 1, each category addresses various levels of physical and environmental changes, different degrees of distancing, size, exposure to others, and types of management actions. The 'primitive' category assumes that individuals attracted to the area prefer it to be free of facilities, resulting in low levels of infrastructure, management, and population density (Clark and Stankey, 1979). In the primitive category, experiences that promote independence, tranquility, isolation, self-confidence, and a connection to nature and challenges are emphasized. Conversely, the urban category focuses on providing high-density, highly managed experiences within a developed environment. According to Table 1, categories 1 through 6 offer more opportunities related to competition, dependence, and enjoyment of social activities (Ormsby et al., 2004). To describe each of these opportunity categories across the spectrum, physical, social, and managerial features were examined (Ormsby et al., 2004; Martin et al., 2009; Groot et al., 2011).

Table 1. Description of six floors of ROS derived from Ormsby et al. (2004).

Category		Description
1	Primitive (P)	Large natural areas where user encounters are infrequent and motorized vehicles are prohibited.
2	Semi Primitive Non-Motorized (SPNM)	An area with a natural environment, medium to large, where the likelihood of individuals encountering each other is low and using Motorized vehicles is prohibited.
3	Semi Primitive Motorized (SPM)	A region with a medium to large natural environment and a low user density and using Motorized vehicles is allowed.
4	Roaded Natural (RN)	The region primarily features a natural environment, though there is some evidence of human activity that typically aligns with the surrounding nature. The frequency of interactions among users is low to moderate. Motorized vehicle use is common, reflecting the construction standards and design of the facilities.
5	Rural (R)	A region with a natural environment that has been significantly improved to enhance recreational activities while preserving vegetation and soil. The frequency of interactions among users is typically moderate to high. Additionally, numerous facilities and parking options are available for motorized vehicles.
6	Urban (U)	The area is well-known for its urban environments, although it also features some natural elements in the background. It is expected to have a large number of users both locally and from nearby areas. There are plenty of facilities for motorized vehicles and car parking, and various public transportation options are frequently available throughout the site.

The land's physical features include aspects such as slope, tilt, altitude, and cultural-historical sources specific to the region. Additionally, it encompasses relatively permanent human structures found in an area, such as roads and dams. Social features are represented by users, their behaviors, and their socioeconomic characteristics, which include age, gender, literacy, income, and culture. Management features of the site include the presence of on-site personnel, educational and informational services, recreational facilities, as well as considerations for safety and security (Ormsby et al., 2004). These three features influence the variety of activities and opportunities for experiences across the spectrum (Clark and Stankey, 1979; Ormsby et al., 2004). Generally, the Recreation Opportunity Spectrum (ROS) not only offers a wide range of classifications—from primitive to urban—but also guides the management of various environmental aspects. This includes biophysical elements (such as vegetation, terrain, topography, and landscape), social factors (like the number of people and the likelihood of interactions), and management considerations (such as development processes, roads, and laws and regulations). Together, these elements create opportunities for individuals to enhance their recreational experiences (Clark and Stankey, 1979; Stein, 2013). The implementation of the Recreational Opportunity Spectrum (ROS) framework in the study area showed that the existing categories are poorly defined and need to be reviewed and adapted to the specific conditions of the region. To create new categories, we first conducted field studies and comprehensive library

research focused on the area, considering its unique characteristics and the essential criteria for forming the ROS framework, as outlined in the ROS guidelines (1987). Next, we developed new categories by considering the criteria for distinguishing different ROS classes, along with the specific conditions and attributes of the study area and the recreational interests of the local population. These new categories were then integrated into the ROS2 framework, which is designed for current recreational areas identified through multi-criteria evaluation. Finally, we established criteria to categorize the study region and define the range of recreational activities available.

3. Results and discussion

This research aimed to facilitate land use planning for recreational purposes by utilizing the Recreational Opportunity Spectrum (ROS) framework. To achieve this, we identified and prioritized the recreational activities of interest to the community through a questionnaire. We also assessed the land's recreational capacity using a multi-criteria evaluation method called multi-criteria linear combination. Following this, we determined suitable zones for recreational development based on Zonal Land Suitability (ZLS). The ROS framework was then adapted to reflect the region's specific conditions. The results of the research are presented below.

3.1. Prioritizing recreational activities

Table 2 presents the prioritized recreational activities of individuals in the study area.

Table 2. Preferential Priority for Recreational Activities.

Type of the region	Preferential priority of the people		
	High	Medium	Low
Forest areas	Picnic Photography Visit the waterfall Walking View the nature of the area (plants, animals, and tectonic properties) Visiting historical and ancient monuments Visiting holy places (If there is any) Visiting and buying something from local markets and crafts	Playground for adults Cable car Playground for children Visiting rural areas and knowing traditional rituals Visit the Museum of Nature Hill climbing science trip in nature to learn Cycling Horse riding Caving Horse-Drawn Carriage Rides Camping Collecting herbal products	-
Mountainous area	Picnic Photography Visit the waterfall Walking View the nature of the area (plants, animals, and tectonic properties) Visiting historical and ancient monuments	Visiting rural areas and knowing traditional rituals Mountain Climbing science trip in nature to learn Horse riding Cycling Sky Flight with gliders or paragliders	Rock climbing
Regions with water bodies	Playground for children Swimming Watching Aquatic Birds photography View the nature of the area (plants, animals, and tectonic properties) Walking Sailing Playground for adults Visiting historical and ancient monuments Visiting and buying something from local markets and crafts	Visiting rural areas and knowing traditional rituals science trip in nature to learn Fishing Cycling Camping Horse riding Jet ski Water skiing	-
Urban parks	Rest and watch around Photography Exercise	Walking Playground for children Playground for adults	Cycling

The research in this area was carried out by other researchers and the results of this section aligned with them (such as Shin et al., 2023 & Pham et al., 2023). According to the results of this study and the review of the related research, it should be noted that when planning for recreational and tourism areas, considering recreational activities of people's interest in prioritizing activities for development is essential. This is very effective in providing a recreational experience with high quality and satisfaction. In this way, the results of this research can be used to optimize the recreational conditions of the region by providing recreational activities of the people's interest that are in line with the ecological potential of the area. It can also lead to the preservation of the area for future and long-term use and increase the people's satisfaction from the presence in the region and the acquisition of desirable and high-quality experiences.

3.2. Presentation of the new classes of ROS framework based on the study area

Research indicates that the Recreation Opportunity Spectrum (ROS) is mainly utilized as a descriptive evaluation tool for recreational areas (Zeng et al., 2021). Burns and Moreira (2013) contend that focusing on nature-based recreational activities in planning can significantly mitigate the environmental impacts of tourism, thus highlighting the potential benefits of using ROS.

In this study, the ROS framework based on regional conditions, was applied for recreational landscape planning. To achieve this, we evaluated the recreational capacity of the area using a multi-criteria evaluation method. Subsequently, suitable zones for recreational development were identified based on Zonal Land Suitability (ZLS) (Fig. 2).

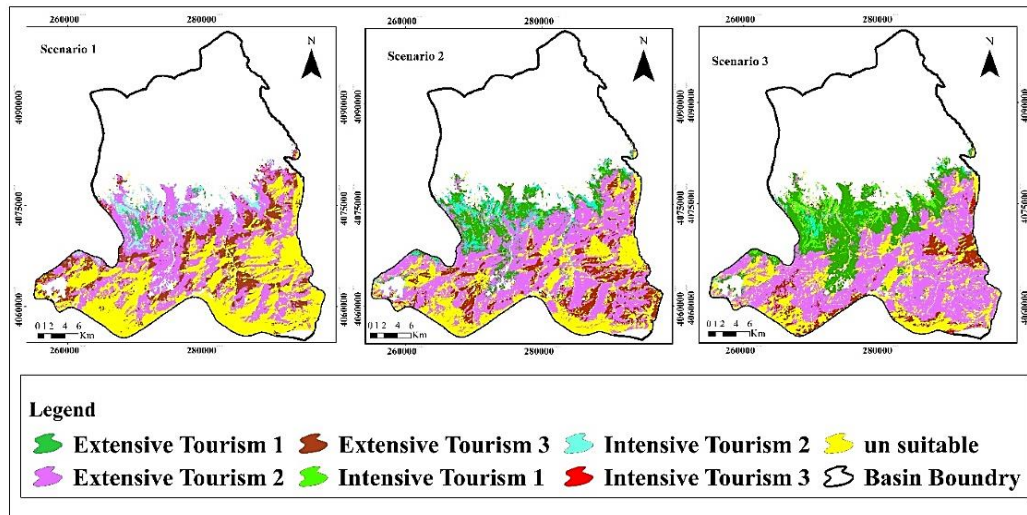


Fig. 2. The final Suitable places based on the MCE triple scenarios.

The ROS classes were created with consideration of regional conditions, as well as the guidelines for developing ROS classes on the 8th floor, and were designated as ROS2. Table 3 outlines the criteria used for forming

the ROS2 classes, while Table 4 presents the framework developed for ROS2, organized into eight classes. The classification of the classes within this framework is illustrated in Fig. 3.

Table 3. Effective criteria for the formulation and presentation of ROS2 classes.

Major criteria	Sub criteria
Biophysical	Remoteness
	Natural
Social experience	Facilities for visitors
	The opportunity to meet new individuals and various groups
Managerial	Evidence of use
	Quality and Accessibility
	Visiting services
	The guidelines for managing an area

Table 4. Developed classes for the ROS2 framework.

Title of the class	Description of the features and conditions of the classes
Natural	Natural areas with very few visitors typically lack roads, facilities, and amenities. When roads do exist, they are often dirt or rocky, making them unsuitable for most vehicles. These areas usually have exceptional conservation value and require special management to ensure their protection.
Semi-Natural Non-Motorized	A natural environment with few visitors typically lacks roads and facilities. When roads are present, they are often dirt or rocky. These areas may also feature outstanding landscapes with unique conservation values, which contribute to their protective significance.
Semi-Natural Motorized	An environment with a natural appearance and a moderate number of visitors. Motorized use is somewhat allowed. These areas usually lack facilities and are often at high altitudes, where no vehicles can move on roads outside of the defined paths.
Low-developed rural	An environment with a natural appearance where human-made structures are visible, but it lacks visitor facilities. Typically, the number of seasonal visitors is moderate.
Developed rural area	An environment that has a natural appearance, where human-made structures are prominently present, is often found near rural areas and roads. This setting can attract anywhere from a moderate to a large number of visitors, although it typically lacks specialized facilities for them. However, the nearby villages provide essential amenities such as shops and accommodation, which benefit the visitors.
Cultural-separated areas	Visitors come to these areas for religious or historical reasons. The availability of facilities and the accessibility of these areas vary based on their location.
Adjacent to city	These areas are situated next to urban centers and possess significant tourist and recreational potential. Facilities and entertainment options are available for visitors in these locations, which can include hotels, restaurants, shops, playgrounds, picnic areas, as well as signs and guides. The areas may be either natural or human-made. It is essential to manage the impact of visitors to maintain the quality of the recreational experience and protect the environment. These areas are frequently visited by people.
Urban	The area is situated within an urban environment and features parks and green spaces. The range of facilities available varies based on the specific location and the number of users. Access to these areas is very convenient. Due to their urban setting, they are surrounded by a variety of amenities, including hotels, restaurants, and shops.

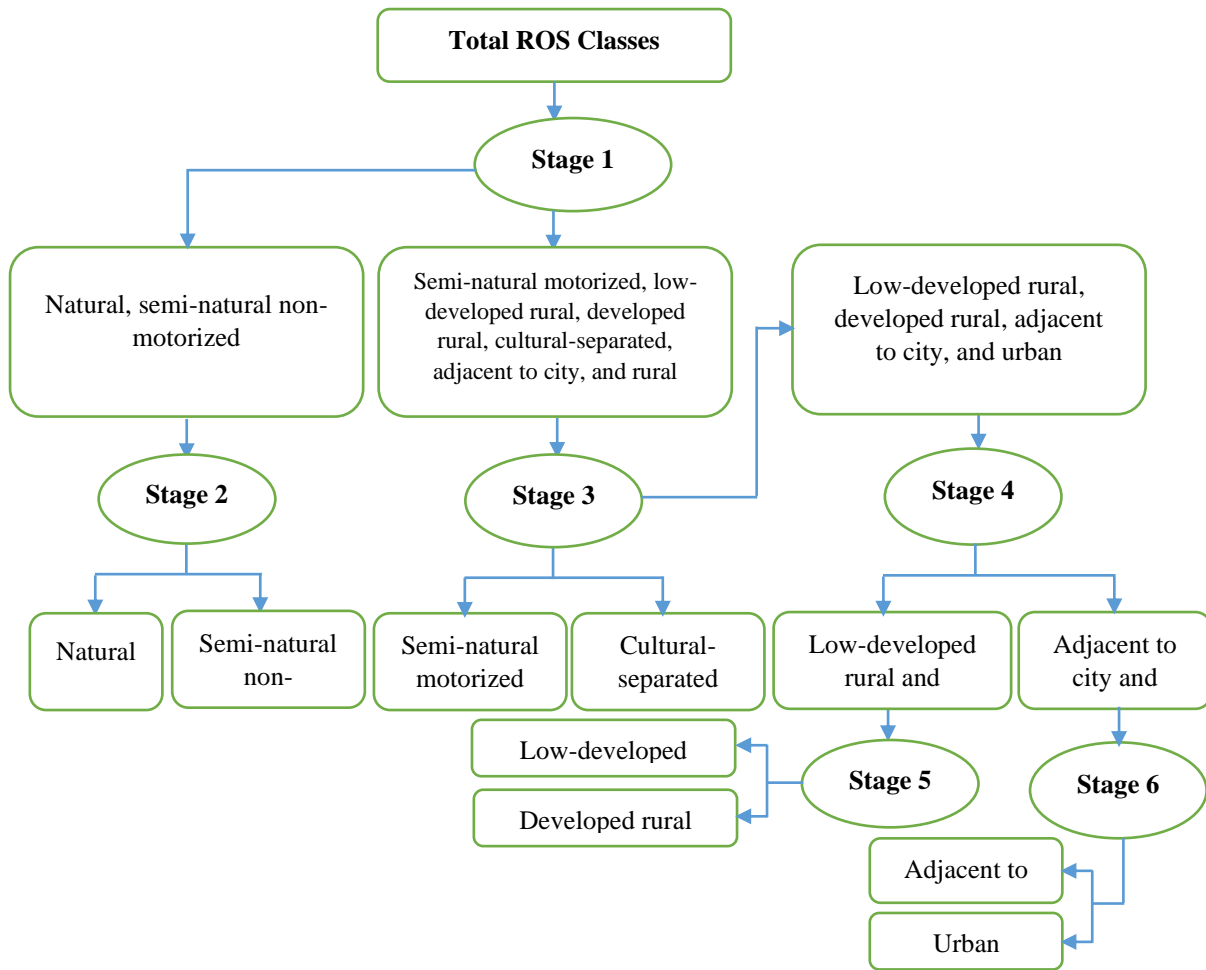


Fig. 3. The ROS2 framework classes categorization.

To separate the study area based on the ROS2 classes, we utilized the recreational area layers and the road access layer. Additionally, the land use map of the region was employed to refine the boundaries and establish the final classes. The following steps correspond to the stages illustrated in Fig. 3.

Stage 1: In the first stage, the area was divided into two distinct categories based on distance from roads. The first category consists of areas that are more than one kilometer away from roads. This includes non-motorized natural and semi-natural regions. The second category includes areas located within one kilometer of roads, which encompasses semi-motorized, low-developed rural areas, developed rural areas, culturally distinct areas, as well as adjacent urban and urban zones.

Stage 2: At this stage, the distance from roads is used to differentiate between natural and semi-natural non-motorized areas. Areas located more than 5 kilometers from roads are classified as natural. Additionally, other criteria, as outlined in Table 5, such as the

presence of human-made structures and evidence of human activity, are applied to refine the boundaries.

Stage 3: In Stage 3, semi-natural motorized areas and cultural-separated classes are distinguished from less-developed rural regions, developed rural areas, adjacent urban zones, and urban areas. Generally, semi-natural areas—characterized by few human-made structures—are found within 1 to 5 kilometers of roads and fall into the semi-natural motorized category. Culturally separated areas include religious sites or ancient artifacts that people use for recreation. Additional criteria outlined in Table 4 are applied to refine the boundaries.

Stage 4: Stage 4 involves distinguishing between low-developed rural areas and developed rural areas, separating them from adjacent urban and urban areas. This classification primarily relies on natural factors. Areas within rural and agricultural lands should be identified as either low-developed or developed rural areas. Additional criteria, such

as available facilities are used to refine the borders.

Stage 5: The distinction between low-developed and developed rural areas is made by examining the level of development and the facilities available. Areas with limited facilities are classified as underdeveloped areas, while others are categorized as developed rural areas.

Stage 6: The division between urban and adjacent urban areas is based on the presence of recreational spaces. Regions within the city

range include urban parks in the urban category. The remaining areas are classified as adjacent to the city. Table 5 presents the general characteristics of the ROS2 categories according to the effective criteria for class differentiation. This table, in conjunction with the process illustrated in Fig. 3, was utilized to differentiate the ROS classes. Additionally, Tables 6 to 8 outline the specific characteristics of each course within the ROS2 framework based on the criteria listed in Table 3.

Table 5. Physical characteristics of the landscape in the ROS2 framework.

Row	Class	Remoteness	Being natural	Facilities for visitors
1	Natural	Usually lacking the road. Roads, if any, are dirt and rocky (non-motorized).	Natural landscapes without changes.	Lack of facilities.
2	Semi-natural non-Motorized	Usually lacking the road. Roads, if available, are dirt and rocky roads (non-motorized).	Natural landscapes with minimum variation in the area. Changes are in line with regional conditions.	Lack of facilities.
3	Semi-natural Motorized	On the road or near pavements and motorways, but at least 1000 meters far from the roads, though roads may be visible in the area.	The natural landscapes are located on the path to the rural areas and their roads. Landscapes can be seen with a natural appearance (except for paved roads that may be visible). Landscapes are typically natural and often found in rural areas. They are altered by the presence of residential developments, roads, pathways, or utility lines like water and electricity. Despite these changes, they still retain the characteristics of natural landscapes.	Lack of facilities for visitors
4	Low-developed rural	On or near the pavement roads, it is at least 1000 meters from the main road.	Landscapes are typically natural features that can be found near rural areas. Although they have been altered by the presence of residential areas, roads, walkways, and utility lines like water or electricity, they still retain the essential characteristics of natural landscapes.	Lack of facilities for visitors. At the same time, being in the vicinity of the villages will benefit viewers from amenities such as shops and residential accommodation.
5	Developed rural	On or near the pavement roads, it is at least 1000 meters from the main road.	Landscapes are typically natural features that can be found near rural areas. Although they have been altered by the presence of residential areas, roads, walkways, and utility lines like water or electricity, they still retain the essential characteristics of natural landscapes.	Lack of facilities for visitors. At the same time, being in the vicinity of the villages will benefit viewers from amenities such as shops and residential accommodation.
6	Cultural-separated	These areas may be on highways, paved roads, dirt roads, and even non-motorized roads.	The environment can be either natural or human-made.	The number of facilities and access to these areas varies according to their location.
7	Adjacent to the urban area	It is adjacent to main roads, paved roads, and highways to a maximum distance of 1000 meters.	These areas may be natural or human-made. In the case of being natural, it often has a significant change in the natural background, especially in adjacent sections of roads and communication paths.	Facilities and entertainment such as a hotel, restaurant, shop, playground, sports facilities, amphitheater, table and chairs, a canopy, a night camp, seasonal exhibitions, and so on.
8	Urban area	In the vicinity of streets and inner-city roads and along highways.	Urban development is dominant to landforms.	Proper facilities like grocery stores.

Table 6. Social Characteristics of Landscape in the ROS2 Framework.

Row	Title of the class	Meeting other people	Evidence of use
1	Natural	Has very few visitors. The likelihood of meeting other people is very low.	Has a natural environment with very modest changes? Changes may be made to the conditions of the region.
2	Semi-Natural Non- Motorized	Has few visitors. The likelihood of meeting other people is very low.	Very few changes may be observed in the environment, which is following the conditions of the region.
3	Semi –Natural Motorized	A crowded environment where people are seen in most areas.	Man-made or natural areas with low to moderate variations that the evidence of other people's use, such as noise or environmental degradation such as soil erosion and surface vegetation loss are observed.
4	Low-developed rural	Average number of visitors. The likelihood of meeting other people is moderate.	Natural areas and human-made structures. Surface vegetation is destroyed in some areas and the soil is compressed. The human noise is low to moderate.
5	Developed rural	The average to a large number of visitors. The likelihood of meeting other people is moderate.	Natural areas and human-made structures. Surface vegetation is destroyed in some areas and the soil is compressed. Human noise is heard normally.
6	Cultural separated	There are different levels of viewers (low to high) based on location.	They may be natural or human-made. The changes made in these areas vary and depend on their location.
7	Adjacent to the urban area	A crowded environment where people are seen in all areas.	Natural areas where evidence of the use of other people such as noise or environmental degradation such as erosion and compaction of the soil and the loss of surface vegetation is observed. Human voices are usually heard. In these areas, managing visitor's impact is essential in order to maintain the visitor's recreational quality and protect the environment.
8	Urban area	A busy environment where people are always present.	Man-made or natural areas with a lot of changes that the evidence of the use of other people, such as the noise observed in it.

Table 7. Management features in the ROS2 framework.

Row	Title of the class	Access (All kinds of authorized trips)	Visiting service	Terms and conditions of the area management
1	Natural	The only non-motorized and non-mechanized use (such as horse riding and hiking) is possible	Lack of facilities for visitors.	The rules and regulations are designed to preserve the natural conditions of the area, such as prohibiting the harvesting of soil, the use of wood for forest trees, wildlife hunting, and so on. Often, they are managed by the Environmental Protection Agency or the Forestry, Rangeland and Watershed Management Organization.
2	Semi-Natural Non-Motorized	There is no road for motorized use. Although it may be low. There are dirt roads and rocky roads, if any. Mountain bikes can be used in these areas.	Lack of facilities for visitors.	The rules and regulations are designed to preserve the natural conditions of the area, such as prohibiting the harvesting of soil, using wood of forest trees, wildlife hunting, and so on. Often, they are managed by the Environmental Protection Agency or the Forestry, Rangeland and Watershed Management Organization.
3	Semi-Natural Motorized	A wide range of vehicles are visible on the road and its access routes. Access routes are limited to paved roads. However, it is possible to see walking paths in the area.	Lack of facilities for visitors.	The rules and regulations are designed to preserve the natural conditions of the area, such as prohibiting the harvesting of soil, the use of wood for forest trees, wildlife hunting, and so on.
4	Low-developed rural	Access routes lead to rural roads. Therefore, all types of vehicles may not be able to pass their routes.	Lack of facilities for visitors.	The rules and regulations are designed to preserve the natural conditions of the area, such as prohibiting the use of wood for forest trees.
5	Developed rural	Access routes lead to rural roads. Therefore, all types of vehicles may not be able to pass their routes.	Lack of facilities for visitors.	The rules and regulations are designed to preserve the natural conditions of the area, such as prohibiting the harvesting of soil, or the use of wood of forest trees.

6	Cultural separated	How to access these areas varies depending on where they are located. Therefore, a wide range of vehicles can be observed on roads and access routes.	The facilities of these areas vary and depend on their location. These facilities may include stores, exhibitions, lounges, and so on.	They are often managed by the Heritage and Tourism Organization.
7	Adjacent urban to urban area	A wide range of vehicles are visible on the road and its access routes.	Facilities like a hotel, restaurant, shop, playground, sports facilities, amphitheater, table and chairs, a canopy, camp for night stay, communication paths, picnic, shops, signs and tokens, and so on. There is a wide range of facilities depending on the area, location, and number of users. Such as the store, playgrounds, seasonal exhibitions, and so on.	The presence of agents and enforcement of laws to reduce the possibility of conflict, and security and prevent damage to resources.
8	Urban area	A wide range of vehicles are always observed on the streets and highways.		The presence of agents and enforcement of laws to reduce the possibility of conflict, and security and prevent damage to resources.

Table 8. Characteristics of natural and human-made recreational spectrum classes (ROS2).

Class	Class 1: Natural	Class 2: Semi-Natural Non-Motorized	Class 3: Semi-Natural Motorized	Class 4: Low-developed rural	Class 5: Developed rural	Class 6: Cultural separated	Class 7: Adjacent to urban	Class: Urban
General description	The natural environment, often unchanged which is protected because of unique and conservational valuable areas, and regions with special management importance.	Natural environment of medium to large size and highly unchanged	The modified often natural environment, generally developed at the low level in the region, and is usually located in the vicinity of rural roads.	An environment with the natural appearance that human structures built up there. At the same time, no significant changes have been made in the region.	It is a natural environment that has undergone significant changes.	These areas are for religious purposes or for the purpose of viewing historical monuments visited by enthusiasts. It may be a natural background or human-made environment.	These areas may be natural or human made. In a case of naturalness, there are significant changes to the natural background.	Within the boundaries of urban areas.
Access	These areas are usually lack of road with suitable access. There are dirt roads and rocky roads, if any. These environments are often at high altitudes and any type of vehicle is not able to navigate these routes.	These areas are usually lack of road with suitable access. There are dirt roads and rocky roads, if any. These environments are often at high altitudes and any type of vehicle is not able to navigate these routes.	Rural roads (may be paved or dirt). Walking paths may be seen. At the same time, due to the placement of parts of these areas at high altitudes and sloping hillsides, therefore, only the defined paths for motorized use can be used.	Access to these areas is often through rural roads and primary roads are available to them. They may be located in highly sloped areas and heights that are seen in parts of these areas. Basic pedestrian paths access them from these areas.	These areas are easily accessible. Paved areas are available to on where they are located. The route to access these areas is from main roads to dirt roads and rocky roads.	How to access these areas varies depending on where they are located. The route to access these areas is from roads to dirt roads.	It is adjacent to urban and crowded areas. Paved areas are suitable for streets access to these areas. Have walking directions.	Access to these areas is very easy. Urban roads and streets are around it. Accessible with pedestrian paths.
Changes and facilities	Changes are generally not seen in the region unless they are essential for the conservation of resources, and in this case they are often made with local materials. These areas often lack the facilities and for visitors.	Few changes may be made to protect resources. These areas often lack the facilities for visitors.	It is a natural environment in which few to moderate changes can be observed. - There are not many facilities in place and they are primarily for the protection of resources and public safety.	Little changes are visible in the landscape. There is lack of facilities for visitors. At the same time, being in the vicinity of villages may benefit viewers from facilities such as shops and residential accommodation.	Changes in land imagery are evident. Lack of facilities and facilities for visitors. At the same time, being in the vicinity of the villages will benefit viewers from amenities such as shops and residential accommodation.	The facilities of these areas vary and depend on their location. They may include a high level of facilities to a small extent.	The fundamental changes are dominant in the parts of the landscape. In these areas, facilities and entertainment for visitors are offered, such as a natural areas that remain in hotel, restaurant, shop, urban texture. Facilities and playground, sports like park furniture, canopy, facilities, amphitheater, shop, equipment for table and chairs, canopy, children and adults, campus for night stay, playground, and sports communication paths, picnic, shop, Signs, etc. These areas have the high ability for tourism and centralized recreation.	Usually human-made environments with grassy areas, shrubs and trees depending on the region's conditions. It rarely includes a natural areas that remain in hotel, restaurant, shop, urban texture. Facilities and playground, sports like park furniture, canopy, facilities, amphitheater, shop, equipment for table and chairs, canopy, children and adults, campus for night stay, playground, and sports communication paths, picnic, shop, Signs, etc. These areas have the high ability for tourism and centralized recreation.
Social interaction	There are very few visitors, so there is a high probability of experiencing isolation and loneliness in the environment. Therefore, the likelihood of meeting others is very low. The environment is calm and quiet.	Has a small number of visitors. The likelihood of meeting others is low. They have a quiet environment with very little noise.	The likelihood of meeting individuals and groups is moderate. The environment is relatively quiet and with a low to moderate noise.	Has a moderate number of visitors. The likelihood of meeting others is modest. A quiet environment with a low to moderate noise.	The number of visitors is relatively modest to a large number. There is the likelihood of meetings, groups with different ages. An environment with a moderate to high noise with noise.	Depending on the location, the likelihood of meeting different types of groups is moderate to severe. Depending on the location and the day of the visit, there is a quiet to crowded environment.	There are a lot of visitors at different times during a day. The number of meetings between different groups with different ages is very high. A busy environment and probably a lot of noise.	Usually, based on the location and facilities, there are different numbers of users. The areas in the city center are crowded daily. The possibility of meeting different groups is very high. There is a busy and probably busy environment.
Visitors' regulations	There are some regulations to protect the natural conditions of the area and the diversity of species of wildlife species. The presence of environmentalists is in place.	There are some regulations to protect the natural conditions of the area and the diversity of species of wildlife species. The presence of environmentalists is in place.	The regulations are in order to protect the natural conditions. The presence of environmentalists or related staff from other organizations, such as natural resources and watershed management, is in place.	Regulations for the protection of natural conditions that may exist at the site.	The implementation of laws is intended to control and reduce conflict, risk boards, parking lot and damage to the region's resources. The presence of agents in the area.	Significant and coordinated controls (such as information boards, parking lot and damage to the region's resources. available facilities) based on the location of the area may be in place.	Implementing laws to control and reduce conflict, dangers and damage to regional resources. The presence of agents in the region is observed.	Implementing laws to control and reduce conflict, dangers and damage to regional resources. The presence of agents in the region is observed.

Fig. 4 shows the results of implementing the ROS2 framework in the study area. Table 8 shows the area of the ROS2 classes and the type of recreational power of the recreational areas proposed by the region-based on the ROS2 framework.

As shown in Table 9, the semi-natural non-motorized area has the highest level of study, followed by the natural class, which is the largest

area in the region. This can be attributed to the management protection zones within the study basin, many of which are mountainous and have difficult access routes. Conversely, the cultural separation class has the lowest level, at just 0.05%. Despite their limited size, the appeal of these areas has led to their classification as one of the ROS2 classes.

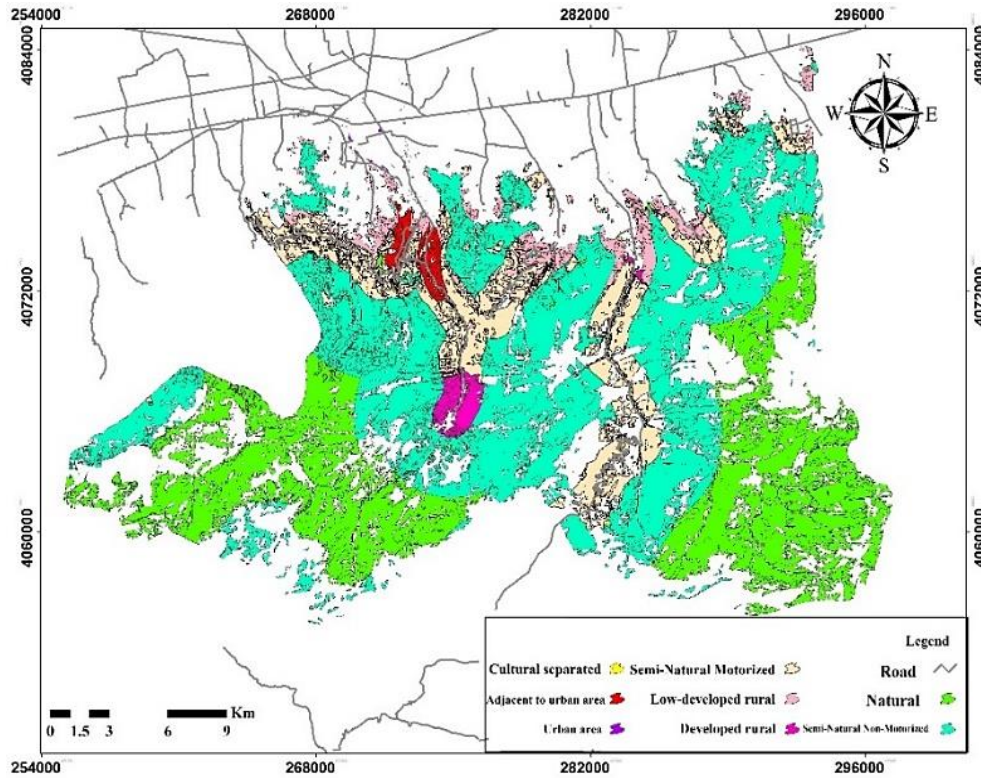


Fig. 4. ROS2 framework implemented for recreational areas in the study area.

Table 9. Area and type of recreational power of proposed areas in each ROS zone.

ROS2 class	Type	Area (hectare)	Area (hectare)
Natural	Extensive recreation	15234.62	15333.68
	Intensive recreation	99.06	
Semi-Natural Non-Motorized	Extensive recreation	20053.59	20852.94
	Intensive recreation	799.35	
Semi-Natural Motorized	Extensive recreation	5282.69	6293.79
	Intensive recreation	1011.1	
Low-developed rural	Extensive recreation	1242.08	1893.93
	Intensive recreation	651.85	
Developed rural	Extensive recreation	516.38	545.93
	Intensive recreation	29.55	
Cultural separated	Extensive recreation	14.35	23.16
	Intensive recreation	8.81	
Adjacent to Urban area	Extensive recreation	275.16	508.02
	Intensive recreation	232.86	
Urban area	Proposed areas for the development of the urban park	32.39	39.69
	City Park and the Nation Park	7.3	

3.3. Selecting the ultimate recreational regions in the area

After discussing the various classes in the region, a decision was made to select areas for the development of new recreational areas, considering both the interests and preferences of the community, as well as the ROS2 classification. In determining the final areas, criteria prioritized by the local population and experts were considered, including the availability of water resources, access roads, and proximity to residential centers. These areas were categorized based on the level of development required for facilities, resulting in three classifications: nature park, forest promenade, and forest park. The nature park requires the least development, while the forest park requires the most. Fig. 5 illustrates the final zones designated for recreational development. In total, seven zones were identified for this purpose in the region. Of the designated areas, three are allocated for the development of forest promenades, three for forest parks, and one for a Nature Park. This classification aims to implement specific management strategies tailored to the potential for development, conservation, and the necessary management plans based on the recreational possibilities of each area. Nature Parks require minimal development, whereas forest parks are designed

to offer a variety of services and amenities for visitors, depending on the environmental potential. Forest parks represent a middle ground between these two categories. As a result, the range of recreational opportunities can be determined by the type of recreational needs and preferences of individuals in each zone. It's also important to note that visitors' expectations regarding facilities in these areas are influenced by the designated classifications. In other words, visitors expect a variety of facilities in a forest park. At the same time, in a region called a promenade or nature park, expectations are lower. To determine the recreational opportunity spectrum in each area, recreational activities that have received the highest priority from the visitor's perspective were prioritized for development. For example, in the forest areas, recreational activities such as picnics, photography, visiting the waterfall, walking, observing the nature of the area (plants, animals, and landmarks), visiting ancient monuments, visiting holy shrines (If any), and visiting and shopping from local markets are of high priority. Therefore, considering the recreational potential of the region, it is possible to develop these activities in the region. In addition, in providing these recreation facilities in the area, other people's recreational needs and preferences should be considered.

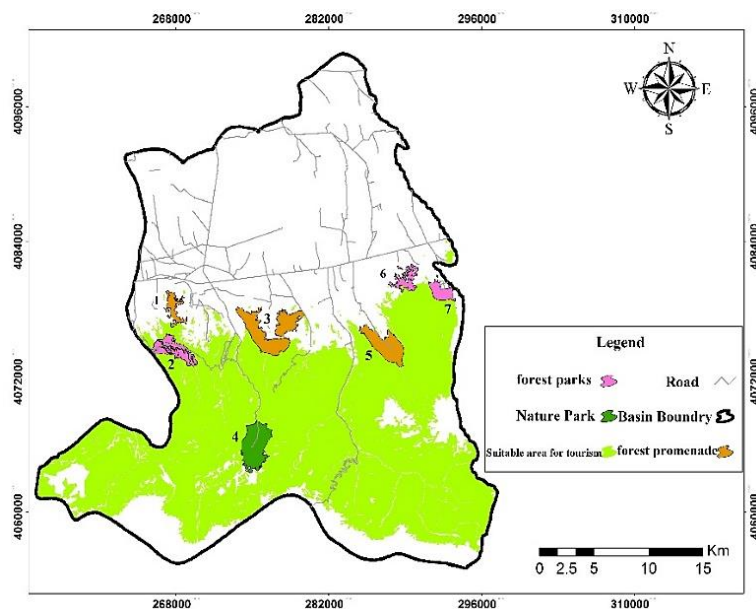


Fig. 5. The final recreational zones for recreational planning of the land.

The locations of these zones in the study area, according to the ROS2 framework (Fig. 6), the area of each zone, the specific type of ROS2

framework used, and the recreational capacity of the land, are presented in Table 10.

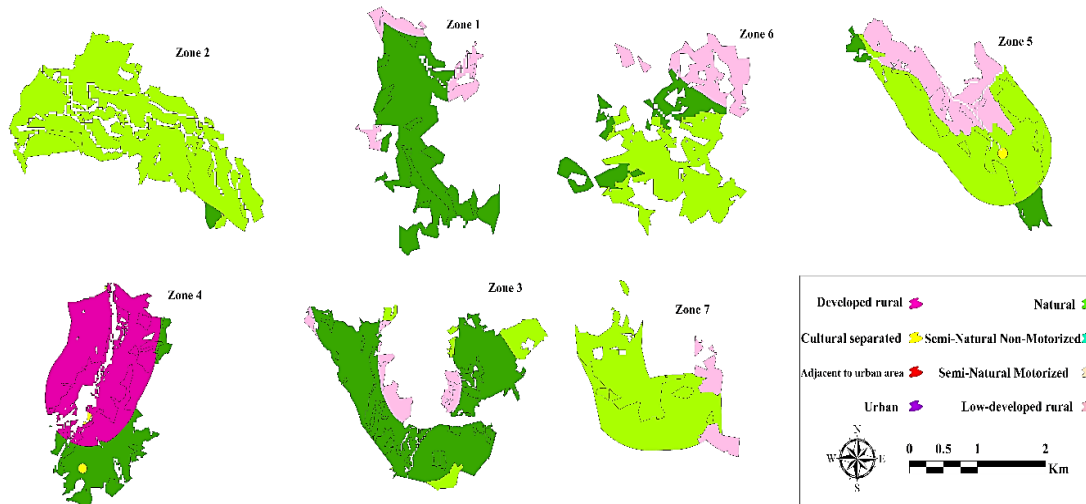


Fig. 6. The proposed areas for the development of the Nature Park (zone 4), forest promenade (zones 1, 3, and 5), and forest park (zones 2, 6, and 7).

Table 10. Area and type of proposed recreation areas.

Zone code	class 2ROS	Type of recreation capacity	Area (hectare)	Total area	Zone code	class 2ROS	Type of recreation capacity	Area (hectare)	Total area
Zone 1	Semi-Natural Non-Motorized	Extensive	199.19	230.55	Zone 5	Semi-Natural	Extensive	35.91	618.7
		Intensive	1.28			Non-Motorized	Intensive	0.8	
	Low-developed rural	Extensive	27.3			Semi-Natural	Extensive	358.2	
		Intensive	1.76			Motorized	Intensive	22.6	
Zone 2	Cultural separated	Extensive	1.02	453	Zone 5	Low-developed rural	Extensive	58.48	248.33
		Extensive	6.35				Intensive	139.68	
	Semi-Natural Motorized	Extensive	247.03			Cultural separated	Extensive	0.69	
		Intensive	196.77			Intensive	2.34		
Zone 3	Cultural separated	Extensive	2.22	1079.86	Zone 5	Semi-Natural Non-Motorized	Extensive	24.94	227.82
		Intensive	0.63				Intensive	28.78	
	Semi-Natural Motorized	Extensive	754.08			Motorized	Extensive	97.72	
		Intensive	91.74			Semi-Natural	Intensive	41.22	
Zone 4	Semi-Natural Motorized	Extensive	77.26	735.69	Zone 7	Low-developed rural	Extensive	36.32	227.82
		Intensive	46.92				Intensive	19.35	
	Low-developed rural	Extensive	93.06			Semi-Natural	Extensive	171.44	
		Intensive	16.8			Motorized	Intensive	33.94	
Zone 4	Semi-Natural Non-Motorized	Extensive	201.16	735.69	Zone 7	Low-developed rural	Extensive	9.73	227.82
		Intensive	9.87				Intensive	12.71	
	Semi-Natural Motorized	Extensive	0.01			Motorized	Extensive	9.73	
		Intensive	0.74			Low-developed rural	Intensive	12.71	
Developed rural	Extensive	503.5	16.81	Zone 7	Low-developed rural	Extensive	9.73	227.82	
	Intensive	16.81				Intensive	12.71		
Cultural separated	Extensive	2.38		Zone 7	Low-developed rural	Extensive	9.73	227.82	
	Intensive	16.81				Intensive	12.71		

In selecting these areas, several factors were considered, including accessibility based on people's recreational preferences, suitable capacity, and the natural characteristics of the land. Approximately 74% of individuals prefer locations that are easily accessible and within a short distance from their homes, alongside adequate recreational facilities. Therefore, criteria for access and proximity to residential areas were considered. Furthermore, within each class of the ROS2 framework in the study area, recreational activities were identified according to the preferences. As a result, for each of the proposed final zones, recreational activities were determined based on the land's capacity and the people's preferences. In this regard, Perez Verdin et al. (2008) stated that one of the most fundamental differences between ROS and other recreational management frameworks is using the needs, preferences, and recreational opportunities of people in mapping and selecting the environment for the development of recreation. In this research, recreational areas have selected with an appropriate distribution to optimize land resource use, prevent overcrowding in specific regions, and minimize the environmental impacts that can occur. This approach aims to enhance the quality of the tourist experience and increase

visitor satisfaction. It is essential to explain that after identifying these recreational areas and developing management plans, monitoring the conditions of the region becomes crucial. Regular assessments will help determine the environmental quality of the area. Furthermore, understanding individuals' experiences and satisfaction levels with these recreational activities plays a significant role in shaping management plans that aim to reduce tourism's impact and improve the overall quality of recreational experiences.

3.4. Planning recreational activities in proposed areas

After identifying the categories within the proposed framework of ROS2 and selecting the final recreation areas in the region, recreational activities were planned. In each zone, plans were developed based on the objectives for regional development, by considering the interests and preferences of the community. Table 11 presents the recreational opportunity spectrum for the ROS2 classes in the study area. Fig. 7. shows the diagram of the steps for implementing the ROS2 framework.

Table 11. Recreational opportunity spectrum based on the ROS 2 framework in the study area.

Classes	Proposed recreation opportunities
Natural	Photography, observing the nature of the area, scientific trips in nature, mountain climbing, and hiking.
Semi-Natural Non-Motorized	Photography, walking, observing the nature of the area, scientific trips in nature, climbing the summit, mountain climbing, and horse riding.
Semi-Natural Motorized	Picnic, photography, visiting the waterfall, walking, observing the nature of the area, local markets, handicrafts, scientific trip in nature, mountain climbing, hiking, horse riding, hill climbing, flying with gliders and paragliders, cycling.
Low-developed rural	Visiting and familiarizing with traditional rituals, picnics, and photography, walking, visiting the waterfall, collecting herbal products, observing the nature of the area, cycling in nature, and scientific trips in nature.
Developed rural	Visiting and familiarizing with traditional rituals, picnics, and photography, walking, visiting the waterfall, collecting herbal products, observing the nature of the area, cycling in nature, and scientific trips in nature, camping, and local markets and handicrafts.
Cultural separated	Picnic, visiting ancient monuments, visiting holy shrines, local markets, and handicrafts, observing the nature of the area, the scientific trip in nature, horse riding, and cycling.
Adjacent to the urban area	Picnic, photography, hiking, children's play, adult play, observing nature, hill climbing, carriage-riding, local market and handicrafts, cycling.
Urban area	Picnic, photography, hiking, children's play, adult play, sports, and physical activity, cycling, local markets, and handicrafts.

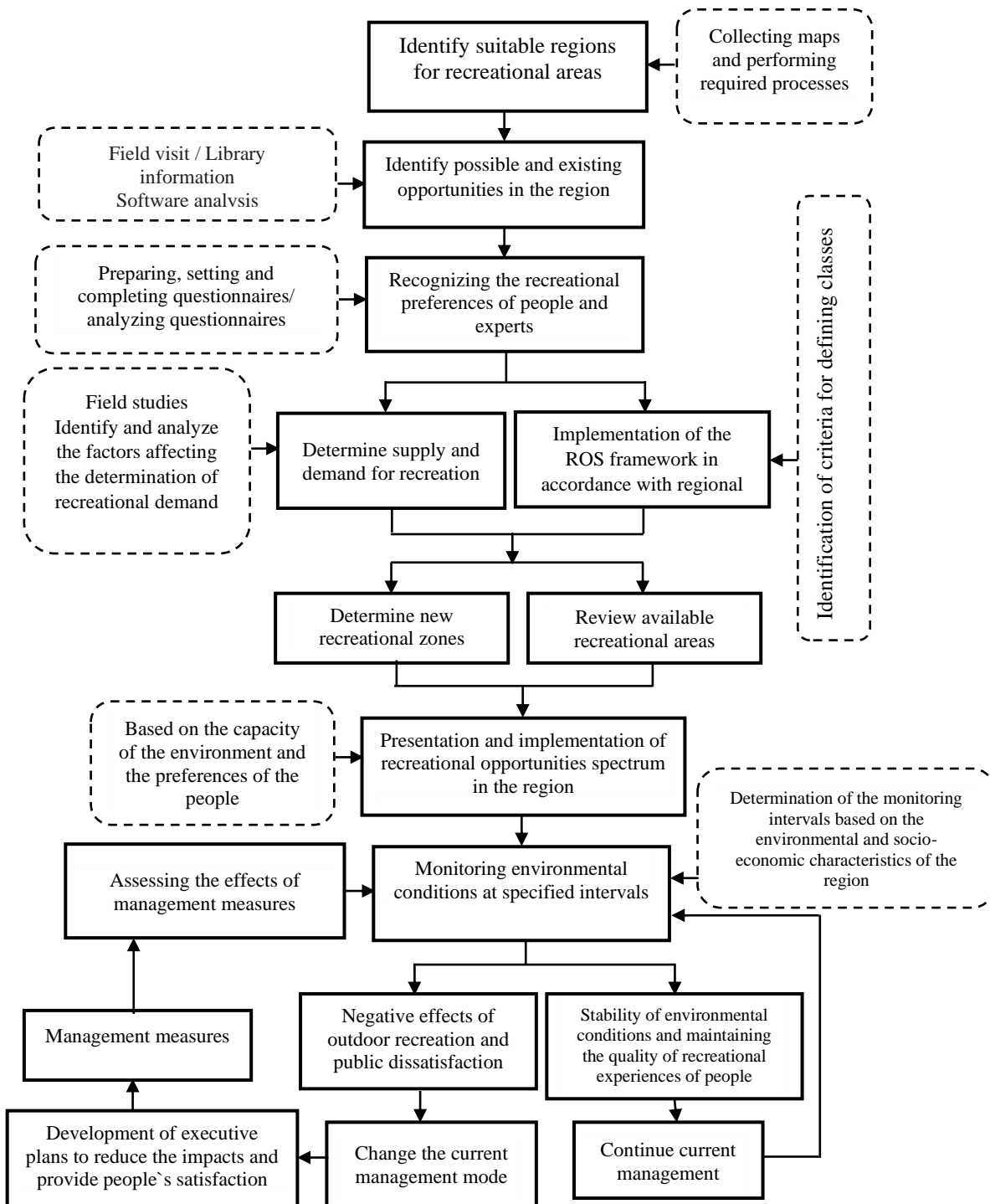


Fig. 7. Flow chart of the ROS2 framework implementation process.

By carrying out the above steps (Fig. 7), recreational planning was conducted by selecting and allocating activities based on regional conditions.

A study conducted by Ormsby et al. (2004) implemented the Recreation Opportunity Spectrum (ROS) framework at the Great Barrier

Reef National Marine Park. Based on the region's specific conditions, they developed ROS classes that fall into five categories: developed, high utilization, moderate, natural, and protected. Other researchers have also utilized the ROS framework to assess recreational facilities in various regions and to provide a diverse range of

recreational opportunities, considering both the capacity of the land and the recreational preferences of the community (Parkin et al., 2000; Perez Verdin et al., 2008; Martin et al., 2009; Groot, 2011; United States Department of the Interior Bureau of Land Management, 2014). In the urban zone, which encompasses urban parks, there are opportunities to provide enjoyable recreational activities that align with the needs and preferences of visitors. To achieve this, our study utilized a questionnaire to identify the recreational activities of interest to visitors and prioritize them for development in the area. Researchers noted that a diverse range of recreational activities in a park can include physical activities such as sports fields, walking trails, cycling routes, playgrounds, and green spaces that will enhance the experience for users. Research has been conducted by various scholars on this topic. For instance, Perez Warren et al. (2008) utilized the ROS framework to plan, develop, and manage outdoor recreation in two protected areas. Their study examined individuals' recreational needs and preferences, as well as the environments they preferred for recreation. They identified popular recreational activities and the social characteristics of participants. The results indicated that most people enjoy observing and appreciating nature, walking, picnicking, wildlife watching, and participating in team activities in the next step, the information gathered identified three categories for each protected area. These categories include: 1) areas with easy access and limited facilities (rural areas), 2) natural areas that have facilities available (roaded natural), and 3) storage areas (semi-primitive, non-motorized areas). They stated that the Recreation Opportunity Spectrum (ROS) is an effective method for planning and managing outdoor recreation and tourism in forested regions. These findings align with the results of this study. Although the conditions in the different study areas vary, a review of other studies indicates that people's opinions about recreational activities around the world are quite similar (Perez Verdin et al., 2008; Martin et al., 2009; Groot, 2011). For instance, research on recreational activities globally demonstrates that walking is a popular pastime, which aligns with the findings of this study. The activities people engage in vary by

region, including picnics, camping, swimming, skiing, collecting forest plants, and observing wildlife. These pastimes align with the survey results on recreational preferences in this area. Therefore, in the present conditions, natural and primitive areas are declining highly, and the demand for experiencing these areas is increasing. The ROS framework is an appropriate management tool for recreational planning and visitor management. Using the ROS Framework can offer a range of recreation opportunities suitable for responding to the expectations of visitors based on the capacity of the environment (Birkemose, 2015). In this regard, Galdavi et al (2024) stated the tourism industry, without careful planning and consideration of ecological, local, cultural, and social factors, can lead to significant issues for any region. In contrast, a well-planned and effectively managed tourism system can promote the sustainable use of environmental, cultural, historical, and other resources within the area.

4. Conclusion

Field studies and surveys conducted in the area revealed that not only were the actual and relatively active attractions lacking basic facilities, but there had also been no efforts to improve the amenities at potential tourist attractions. For instance, many forest areas in the region, which attract numerous visitors, are spacious but lack essential facilities. It is evident that, after identifying the recreational areas based on visitor demand, the next priority should be to prepare and equip these environments. Therefore, to effectively manage recreational areas, it is essential to assess both the land's recreational potential and the needs and preferences of individuals. Their satisfaction plays a crucial role in the successful management of these spaces. In this context, the Recreation Opportunity Spectrum (ROS) framework serves as a valuable planning and management tool. It helps identify resources and outline recreational opportunities across various environments, making it applicable to all landscape surveys. The nature of the spectrum, along with its indicators and criteria, depends on the region's objectives, the authority of the organizations involved, and management responsibilities. This framework

considers both the land's capacity and the recreational needs and preferences of the community. It provides a variety of recreational opportunities based on specific categories defined for the region. Planning and recreational management are carried out with a focus on the primary users of the area. Moreover, Environmental monitoring is a key stage in implementing this framework, allowing users to update information while checking environmental conditions and achieving area objectives.

In the current study, the ROS framework was employed for recreational planning in the Gorgan watershed. The findings underscore the effectiveness of the ROS framework. It highlights the importance of preserving the region's quality and characteristics while addressing the needs, preferences, and satisfaction of visitors. Additionally, this approach aims to enhance individuals' enjoyment of recreational experiences. By utilizing this framework, a better understanding of the recreational needs, preferences, and desires of the community, as well as the value placed on visiting and using recreational areas could be reached. This information can then be used to effectively plan tourism and recreational activities in the region. This approach ensures that people's satisfaction and the quality of their experiences are prioritized while also managing the environmental impact of tourism based on the area's capacity. It's important to monitor and review the implementation of this framework periodically to address the needs, preferences, and satisfaction of visitors while maintaining environmental conditions. The results of this study demonstrate that the framework is flexible enough to be applied in different regions. Therefore, the ROS2 framework can serve as a guide for planning and managing recreation and tourism in similar areas, provided there is a comprehensive study of the land that considers its recreational potential and visitor feedback.

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