



Environmental and Social Impacts of Off-Road Tourism in the Forests of Guilan, Northern Iran

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Abstract

In recent years, off-road (4×4) tourism has become one of the most popular forms of nature-based recreation in the forests of Guilan. The combination of forest trails, pristine landscapes, and the thrill of driving through rugged terrain has attracted many visitors to the region. However, the unbalanced development of this tourism activity has led to significant environmental and social challenges. This study aims to examine the environmental and social impacts of off-road tourism in Guilan's Forest ecosystems and to propose practical strategies for the sustainable management of such activities. A descriptive-analytical approach was adopted, and data were collected through field observations, interviews with local communities, and a review of environmental reports. The findings reveal that off-road driving causes soil erosion, vegetation destruction, noise pollution, and a decline in wildlife population within the forests. From a social perspective, the growing influx of off-road tourists has altered local lifestyles, created cultural conflicts, and reduced community satisfaction with tourism activities. To mitigate these challenges, it is recommended that designated routes be established for off-road vehicles, environmental monitoring systems be strengthened, and educational programs be provided to raise awareness among visitors and local residents. Furthermore, the development of alternative forms of tourism—such as ecotourism and nature-based cycling—can help preserve the environment while fostering positive engagement between tourists and local communities.

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Introduction

Natural resources are essential for maintaining ecological balance, conserving biodiversity, and supporting national economic development. Effective planning for their management and optimal use is therefore crucial (Faraji Sabokbar et al., 2022). Among these resources, forests are among the most valuable ecosystems on Earth. They play a key role in sustaining environmental stability and fulfilling human needs. Forests influence both human life and the broader biosphere through oxygen production, carbon dioxide absorption, soil protection, water regulation, and the supply of timber and non-timber products (Jalilian, 2021). In addition to their ecological value, forests—with their untouched beauty and unexplored attractions—are highly appealing tourist destinations.

Tourism is an intrinsic human activity that allows individuals to rejuvenate and perform their daily duties more effectively. This notion has significantly contributed to tourism development worldwide (Alizadeh et al., 2024). The expansion of tourism has both benefits and drawbacks; appropriate management can ensure that regional tourism progresses sustainably while yielding desirable outcomes (Sadeghi & Koravand, 2022).

Sports tourism has evolved from an industry into a global socio-economic phenomenon (Mortezaee & Kalate Seifari, 2020). The integration of sports and tourism has led to a new form of travel that promotes recreation and leisure while improving physical and mental health (Asheghi et al., 2022). Among the key drivers of sports tourism development are natural resources (Amin Rostamkolae & Poursoltani, 2019). Forests, in particular, have emerged as significant attractions for sports tourists. However, evaluating the ecological capacity of forest areas is necessary before developing such tourism infrastructure (Makhdoom, 2013).

Adventure tourism, a major branch of sports tourism, has unique appeal and attracts enthusiasts who seek excitement and risk. It is strongly influenced by environmental conditions (Mahmoodi et al., 2023). This form of tourism is not confined to long summer holidays; instead, short-term trips—especially weekend excursions—have become more popular. It typically takes place in natural, remote, and unconventional destinations, where participants expect to encounter varying levels of challenge and risk (Safaie Nodehi, 2021). Adventure-based competitions combining physical activity and recreation have also gained popularity, driven by people's desire for fitness, immersion in nature, and thrill-seeking (Cater et al., 2018).

Off-roading, as a subcategory of adventure tourism, involves travel through rough natural terrain using specialized vehicles such as off-road cars or motorcycles. This activity combines excitement, physical challenge, and direct engagement with nature, allowing participants to overcome natural obstacles and experience the raw beauty of the environment (Buckley, 2018). Off-road tourism has grown into one of the most popular sectors of the tourism industry. Beyond recreation, it generates income for regions with attractive natural landscapes. Mountainous, desert, and forested areas are major off-road destinations, often contributing to the growth of local businesses—including lodging, restaurants, and vehicle rental services (Beedie, 2008).

Despite its appeal, off-road tourism also imposes environmental and social pressures. Like other economic activities, it can cause serious ecological and socio-economic damage (Hojjat Shamami & Javan, 2022). Common impacts include vegetation destruction, soil erosion, noise pollution, and harm to wildlife (Buckley, 2004; Mahmoodi, 2021). The lifestyle associated with off-roading can also affect local communities, sometimes causing cultural disruptions and social tensions. Promoting environmental awareness and responsible behavior among tourists can help mitigate these effects and maintain the integrity of natural landscapes. The sustainable development of tourism therefore depends on improved infrastructure and balanced support for environmental, economic, and social sustainability (Azizpour et al., 2024).

Several related studies provide a foundation for this research. Adabi Firouzjah et al. (2009) examined the natural attractions influencing the development of sports tourism in Iran from the perspective of sports and tourism experts. Their findings showed that destinations with lower



sensitivity to seasonal changes—thus offering longer tourism periods and more diverse activities—play a crucial role in the growth of Iran's sports tourism.

Abbasi et al. (2017) investigated and prioritized strategies for attracting adventure tourists in Isfahan Province. They identified advertising and information dissemination, environmental conditions, infrastructure, accommodation, cultural and social factors, and safety measures as the most influential elements in developing adventure sports tourism.

Karimi et al. (2020) designed a model for advancing adventure sports tourism using a grounded theory approach. They highlighted a range of challenges, including administrative and managerial inefficiencies, inadequate equipment, financial and economic barriers, safety concerns, and insufficient infrastructure and information flow. Opportunities encompassed supportive legal frameworks, cultural and educational initiatives, academic foundations, and trained professionals. Their proposed solutions—focused on safety management, education and awareness, event and venue organization, and innovation—were found to generate economic, social, and cultural benefits.

Mahmoodi et al. (2023) developed a strategic plan for promoting adventure tourism in Kurdistan Province. They argued that fostering sports tourism, particularly adventure-based forms, could serve as a catalyst for regional tourism development. The study emphasized the importance of infrastructure planning and government support to sustain nature-oriented sports tourism in the area.

Cater et al. (2018) investigated adventure sports competitions that integrate extreme sports within a competitive framework. Their results revealed that participants were primarily inspired by physical challenges, interaction with nature, and the sense of adventure, while social engagement also played a considerable role. Interestingly, most participants did not self-identify as professional adventure athletes but as enthusiasts engaged in regular recreational activities. Although these competitions have a limited direct economic effect on tourism, they yield personal benefits for participants and create substantial commercial opportunities for sponsors and host destinations.

Lerdsuchatavanich et al. (2017) analyzed the environmental effects of off-road tourism in Khao Krajome, Thailand—an area accessible only by off-road vehicles. They found that noise levels exceeded permissible limits by 2.5 times, which correlated with reduced numbers of nearby animals, suggesting severe noise impacts on wildlife. Moreover, soil compaction along vehicle tracks was significantly higher than in surrounding areas, indicating land degradation caused by off-road travel.

Bhandari (2018) conducted a field study in Kenya demonstrating that off-road driving severely damages plant biomass and harms ecosystems more than other environmental stressors. Restricting these activities was shown to aid recovery in affected areas, although regeneration occurred slowly. The study offered management insights for improving conservation practices in national parks and wildlife reserves.

Hungenberg et al. (2019) explored how adventure sports participants acquire information and form social communication patterns. They found that novices rely more on social networks and peers, while experienced participants depend on personal memory and past experiences. Cultural factors strongly influenced communication and marketing tendencies. Buckley (2018) further emphasized the need to study participation paths across different life stages, integrating social, physical, and psychological dimensions of adventure tourism as a holistic recreational phenomenon.

Despite its increasing popularity, comprehensive research on the environmental degradation and social disruption caused by off-road tourism in the forests of Guilan, northern Iran, remains limited. Balancing tourism development with environmental conservation and social sustainability has become a critical challenge, particularly since Guilan's forests form part of the globally recognized Hyrcanian natural heritage. Understanding the full range of these impacts is vital for formulating effective management strategies.

This study aims to fill this research gap by addressing the following key questions:

1. What are the main environmental impacts of off-road tourism in the forests of Guilan, with specific reference to vegetation destruction and soil erosion?



2. How does off-road tourism influence local communities in terms of social and cultural transformation?
3. What are the perceptions of local residents regarding off-road tourism, and what challenges do they experience as a result of this activity?
4. What management policies currently regulate off-road tourism in the region, and how effective are these measures?

The primary objective of this research is to evaluate the environmental and social impacts of off-road tourism in the forest areas of Guilan. To achieve this, the study investigates the ecological consequences of off-road activities—particularly vegetation degradation and soil erosion—while also examining the social dimensions of such tourism and identifying the cultural changes it generates within local communities. Furthermore, it analyzes the attitudes and experiences of residents toward off-road practices and assesses existing management policies implemented by relevant authorities to regulate and mitigate the negative effects of this activity.

Materials and Methods

This research employs a descriptive-analytical approach based on the systematic review of scientific literature and official reports. The main objective is to examine the environmental and social impacts of off-road tourism and to propose solutions for sustainable management. Data collection was conducted through several reliable sources. Library studies included academic articles, books, theses, and research reports offering insights into the ecological and social consequences of off-road tourism. Official reports from environmental organizations and tourism agencies were reviewed to obtain accurate data on areas affected by off-roading—particularly soil erosion, vegetation disturbance, and wildlife impact. Case studies from countries with successful management practices were also analyzed to identify practical models for sustainable off-road tourism.

After data collection, the information was analyzed using qualitative content analysis. Various sources were compared and interpreted according to environmental, social, and economic criteria, which facilitated the identification of shared patterns and the development of actionable recommendations. This method provided a comprehensive understanding of off-road tourism's effects and suggested ways to reduce its negative impacts while improving sustainability.

The forests of Guilan, encompassing about 550,000 hectares, extend from the Astara River on the Iran-Azerbaijan border to the Chaboksar River in eastern Guilan. These forests, forming a narrow strip along the northern slopes of the Alborz Mountains, possess remarkable biodiversity (Hasanimehr, 2013). With the Hyrcanian forests recently inscribed on the UNESCO World Heritage List, increasing environmental concerns have led to their classification under protective management (Moradianfard et al., 2022). In Guilan Province, three forest areas—Gosht Rudkhan, Siyah Rudbar, and Lisar (a protected zone)—are listed as part of this World Heritage site (Hosseini, 2019). These regions, alongside adjacent forest settlements, are particularly significant for the present study. Roughly 2,041 forested settlements sustain permanent or seasonal residents who depend heavily on forest resources (Safari et al., 2024). Consequently, local participation in forest management has become indispensable. The interactions between these communities and off-road tourists often generate cultural disruptions and social tensions. Therefore, given the ecological importance and the socio-cultural sensitivity of Guilan's Forest environments, special consideration has been devoted to analyzing the environmental and social consequences of off-roading in this study.

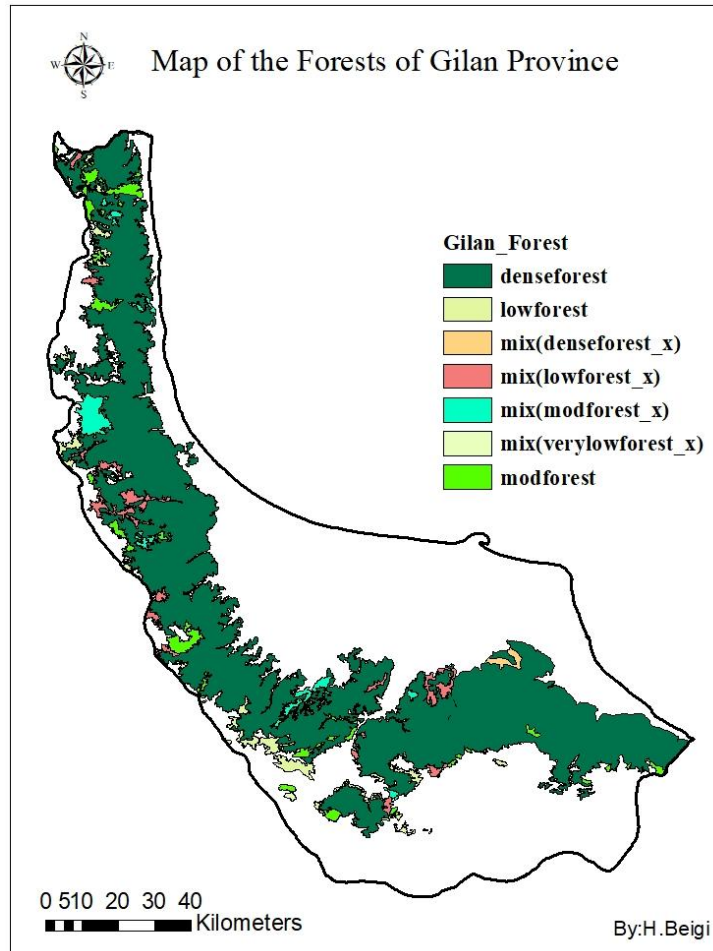


Figure 1. Map of the Forests of Gilan Province

Research Findings

1. Environmental Impacts

When assessing the environmental impacts of tourism, it is essential to adopt a holistic perspective. Environments—whether physical, economic, or social—function as complex, interconnected systems in which the components influence one another dynamically. Consequently, the ultimate outcomes of any change often extend far beyond its initial direct effects. These impacts tend to accumulate, amplifying secondary processes and broadening their overall scope in unexpected ways. Addressing individual problems in isolation may therefore overlook the cumulative consequences that emerge from the interaction of multiple factors (Williams, 2020). Based on field observations and previous studies, the main environmental consequences of off-road tourism in the forests of Gilan are summarized in Table 1.

**Table 1.** Environmental Impacts of Off-Roading in Forests

Environmental Indicators	Consequence	Research
Physical Soil Characteristics	The results from measuring soil physical characteristics showed that soil moisture in areas affected by off-road traffic had decreased significantly. In areas where vehicles had passed, soil moisture was considerably lower than in control areas, and this decrease may be due to the excessive compaction of the soil caused by frequent off-road vehicle passage.	Kartoolinejad et al., 2012; Mahmoodi, 2021
Changes in Soil Density and Permeability	Analysis of soil samples showed that soil density had significantly increased in areas with frequent traffic compared to areas without traffic. This increase in density resulted in reduced soil permeability, which could negatively impact the natural water cycle in the soil and vegetation growth. As a result, soil productivity in the affected areas decreased, which over time could lead to desertification in susceptible regions.	Tavnkar et al., 2009; Mahmoodi, 2021; Lerdsuchatavanich et al., 2017
Changes in Soil Chemical Characteristics	Measurements of soil samples indicated that organic carbon levels in the soil had decreased in areas with heavy traffic. Additionally, the soil's pH slightly increased (alkalization), which may indicate the effects of reduced organic material and changes in the biological processes of the soil.	Mahmoodi, 2021
Impact on Vegetation and Plant Species Composition	Field observations and data analysis showed that there was a significant reduction in plant species diversity in areas affected by off-road traffic. More sensitive species to mechanical pressure and soil compaction had decreased, while some drought-tolerant and pressure-resistant species had increased. This change in the plant composition could be a sign of gradual ecosystem degradation.	Mahmoodi, 2021; Buckley, 2018
Effects on Wildlife Habitat	The results of the surveys showed a decrease in the observation of animal species in areas affected by off-roading. This decrease could be due to the increased noise and vibrations caused by vehicle passage (the average noise level measured during the busy season was 24.3 dB, and 12.1 dB during the off-season, which was 2.5 times higher than the legal limit of 10 dB), the destruction of vegetation, and the reduction of food sources. Damage to tree bark also leads to the entry and spread of fungi. Areas with less traffic reported higher wildlife density.	Kartoolinejad et al., 2012; Mahmoodi, 2021; Lerdsuchatavanich et al., 2017



Figure 1. Some of the environmental impacts of off-roading in the forest
 Right - Formation of ruts in the soil beneath the tracks of off-road vehicle
 Left - Damage to tree trunks along the path of off-road vehicles

2. Social and Cultural Impacts

In this study, the lifestyle of off-road enthusiasts is regarded as an influential factor shaping the social and cultural consequences of their activities. To analyze these impacts on forest dwellers and host communities, the “demonstration effect” and “acculturation” theories were employed. The social outcomes of tourism development can be both positive and negative and often vary geographically (Williams, 2020).

According to the demonstration effect, local residents may be influenced by the behaviors, consumption patterns, and lifestyles of tourists, adopting certain attitudes or practices observed among them (Burns, 1999). In the context of off-road tourism in Guilan’s forests, these influences can operate in two directions. On the positive side, many off-road tourists exhibit appreciation for nature and environmental conservation—behaviors that may encourage local communities to protect natural resources and to engage in sustainable tourism practices. This dynamic can also promote local entrepreneurship, as residents recognize the economic potential of tourism and establish eco-lodges, guiding services, and sales of local products.

Conversely, some residents may mirror tourists’ consumerist tendencies, gradually moving away from traditional lifestyles and cultural values. Such transformations can weaken local identity and cultural heritage. Furthermore, excessive use of local resources—such as water, agricultural lands, or forest areas—by tourists, along with visible disparities in living standards or facilities, may provoke feelings of inequality and social resentment. The demonstration effect tends to be most evident when host–visitor interactions are superficial and short-term. When these relations become ongoing and deeper, the process shifts toward acculturation (Williams, 2020).

The acculturation theory explores how sustained cultural contact leads to mutual adaptation and transformation. As Berry (1997) explains, continuous exposure to external cultural influences can result in modifications to local customs, social norms, and collective values. Within the context of off-road tourism in Guilan’s Forest ecosystems, this process can manifest through several pathways—ranging from the gradual integration of new leisure behaviors and consumption practices to evolving perceptions of modernity, identity, and community–environment relationships.

Within the framework of acculturation theory, the social and cultural responses of host communities to off-road tourism in the forests of Guilan can be categorized into four distinct patterns:

1. **Cultural Integration:** In this form, local residents selectively adopt certain cultural elements from tourists while retaining their own traditions and identity. Such balanced interaction can foster



sustainable tourism, particularly when local cultural values—such as respect for nature and adherence to traditional customs—correspond with tourists' environmentally conscious behaviors.

2. **Cultural Assimilation:** Here, some residents gradually abandon their traditional norms and fully embrace the lifestyle and values of tourists. For instance, local youth may imitate the consumption and leisure patterns of urban visitors, resulting in cultural erosion and a departure from rural or indigenous ways of life.
3. **Cultural Separation:** In certain cases, communities deliberately limit social contact with tourists to safeguard local identity and traditions. This reaction commonly emerges when tourism triggers environmental harm or social tension, prompting residents to perceive visitors as external threats to their livelihoods and environment.
4. **Marginalization:** Representing the most adverse scenario, marginalization occurs when local populations not only lose their cultural identity but also fail to integrate into the new tourism-driven economy. As a result, the economic and social divide between tourists and residents widens, potentially escalating into social alienation or conflict.

These four dimensions encapsulate the spectrum of cultural transformation processes induced by off-road tourism and provide a conceptual lens for analyzing its social impacts on the host communities of Guilan's Hyrcanian forests.

Discussion and Conclusion

Off-road tourism can contribute to local economic growth by creating business opportunities in vehicle rentals, eco-lodges, and hospitality services, thus fostering regional development. However, if these activities expand without adequate planning, environmental degradation such as deforestation may outweigh economic gains (Mason, 2020). Research shows that local communities are increasingly concerned about the environmental and social effects of off-road tourism. Residents of Guilan's Forest areas believe that excessive vehicle traffic causes noise pollution, habitat destruction, and resource depletion. As a result, communities with a commitment to sustainable tourism have called for stricter regulations to control vehicle movement within forest areas.

Although Iran's Nature Tourism Regulations were approved by the Cabinet on April 3, 2024, and Article 5 defines the responsibilities of the National Working Group for managing special natural areas, alongside Paragraph 11, which addresses guidelines for organizing and monitoring off-road driving, specific legal provisions remain absent. There are still no clear laws to identify authorized mountain tourism zones or to control off-roading under the supervision of the Department of Environment, the Ministry of Cultural Heritage, Tourism, and Handicrafts, or the Ministry of Youth and Sports. Consequently, tourists continue to enter secondary roads and deep forest zones, endangering wildlife. In contrast, several other countries have established off-roading regulations aimed at protecting ecosystems, ensuring driver safety, and preventing resource depletion.

This research found that off-road tourism in Guilan's Hyrcanian forests—listed as a UNESCO World Heritage site—has generated significant environmental and social consequences. Environmentally, the activity has caused reduced vegetation cover, soil compaction, accelerated erosion, and threats to wildlife habitats, all of which may disrupt ecological stability. Socially, while the economic opportunities created by tourism have supported some local businesses, concerns have emerged about cultural erosion, lifestyle changes, and dissatisfaction related to the exploitation of natural resources.

These findings concur with previous studies. Lerdsuchatavanich et al. (2017) in Thailand reported that off-road activities led to increased noise, reduced animal populations, and compacted soil—results comparable to those observed in Guilan. Similarly, Bhandari (2018) in Kenya confirmed that off-road driving damaged vegetation and wildlife, and noted that restricting such activities could help restore affected areas. These outcomes support this study's recommendation to designate specific routes for off-road vehicles and implement restrictions in sensitive regions. The social results also align with theories of the demonstration effect and acculturation applied here: the interaction between off-road tourists and local residents causes both positive and negative outcomes. Williams (2020) emphasizes



that social impacts vary by location, while Berry (1997) illustrates that continued cultural contact can alter local traditions—both consistent with the present conclusions.

Currently, off-road tourism in Guilan is expanding without proper oversight or management. Undefined activity zones, unregulated tourist entry, weak enforcement, and fragmented policy have led to environmental damage and increasing community dissatisfaction. Economic benefits are poorly distributed, with non-local investors capturing most profits while local communities receive limited returns. Since adventure tourists are strongly attracted to off-roading and Guilan's forests are a key destination, several measures are recommended: establish official off-road routes; strengthen regulatory frameworks; engage local communities in participatory management; launch ecological rehabilitation programs; promote environmental education for tourists; and enhance coordination among responsible authorities. These actions are essential to minimize adverse impacts and advance sustainable off-road tourism in Guilan's Hyrcanian forests.

- *Establish designated off-road routes to prevent the excessive entry of vehicles into sensitive forest areas and to protect nature.*
- *Enforce restrictive regulations for off-road vehicles in protected areas and national parks, especially in regions with sensitive and fragile ecosystems.*
- *Educate tourists and local communities about responsible behaviors in nature to raise awareness regarding environmental conservation.*
- *Develop sustainable tourism infrastructure, including eco-lodges and dedicated walking and cycling paths, offering alternatives to motorized tourism and reducing pressure on nature.*
- *Implement seasonal restrictions on off-road tourism, particularly during critical times such as wildlife breeding seasons and periods of vegetation growth, to minimize negative impacts.*
- *Establish monitoring systems and impose legal fines for environmental violations in forest areas to prevent excessive environmental degradation.*

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