



Original Article

Sustainable Ecotourism Assessment in the Southern Foothills of the Alborz (Kan to Darabad River Valleys) Using the DPSIR Framework

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Abstract

Purpose- During the 21st century, ecotourism has become a mainstream alternative for tourists. It is a critical approach to integrating economic growth with the protection of the environment, ensuring sustainable tourism while at the same time transforming modalities of tourism. The aim of the research is to evaluate the impacts of ecotourism in the southern slopes of the Alborz region by utilizing the DPSIR approach.

Design/methodology/approach- The research location is the old settlements from Kan to Darabad that enjoy a large tourism potential with various attractions (natural, human, infrastructural, and physical). The sites enjoy a combination of tourism activities (ecotourism, cultural, sportive, food, and religious). The research is applied research in objective and descriptive-analytical in method. The data has been collected through library research (statistical and documentary) and field research (survey and interviews).

Findings- The research population in this study included 30 experts, including experts in field of tourism, professors from universities, officials from the Cultural Heritage, Handicrafts, and Tourism Organization of Tehran, and officials from various related organizations, selected with the Delphi method. The research tried to evaluate the effects of ecotourism in the southern slopes of Alborz by utilizing the DPSIR approach, which showed that environmental effects at the five-element level -Driving Force, Pressure, State, Impact, and Response- make it possible to undertake a cause-and-effect analysis of environmental pressures from ecotourism. The results of the research identified 10 driving forces, 7 pressure elements, 9 state indicators, and 9 effects. The main response favored policy-making, strategic planning, and management in utilizing natural and human opportunities, capabilities, and resources of the southern slopes of Alborz. The goal is to achieve sustainable development of tourism and the region through nature-based integrated sustainable tourism by converting current challenges and weaknesses into strengths and windows of opportunities.

Research limitations/implications- The vast geographical region that is encompassed by the research from Kan to Darabad was prone to numerous limitations, including the non-availability of official data pertaining to the volume of tourists and tourism-based attributes of the research region, non-response of certain tourists to certain questions that were asked during the survey, and time limitations for the completion of the questionnaire.

Originality/value- The research employed the use of past research to promote theoretical research discussion and to seek alternative research indicators through the use of scoring with the DPSIR methodology.

Keywords: Impact Assessment, Ecotourism, Southern Alborz Foothills Environment, DPSIR Framework.

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1. Introduction

Today, tourism, as an inseparable part of the human experience, has always played a significant role in the discovery of new places and cultures. This activity has become the most important source of income, employment, and the development of infrastructure and facilities in many countries. However, its uncontrolled and excessive growth, and the increase in the number of tourists without proper planning, have become a threat to the environment. Among the types of tourism that affect the economic income of countries, ecotourism is of great importance, as it emphasizes the preservation of natural values and local communities. This new form of tourism, which supports and protects the environment, is dependent on nature and its resources (Trisic et.al, 2023).

Global reports indicate that with new and technological developments, tourism has also undergone changes. The strong inclination towards nature-based and ecocentric tourism is one such change. 74% of travelers prefer to use environmentally friendly accommodations (Benameur et.al, 2024, p.823). Despite the importance of ecotourism, an analysis of the global environmental situation in recent decades shows the destructive effects of humans on the environment, leading to severe issues such as deforestation, increased wastewater, reduced water quality, drastic climate change, and many other effects. Therefore, an ecosystemic approach and paying attention to human actions within the ecosystem structure are crucial for better biosphere management. The DPSIR framework (Driving Force, Pressure, State, Impact, Response), developed by the European Environment Agency (EEA), is a suitable analytical tool for identifying causal relationships between humans and the environment. It has been used in this study to assess ecotourism in the studied area.

Many regions in Iran have high and suitable potentials for tourism, especially ecotourism. Each, according to its natural features and due to the country's climatic and geographical diversity, has played a role in attracting domestic and foreign tourists since ancient times. The villages located in the southern foothills of the Central Alborz, which have now become part of the urban fabric, are one of the country's important tourist-attracting regions, with their environmental capacities and specific activity characteristics. This area includes pristine

areas, natural landscapes, rivers, valleys, peaks, and diverse plant and animal species, and is known as the air corridor of Tehran, playing a crucial role in purifying the capital's polluted air. Alongside the environmental capacities of the Tehran foothills, there are challenges and problems such as environmental, economic, socio-cultural, managerial-institutional, and infrastructural issues facing the urban environment, which make an investigation inevitable with the focus on achieving sustainability and improving environmental quality. The main challenge of this research is the lack of a systematic framework for a comprehensive analysis of ecotourism in the southern foothills of Alborz (from Kan to Darabad); a framework that can identify the driving forces and environmental pressures, explain the existing state and impacts, and finally, provide appropriate managerial responses.

Therefore, based on the DPSIR framework, what are the driving forces, pressures, existing state, impacts, and managerial responses related to ecotourism for achieving sustainability in the southern foothills of Alborz (from Kan to Darabad)? Based on the stated question, the objective of this research is to identify the causal chains and perform an environmental analysis of ecotourism to provide solutions for reducing the harmful effects of nature-based tourism on the environment of the southern foothills of Alborz.

2. Research Theoretical Literature

2.1. Tourism

In terms of terminology, the word "tourism" is derived from the word "tour," meaning a journey from one point to another. In French, it means traveling around, and in Persian, it is used to mean traveling a lot (Mahallati, 2003).

According to the World Tourism Organization (WTO) definition, tourism refers to the activities of a person traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes (Reichman, 1995; Gunn & Var, 2002). Many experts, researchers, and international academic and research communities have accepted and officially recognized the World Tourism Organization's definition.

2.2. Ecotourism

Although many researchers and scholars have expressed their views on this term, the first person to use it was Hector Ceballos-Lascurain while he

was working on a nature conservation project. Others trace the word's use back to an earlier period and to Hetzer (Alia, 2011). Hetzer believed that ecotourism emerged in response to negative and inappropriate development practices and the disregard for environmental considerations, based on the following criteria:

1. It protects the environment and has the least negative impact on the natural environment (Nazari, 2009: p. 2).
2. It promotes the culture of local communities and has the least negative impact on culture, maximizing responsibility towards the host community and reducing threats to biotic communities (Drumm & Moore, 2002; Blamey, 2001).
3. It ensures increased economic benefits for the host community.
4. It increases the satisfaction of tourists to attract their participation (Niazmand, 2004).
5. It educates and raises awareness about the environment for both tourists and the host community (McKinney, 2016).
6. It defines new markets and attractions (Fleischer & Tchetchik, 2005).
7. It educates and promotes the culture of citizens (TIES, 2002).

Therefore, ecotourism is a commitment to achieving conservation goals, improving the welfare of local communities, increasing participation, and creating new businesses (Jin et al., 2020). It is a platform for creating partnerships and a shared guide for tourists who are seeking to experience and learn about natural areas and diverse cultures (Drumm & Moore, 2002). For this reason, ecotourism has the potential to contribute to sustainable tourism development, revitalize forgotten rural areas, and reduce their poverty (Wondirad, 2020). Since ecotourism is an environmentally friendly activity that occurs in naturally rich areas and is a type of sustainable tourism (Imani et.al, 2022: p. 74), it provides better connections, job creation, and development (Cheia, 2013).

2.3. Sustainability Theory and Socio-Ecological Systems

DPSIR is variously determined by numerous inter-/multi-disciplinary theories, yet it has much stronger correspondence to the theory of sustainability and to the theory of social-ecological systems (SES).

Since the early 1990s, the field of tourism has undergone a serious reappraisal through the prism of sustainability principles, to the point of bringing cultural, natural, and historic resources, as well as indigenous communities' heritage, into sharper focus. From all the different concepts that tried to combine sustainable principles with those of tourism, by far the most common and favorably received has been that of ecotourism. In particular, from 1994 to 1996, among the most complete of the definitions of the field of ecotourism were expressed by academics. Those definitions had aimed at augmenting precision and clarity by emphasizing the role of conservation, of education, of ethics, of sustainability, and of the respective effects and local benefits that accrue (Boroumand et al., 2021).

Sustainable ecotourism has several linkages to various United Nations-established Sustainable Development Goals (SDGs) (Healy et al., 2023) such as:

Goal 6: Clean Water and Sanitation

SDG 8: Decent work and economic growth

SDG 12: Responsible Consume and Production

SDG 13: Climate Action

Sustainable Development Goal 15: Land Ecosystem Conservation and Biodiversity.

To comprehend environmental sustainability is to discern the interaction of anthropogenic drivers, pressures, and responses. The DPSIR is employed as an analytic method for measuring these processes. The social-ecological systems theory also contends that society and the environment are a combined, continuous whole in which humankind's drivers impose pressures upon the environmental framework. These pressures provoke state changes in the environment to invoke correspondingly proper managerial responses based upon the resulting effects. Such a theoretical methodology reveals the complex and dynamic interactions of humankind within an open-ended system of dependency by way of feedback. DPSIR framework establishes the causal linkages that bind human activities, the resulting direct ecological impacts, and after-effects and effects. It is thus considered to be an influential instrument for sustainability analysis and for tracking natural resource management (Binder et al., 2013: p. 26).

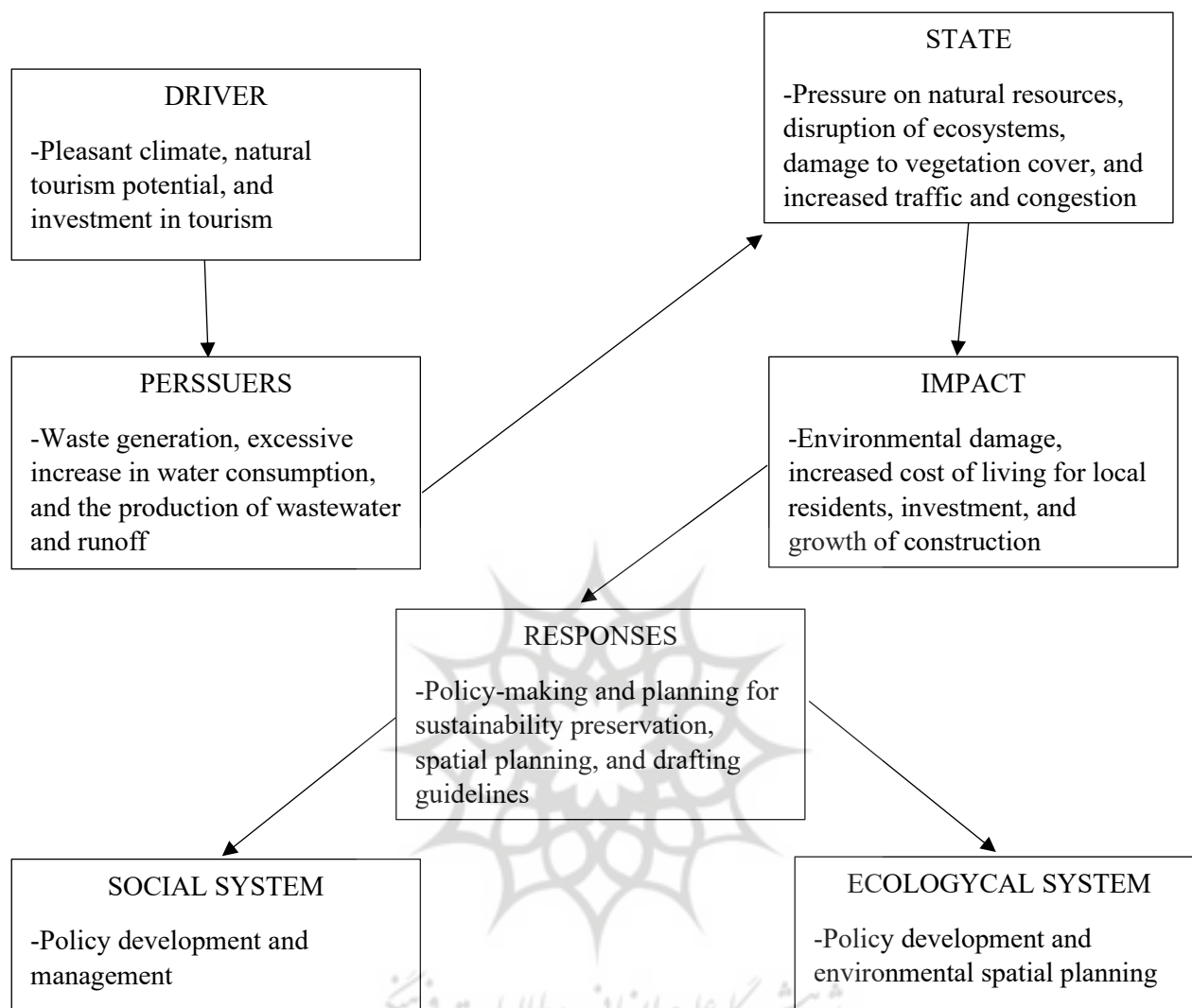


Figure 1: Conceptual Model of the Research

2.4. Research Literature Review

In recent decades, the **DPSIR model** has been used in various studies to assess sustainability. Furthermore, numerous studies have been conducted on **ecotourism**. While each of these two concepts individually has an extensive history, there

have been limited studies on the impact of ecotourism using the DPSIR assessment model. Table No. ... provides a limited overview of the research conducted in the two fields of study (ecotourism, the DPSIR framework, and the connection between the two).

Table 1. Research Background

Row	Article Title (In the field of ecotourism)	Author	Research Method	Outcome
1	A Study of the Role of Dubai's Ras Al Khor Wetland in Guiding Urban Tourists Towards Environmentally-Friendly Ecotourism (In the field of ecotourism)	Deci and Ryan (2012)	Questioning tourists	Most visitors prefer watching flamingos over strolling through markets and hotels (highlighting the importance of ecotourism)
2	A Study on the Role of Ecotourism in the Sustainable Development of Malaysia's East Coast Economic Region (ECER) by Assessing the Region's Ecotourism Potential (In the field of ecotourism)	Bhuiyan (2011)	Strategic study method	The study examined the strengths and weaknesses of this region in terms of sustainable development and the ecotourism industry, and proposed appropriate strategies to

Row	Article Title (In the field of ecotourism)	Author	Research Method	Outcome
				reduce weaknesses and further enhance strengths.
3	Ecotourism Site Selection in Thailand's National Parks Using GIS and AHP (In the field of ecotourism)	Bunruamkaew and Murayam (2011)	Site selection methods	They examined six indicators and eight criteria and identified the best location for ecotourism development.
4	A Study on Nature Tourism in India (Sikkim State) (In the field of ecotourism)	Kumari et al. (2010)	Analytic Hierarchy Process (AHP)	Emphasis on the importance of ecotourism
5	Application of the DPSIR Framework in the Integrated Environmental Assessment of Climate Change in Tehran City	Salehi (2018)	DPSIR framework	The environmental consequences of population growth and the unplanned expansion of Tehran have led to increased temperatures and greater vulnerability.
6	The DPSIR framework and its applicability in environmental decision-making	Khatibi (2015)	DPSIR framework	The DPSIR framework can classify and simplify diverse information about the environmental system and provide its outputs to policymakers.
7	An empirical analysis of the environmental efficiency of tourism in environmentally prioritized areas based on the DPSIR-SBM framework: A case study of the Yellow River Basin, China	Yang (2022)	DPSIR -SBM	The overall efficiency of tourism in the Yellow Sea Basin has shown a fluctuating upward trend over time, and the initial environmental value of tourism, economic and technological development capacity, ecological pressure, and government intervention have influenced the convergence of the river basin and its three sub-basins.
8	Rapid development and its challenges (Ecology of Iran)	Irani et al. (2022)	DPSIR framework	Supporting the local community is essential to address existing challenges.
9	Environmental impact assessment of tourism development on the Lute Desert using the DPSIR-TOPSIS framework	Mohammadpour (2021)	DPSIR framework and ecotourism	There has been a decline in cultural values and customs, socio-cultural dualities, land-use changes, and ultimately the development of tourism in the lute Desert.
10	Assessment of ecotourism impacts in the Rudbar and Qasran region	Tavakolinia et al. (2017)	DPSIR framework and ecotourism	Increased construction and the expansion of secondary homes have caused harmful impacts on the environment of the Rudbar, Qasran, and Lavasanat regions.
11	How can the DPSIR framework be used to structure problems and facilitate empirical research in coastal systems?	Lewison (2016)	DPSIR framework and ecotourism	Quantitative analyses and interdisciplinary applications of environmental factors, with a focus on social and cultural dimensions.

A review of prior research indicates that most studies have either addressed ecotourism independently or merely employed the DPSIR framework for analyzing environmental issues, while investigations combining these two domains remain limited. For instance, Deci & Ryan (2012) examined the role of the Ras Al Khor wetland in Dubai in directing tourists toward ecotourism,

Bhuiyan (2011) explored the role of ecotourism in the sustainable development of Malaysia's coastal areas, and Bunruamkaew & Murayam (2011) conducted ecotourism site selection in Thailand's national parks using GIS and AHP. In Iran, studies such as Tavakolinia et al. (2017) investigated the impacts of ecotourism in Roudbar-e Qasran using the DPSIR model, while Mohammadpour (2021)

analyzed the effects of tourism in the lute Desert through the DPSIR–TOPSIS approach. In the present research, previous studies have been utilized to enrich the theoretical foundations of the study and to help determine part of the research indicators. The distinctive contribution of this study lies in the fact that, for the first time, it assesses the impacts of ecotourism in the southern foothills of the Alborz Mountains (from Kan to Darabad) within the DPSIR framework, applying a scoring-based approach. This method not only identifies driving forces, pressures, states, and impacts, but also enables the formulation of managerial and policy responses.

3. Research Methodology

3.1. Geographical Scope of the Study

The southern foothills of the Alborz Mountains, particularly the section overlooking the Tehran metropolitan area, represent one of the key ecotourism destinations. Due to the presence of historic villages with diverse natural, cultural, and infrastructural attractions, this region holds substantial potential for tourism development. In mountainous areas, including the young folds of the Alborz, some parts are characterized by steep slopes and highly challenging accessibility, making them naturally impassable. Based on local experience, the most effective routes and communication paths in such terrains are those aligned with valleys (Sojasi et al., 2014, p.15). Within this region, a wide range of tourism activities—including ecotourism, cultural tourism, sports, gastronomy, and religious tourism—take place, attracting large numbers of visitors during different seasons of the year (Ali

Akbari, 2016). The study area encompasses a portion of Shemiran County, centered around the urban point of Tajrish, including District 1 and parts of Districts 2 and 5 of Tehran Municipality. In terms of urban services, it falls under the jurisdiction of Tehran Municipality, while politically and administratively it is governed by the Shemiranat County Administration. The southern foothills of the Alborz Mountains, extending from Kan to Darabad, form part of the southern slopes of the Alborz range, bounded to the west by the Kan Valley and to the east by the Darabad Valley.

This region, recognized as one of the most important and sensitive piedmont ecosystems of Iran, is characterized by historic rural settlements situated in close proximity to the Tehran metropolis. It possesses remarkable biodiversity and unique natural landscapes—including natural parks, river valleys, waterfalls, and native vegetation—as well as religious, historical, and cultural attractions. The elevation and topographic diversity of the area create climatic contrasts with the Tehran plain, such that as one ascends from the lowlands to higher altitudes, temperatures decrease while precipitation levels rise. This climatic gradient contributes significantly to the region's pleasant and favorable weather conditions (Mahmoudian et al., 2009).

However, despite its climatic advantages and strategic natural location, the area faces numerous challenges. Human activities and excessive pressure on natural resources have resulted in various environmental problems, most notably pollution and the degradation of natural resources, including vegetation cover (Tehran Environmental Studies Office, 2021).

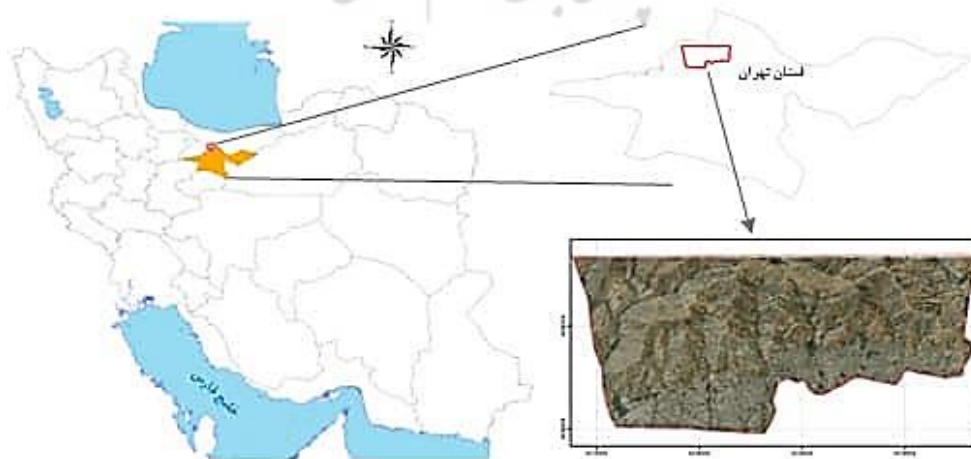


Figure 2. Geographical Location of the Study Area

3.2. Research Method

From a methodological perspective, this study adopts a descriptive-analytical approach with an emphasis on causal relationships. Data were initially collected in qualitative form and subsequently transformed into quantitative measures for analysis. In terms of research purpose, the study is classified as applied research. A library-based method was employed to develop the theoretical foundations and review the research background, as well as to gain an understanding of the study area. For data collection, field methods were utilized, including a researcher-designed questionnaire and semi-structured interviews. The statistical population of the research comprised 30 specialists, including academics and key experts in the field of tourism, selected using the Delphi method. For data analysis, descriptive statistics and the scoring method were applied. The ranking of variables was based on weighted averages, impact intensity, effect scale, and reversibility. Data categorization was conducted according to the five dimensions of the DPSIR model and presented in the form of tables and detailed analyses.

Data collection was carried out by consulting official documents and reports from relevant research centers, as well as through expert questionnaires and interviews. The researcher-designed questionnaire was developed to assess the impacts of ecotourism (nature-based tourism) on the region within the DPSIR framework, using the driving force, pressure, state, and impact criteria. The questionnaire was constructed based on expert consultations through the Delphi method. This process was implemented in two stages: in the first stage, experts identified the main factors affecting the environment, and in the second stage, they assigned scores to these factors.

3.3. The DPSIR Framework

The DPSIR framework is an acronym derived from the terms **Driving forces, Pressures, State, Impact, and Response**, which together define the causal chain of factors influencing the environment. It provides a means to identify and interrelate these determinants while also seeking to establish a logical linkage among them (Zakaei, 2011).

This concept was first introduced by the OECD in 1994 and was later adopted by the European Environment Agency (EEA) in 1994 and 2007 as a

strategic framework for environmental assessment and policy development. Within this framework, the categories of driving forces, pressures, states, impacts, and responses are distinguished from one another (Kristensen, 2004).

Based on this framework, which begins with **Driving Forces (D)**—including economic sectors and human activities—and extends through **Pressures (P)** (such as leakage, emissions, and waste), **State (S)** (physical, biological, and chemical conditions), and **Impacts (I)** on ecosystems, human health, and functions, finally leading to **Responses (R)** in the form of political or policy actions (such as prioritization, goal-setting, and indicators) (Tavakolinia et al., 2017).

Using this framework, the factors related to the study area were extracted, and the results were presented across **five dimensions**—environmental, economic, socio-cultural, physical, and managerial—institutional—encompassing **20 variables and 40 indicators**.

4. Research Findings

According to the DPSIR framework, which is applied to describe the relationships between the sources of problems and their outcomes, the present study sought to identify drivers and pressures and to establish causal relationships between human activities and the environment. The current status of the region was analyzed within the stages of the DPSIR model using the **scoring method**. In this approach, each indicator was assigned a score ranging from 1 to 5:

5 = Very good / Positive

3 = Moderate

1 = Very weak / Negative

Intermediate scores represent values ranging from *very weak* to *very good*. The scores were derived from field-based sources, expert observations, and specialist opinions, aggregated through averaging methods. The **tables** related to **driving forces, pressures, states, impacts, and responses** were scored according to three key criteria: **intensity of impact, scale of impact, and reversibility**, and the final composite scores were subsequently calculated.

4.1. Driving Forces

In the southern foothills of the Alborz Mountains, **ten major driving forces** were identified, the most significant of which are as follows:

Table 2. Major Driving Forces and Their Ranking in the Study Area

No.	Driving Force	Impact Intensity	Impact Scale	Reversibility	Total Score	Rank
1	Pleasant climate	4.6	4	5	13.6	1
2	Potential and natural tourism attractions	4.8	4.5	4	13.3	2
3	Investment in local tourism (e.g., nature-based, cultural-historical, and experiential tourism)	4	5	4	13	3
4	Growth of tourist population due to lifestyle changes	4.3	5	2.7	12	4
5	Strength of local institutions (e.g., neighborhood councils, community management, environmental NGOs)	3	3.9	5	11.9	5
6	Tourism revenues through the expansion of restaurants, cafés, and food outlets	3.9	3.6	4	11.5	6
7	Climate change (reduced precipitation and rising temperatures)	5	5	1	11	7
8	Religious tourism attractions	3.25	3	4	10.25	8
9	Growth of seasonal population	3	4	2.7	9.7	9
10	Expansion of transportation, especially road construction in mountainous areas	4	3.66	2	9.66	10

Climate as a Driving Force- The findings indicate that one of the key driving forces attracting tourists to the study area is its pleasant temperature compared to other parts of Tehran. Within the study boundaries, summer is the warmest season of the year with an average temperature of 27.37°C, while the months of December, January, February, and March are the coldest, with an average of 5.3°C. The months of April (16.4°C), November (11°C), and October (18.8°C) are characterized by more moderate and pleasant temperatures relative to other months, thus accounting for the highest tourist inflow during these periods (Meteorological Organization, 2021).

In terms of precipitation, the area experiences very little rainfall during the summer months, while the majority of precipitation occurs between November and May. A significant portion of this precipitation falls as snow, which in itself serves as a catalyst for tourism development in the region. Snowfall, particularly in late autumn, attracts visitors for activities such as hiking, sports competitions, and nature-based recreation.

Despite its favorable climate, this part of Tehran has not been immune to micro-level climate change.

Over the past 30 years, the precipitation regime based on the SPI index has shifted from 1.20 (relatively wet) to -0.046 (near normal). Accordingly, based on SPI¹ standards, Tehran is approaching drought conditions. This climatic change has directly affected tourism activities, particularly winter recreation such as skiing, due to the reduction in snowfall (Driving Force ranked 7). According to Figure 2, which illustrates the moving average of temperature from 1993 to 2020, the average increased from 15.8°C in the first decade to 16.1°C in the second decade, and 16.9°C in the third decade. Therefore, over the 30-year statistical period, the temperature rose by 1.1°C, which has had a notable impact on tourism activities.

Population as a Driving Force- The share of Tehran's population relative to the national population increased from 8 percent in 1956 to 12 percent in 2024. Similarly, the population of the study area has followed an upward trend, rising from 216,467 persons in 1986 to 591,375 persons in 2022 (Tehran Municipality, 2024).

1 The SPI was calculated by the authors based on meteorological data provided by the Meteorological Organization over a 30-year period from 1993 to 2023.

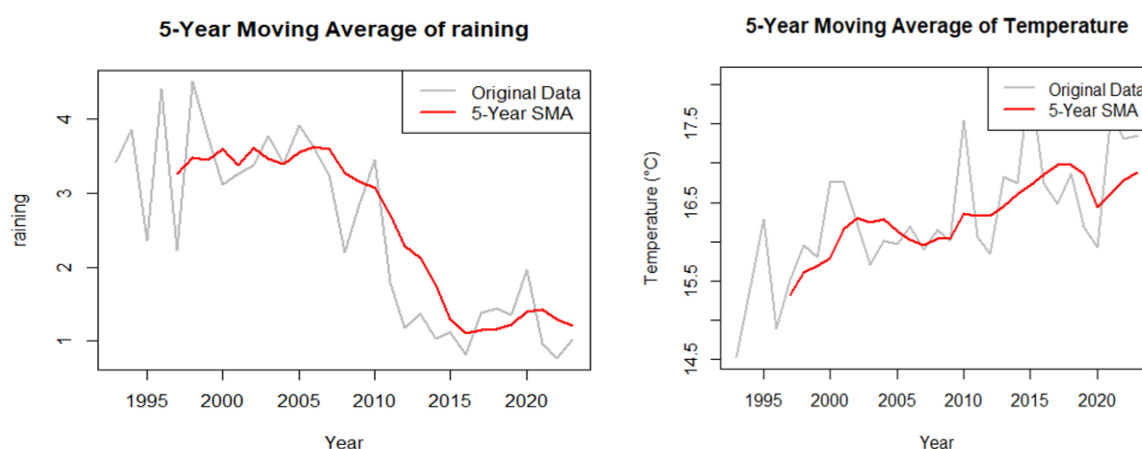


Figure 3. Moving Average of Temperature and Precipitation

(Source: Representation of temperature and precipitation moving averages using R software)

Based on expert opinions and survey results, the growth of seasonal population (**ranked 9**) and overall population increase have acted as driving forces impacting environmental resources, demographic characteristics, economic conditions, physical transformations, and management-related challenges.

The growing population during weekends and holidays, the temporary settlement of Tehran residents in second homes, congestion along hiking trails, the expansion of accommodation facilities, the increase in restaurants, cafés, and recreational centers (**ranked 6**)—which in turn generate seasonal employment opportunities—along with the organization of seasonal parking facilities, the strengthening of urban water and sewage systems, the establishment of comprehensive seasonal service centers, the implementation of tourism projects by local institutions, and periodic environmental clean-up initiatives conducted by voluntary environmental groups (**ranked 5**), as well as investment in local tourism (**ranked 3**) that has enhanced regional income, all constitute significant driving forces influencing tourism activities in the region.

Natural and Religious Attractions as Driving Forces-

The region possesses a wide range of natural and religious tourism potentials and attractions (**ranked 2 and 8**). The significance of natural attractions lies in the presence of river valleys, mineral springs, waterfalls, and wildlife habitats, all of which contribute to the ecological and recreational value of the area. Easy access to mountainous zones and

ski resorts serves as an important driving force for attracting seasonal tourists and weekend visitors.

Religious and pilgrimage sites (**18 locations**), including *Imam Zadeh Davood*, *Imam Zadeh Saleh*, and *Imamzadeh Ghasem*, constitute additional driving forces drawing tourists from various regions to this area. Furthermore, historical monuments such as the Kan inscription, located in the Kan Valley, and the Darabad River historic bridge, which dates back to the Safavid era ([Habibi, 2015](#)), add distinctive value and reinforce the tourism potential of the region.

Drivers of Transport Expansion and Accessibility-

The availability of transport infrastructure in the region (**Rank 10**) through the means of public transport systems (i.e., metro, bus rapid transit, shared taxis, and highway networks) and the expansion of secondary mountain roads, have played an integral role in improving and simplifying access for the people in Tehran, nearby municipalities, and arriving tourists. Empirical evidence from the Municipality and the Traffic Police is indicative of the fact that after the introduction of the Tajrish Metro Station, there was a double increase in tourists flowing into the northern mountainous zones of Tehran on Fridays and national holidays. In addition, with Nowruz and other major national holidays, the usage of using the metro to gain access to northern recreational zones of Tehran rose as much as 35% ([Tehran Metro Operating Company, 2021](#)).

The key drivers identified in the southern foothills of the Alborz Mountain range are a combination of

natural factors (tourism potential and climatic conditions) and man-made drivers (populations growth and investment). In one regard, the drivers have brought about the economic and social advancement of the area; on the other, they have created significant environmental pressure. Recent changes in climate, defined by increasing

temperatures and shrinking rainfall, have altered the trends and diversities of the tourism activity patterns, thereby acting as an overriding driver.

4.2. Pressures

According to the afore-discussed factors and their resulting outputs, varying types of environmental pressures (P) have been established, as in Table 3.

Table 3 – List of Environmental Pressures in the Study Area

No.	Pressure Factor	Intensity of Impact	Scale of Impact	Reversibility	Total	Rank
1	Waste generation	4	4	3.5	11.5	1
2	Excessive consumption and over-extraction of water resources	4.5	3.83	2.5	10.83	2
3	Wastewater and runoff generation	4	3.7	3	10.7	3
4	Land-use change	4.5	3.68	2.5	10.68	4
5	Degradation of rangelands and orchards	4.5	3.67	2	10.17	5
6	Increase in mobile sources of air pollution and traffic volume	4.5	3.5	2	10.00	6
7	Overexploitation of natural resources and rivers	4	3.6	2	9.6	7
8	Soil erosion	4.5	3	2	9.5	8

The rationale and mechanism of what has occurred within the DPSIR framework are assessed through the concepts of Driver (D) and Pressure (P). Accordingly, in the study area (District 1 and parts of Districts 2 and 5), due to the passage through relatively dense residential zones, air pollutants derived from human activities have generated pressures—stemming from a combination of anthropogenic activities and unsustainable development—that have directly affected ecosystem health. Among these pressures, the following can be highlighted:

Waste and Wastewater/Runoff Generation- Solid waste production in the mountainous areas of Shemiran (northern districts of Tehran such as Darband, Darakeh, Darabad, Evin, Velenjak, Kan, Souhanak, and surrounding highlands) is considered one of the major environmental challenges. Owing to its unique natural features, high tourist influx, and proximity to urban fabric, this region is highly vulnerable to the pressures caused by waste generation (Rank 1). Tourists and mountaineers, mountain restaurants and teahouses in areas such as Darband, Darakeh, Tochal, and Kan, as well as peripheral villages and mountain settlements such as Kan, Sulqan, and Souhanak, in addition to pilgrims and visitors to religious or

historical sites—especially during holidays—constitute the main sources of solid waste production.

The average daily waste generation in Tehran (urban + rural) is approximately 45,000 tons, of which nearly 1% (equivalent to ~450 tons per day) is attributed to the mountainous areas of Shemiran (based on regional updates and the share of tourism-oriented populations). The per capita waste production in northern Tehran (including Shemiran) is about 1,200 grams per person per day, which is significantly higher than the citywide average and almost twice the national average (~600–760 grams).

Wastewater production (Rank 3) also imposes considerable pressure on the environment. Certain restaurants and facilities operating along riverbanks (e.g., in Darakeh and Darband) discharge their sewage directly into rivers without treatment (Kouzehgar et al., 2015, pp. 11–25).

Overexploitation of Natural Resources (Water, Soil, Vegetation)- The overuse of natural resources (water, soil, and vegetation) (Rank 7) has severely contributed to erosion, pollution, and ecosystem degradation, exerting destructive impacts that, if continued, will gradually undermine the environmental sustainability of the region.

Deforestation and rangeland degradation (Rank 5), caused by overgrazing, wildfires, logging, construction activities, and climate change, have resulted in reduced vegetation cover, increased soil erosion, and a decline in biodiversity, thereby negatively affecting ecosystems and water resources (Tehran Provincial Department of Natural Resources).

Soil erosion (Rank 8) in this area, due to topography, steep slopes, and intense rainfall, has exerted detrimental effects on soil quality, vegetation cover, water resources, and regional infrastructure. Overextraction from springs and qanats, particularly for tourism-related purposes (restaurants, cafés, etc.), along with the reduced discharge of rivers such as Darakeh and Darband due to unauthorized or unregulated water use, combined with the discharge of untreated sewage into surface water bodies, have led to water quality deterioration and rendered these resources increasingly unusable (Tehran Regional Water Company, 2019).

Transit Traffic and Land-Use Change- Transit traffic in the area, particularly on holidays, has increased

pollution due to the high volume of vehicles and prolonged congestion along local access routes (Rank 6). On weekends and public holidays, intercity traffic toward northern Tehran and the Shemiran region becomes extremely heavy. Given the old urban fabric of Shemiran and the limited capacity of its narrow streets and entry routes, the existing infrastructure is insufficient to accommodate the vehicular load.

Land-use change (Rank 4) has had major impacts on soil erosion, biodiversity loss, water resources, and natural ecosystems. Remote sensing analyses using Landsat imagery revealed that from 1988 to 2018, the extent of residential, commercial, industrial, and transportation areas steadily expanded, while open spaces and green areas (shown in red) significantly decreased (Figures 4 and 5). In this area, land-use transformation has primarily included the conversion of natural lands into residential and tourism zones, which has placed significant stress on the environment and natural resources, threatening the integrity of ecosystems and adversely affecting local communities' livelihoods and the region's economic sustainability.

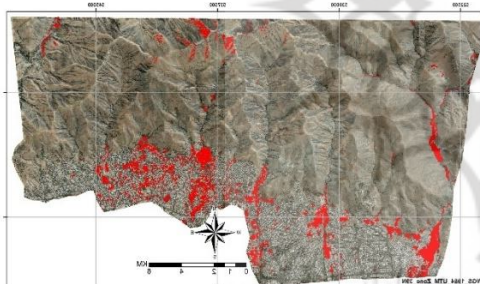


Figure 4. Built-up areas in 1985

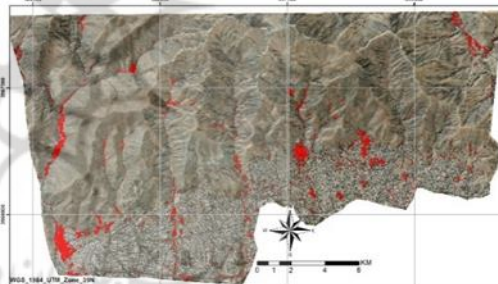


Figure 5. Built-up areas in 2024

4.3. State

In light of the pressures resulting from the aforementioned drivers, specific conditions have

emerged in the study area. These changes can be examined within the framework of the resulting "States" (S), as presented in Table 4.

Table 4 – List of State Indicators in the Study Area

No.	State Indicator	Intensity of Impact	Scale of Impact	Reversibility	Total	Rank
1	Pressure on resources and ecosystem disruption	4.5	4.17	2.5	11.17	1
2	Damage to vegetation cover and soil erosion	4.33	3.67	3	11	2
3	Increased traffic congestion during holidays and crowding along routes	4.25	4.17	2.5	10.92	3
4	Dispersed investment in local tourism	3.83	3.67	3	10.5	4
5	Alterations in architecture and landscape	4.25	3.67	2.5	10.42	5

No.	State Indicator	Intensity of Impact	Scale of Impact	Reversibility	Total	Rank
6	Insufficient facilities for the floating population	3.67	3.67	3	10.34	6
7	Limited infrastructure and weak waste management system	3.75	3.83	2.5	10.08	7
8	Increased water and soil pollution	3.62	3.67	2.67	9.96	8
9	Cultural changes	3.75	3.67	2.5	9.92	9
10	Emergence of new seasonal jobs (e.g., growth of eateries)	4.37	3.67	1.67	9.71	10

Ecosystem Disruption and Pressure on Resources-

Ecosystem disruption (Rank 1), caused by urban development, land-use changes, excessive exploitation of natural resources, and pollution, has led to biodiversity loss, alterations in vegetation cover, damage to vegetation and soil erosion (Rank 2), and increased water and soil pollution (Rank 8). As a result, the natural capacity of the region to accommodate tourism has been significantly reduced.

Changes in Regional Architecture and Landscape-

Alterations in the architecture and landscape of the region (Rank 5) have significantly influenced aesthetics, cultural identity, ecosystems, and overall quality of life. Inappropriate architectural practices, implemented without consideration of climatic conditions, topography, and land slope, have contributed to increased visual pollution, degradation of natural scenery, and the erosion of local identity. The expansion of tourism and uncontrolled villa construction have drastically transformed the traditional architecture and landscape of Shemiranat. The use of incompatible materials, irregular construction patterns, and the destruction of vegetation cover have diminished visual quality and undermined the region's indigenous identity.

In addition, road development has caused the destruction of vegetation, alteration of the natural landform, greater vehicular influx, noise/visual pollution, and the fragmentation of natural scenery, thereby disrupting the cultural landscape. The

vertical expansion of buildings—particularly along mountain slopes—has eliminated the natural skyline and reduced visual access to pristine landscapes. In some areas, natural views have been replaced with faceless building façades lacking spatial identity. Contemporary architectural trends in the area fail to reflect the climate, culture, and natural environment of Shemiran.

Cultural Change- Cultural transformations (Rank 9) in this region encompass social and cultural impacts stemming from urban development, tourist influx, and shifts in local lifestyle patterns. These changes have affected cultural identity, traditions, and social interactions. The arrival of urban and non-local tourists has influenced dress codes, social behavior, music, language, and local interactions. Younger generations in Shemiran's villages are increasingly inclined toward urbanized lifestyles, while traditional culture is gradually fading.

In addition to these factors, the emergence of new seasonal jobs (e.g., growth of eateries) (Rank 10) and the shortage of facilities for the floating population (Rank 6) have also contributed to shaping new conditions in the study area.

4.4. Impacts

Within the DPSIR framework, the degree of impacts is evaluated to determine the resulting consequences. The most significant impacts in the study area, as identified by experts and respondents, are presented in [Table 5](#).

Table 5 – List of Impacts in the Study Area

No.	Impacts	Intensity of Impact	Scale of Impact	Reversibility	Total	Rank
1	Environmental damages (destruction of vegetation cover, decline in water quality, biodiversity loss, and depletion of natural resources)	4	3.7	3.7	11.4	1
2	Rising cost of living (land, housing, and services) for local residents	4.3	4	3	11.3	2
3	Investment and construction growth (degradation of tourism destinations)	4	4	3	11	3
4	Dependence of the local economy on seasonal income	4.5	3	3	10.5	4
5	Increase in social tensions (conflicts between local residents and tourists)	4	3	3	10	5
6	Cultural diversification and erosion of indigenous culture	4	3	2.5	9.5	6
7	Transformation of the native landscape	3	3	3	9	7
8	Increased risks (floods, wildfires, biological and health hazards, etc.)	3	3	2	8	8
9	Pollution (air, water, noise, visual, etc.)	3.5	3	1	7.5	9

Environmental Damages, Increasing Risks, and Growth of Constructions- Environmental damages (Rank 1) have had significant impacts on the quality of life and the natural landscape of the region. These effects have led to the degradation of natural beauty and the destruction of habitats. As illustrated in Figures 3 and 4, vegetation cover (marked in red) has substantially declined between 1985 and 2025, while built-up areas have increased. The expansion of construction activities, particularly along riverbanks and foothill lands, has negatively affected water and soil quality as well as plant species. With the intensification of human activities in natural areas, ecosystems have been disrupted, leaving destructive consequences. Such consequences include the reduction of soil fertility for agriculture, the occurrence of hazards such as flooding (Rank 8) due to vegetation loss and the increase in built-up areas, and the decline or transformation of tourism destinations and activities—all of which represent negative outcomes of intensified human activities in natural landscapes.

Dependence of the Local Economy on Seasonal Income- The growth of seasonal income (Rank 4), particularly in tourism, local services, and seasonal businesses (such as restaurants, cafés, and local shops), has had a notable impact on the regional economy. However, these effects have been highly sensitive to economic fluctuations, environmental conditions, and tourism policies. Rising living costs and the decline in local quality of life (Rank 2), caused by increasing prices, reduced income, and economic transitions, are strongly evident.

5.5. Response

Various approaches exist for addressing and mitigating problems, as well as reducing negative impacts—either directly through the state (D) or impact (I), or indirectly by acting on pressure (P) and driving force (D). The relationship between driving forces and pressures with technology-based economic activities and their corresponding systems is particularly important. Effective responses to these impacts largely depend on how they are perceived and on the application of new technologies and innovative methods.

Table 6. List of Response Forces in the Study Area

No.	Response	Impact Intensity	Scale of Impact	Reversibility	Total	Rank
1	Policy-making and planning for maintaining sustainability and environmental compatibility with ecotourism activities	4.5	3	4	11.5	1
2	Spatial planning in the three dimensions of economy, society, and environment, with emphasis on integrated natural resource management	5	2	4	11	2
3	Developing guidelines to balance investment between various economic sectors and nature-based tourism	3.75	3	4	10.75	3
4	Planning and management for pollution control	3.5	3	4	10.5	4
5	Restoration of vegetation cover and implementation of watershed management projects	3.25	3	4	10.25	5
6	Development of sustainable tourism with emphasis on education and local capacity building	4	3	3	10	6
7	Organization and optimal management of land use	3.5	2	4	9.5	7
8	Establishing cooperation among governmental institutions, municipalities, environmental organizations, and local communities for tourism development with an emphasis on awareness-raising and education	4	3	2	9	8

In the ecotourism domain of Shemiranat, spatial planning aimed at sustainable use of natural resources and the development of responsible tourism (Ranks 2 and 6) should be examined across three key dimensions: economic, social, and environmental. Economic responses include diversifying income sources, strengthening local employment, and managing tourism-derived revenues. Social responses include active participation of local communities in decision-

making, preserving and enhancing cultural identity and traditions, and providing education for both residents and visitors. Environmental responses include preserving vegetation cover and water resources, implementing precise tourism zoning based on ecological carrying capacity, managing waste, controlling construction activities, and applying green technologies. These measures collectively fall within a spatial planning framework for tourism development.

Table 7. Responses within the Framework of the Socio-Ecological Systems Theory (DPSIR Model)

Row	Dimension	Component	Response
1	Driving Force	▪ Growth of tourist population ▪ Growth of seasonal population ▪ Climate change ▪ Expansion of transport and accessibility	❖ Spatial planning in economic, social, and environmental dimensions ❖ Establishing cooperation among institutions and implementing pollution reduction projects ❖ Preparing a comprehensive tourism development plan
2	Pressure	▪ Wastewater and runoff production ▪ Overexploitation of natural resources ▪ Land-use changes	❖ Planning and management for pollution control ❖ Spatial planning with emphasis on integrated natural resource management ❖ Organization and optimal management of land use
3	State	▪ Cultural changes ▪ Transformations in architecture and landscape	❖ Sustainable tourism development with emphasis on education and local capacity building ❖ Policy-making and planning for environmental compatibility ❖ Revision of construction laws and regulations

4	Impact	▪ Environmental degradation and pollution ▪ Investments in construction sectors ▪ Dependence of the local economy on seasonal income ▪ Social vulnerabilities	❖ Planning and management for environmental damage and pollution control ❖ Restoration of vegetation cover and watershed projects ❖ Developing guidelines for balancing investments across economic sectors and nature-based tourism ❖ Building partnerships among institutions for awareness-raising and community education to reduce impacts
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6. Discussion and Conclusion

The southern foothills of the Alborz, stretching from Kan to Darabad, possess unique geographical advantages, rich natural resources, and valuable historical, cultural, and religious attractions, providing considerable potential for the development of nature-based tourism. However, due to the lack of integrated planning, weak resource management, uncontrolled construction, mounting pressure on natural resources, and insufficient tourism services, this potential has not been properly utilized. The region, with its traditional villages, rich biodiversity, mountain landscapes, indigenous culture, and accessibility (through metro, roads, and hiking trails), offers high capacity for the development of sustainable ecotourism.

Nevertheless, the analysis conducted using the DPSIR framework (Driving forces, Pressures, State, Impacts, and Responses) combined with a scoring method reveals that:

- Unregulated construction in foothill areas has disrupted ecological balance.
- Increasing waste generation and the deterioration of water quality (e.g., Darakeh River) are direct consequences of uncontrolled tourism.
- Weak local participation and lack of education have reduced the effectiveness of conservation and management policies.
- The region's economic and cultural potential, if guided by sound policy-making, could play a significant role in fostering sustainable tourism and improving local livelihoods.

This research applied the DPSIR model to identify and analyze the continuous interactions among drivers (D), pressures (P), state (S), impacts (I), and responses (R) in the southern Alborz foothills. Within the framework of socio-ecological systems (SES) theory, these five components function as interlinked parts of a dynamic human–environment system. The findings show that the social system (e.g., tourist population growth, infrastructure development, cultural transformations, and uncontrolled construction) interacts directly with the ecological system (e.g., natural resources,

vegetation, biodiversity, climate). Without effective management, this interaction imposes severe pressures on the ecosystem's carrying capacity.

Feedback loops play a critical role in this complex system. For example, climate change and environmental degradation diminish the quality of tourist experiences, which, in the long run, result in local economic decline—creating a vicious socio-ecological cycle.

According to the SES perspective, sustainability can only be achieved through synergy among stakeholders (citizens, tourists, government, local institutions) and targeted conservation of natural resources. Land-use planning, participatory education, sustainable tourism development, and the adoption of green technologies are fundamental requirements for maintaining the balance of this system.

The study demonstrates that tourism impacts extend beyond the environment, deeply affecting cultural, economic, and institutional structures of communities, thereby necessitating an interdisciplinary and systems-oriented approach to policymaking. Within the SES model, the southern Alborz foothills represent a fragile socio-ecological system that, while endowed with significant potential for sustainable tourism, faces the risk of collapsing human–nature equilibrium if current trends of degradation and weak management persist.

Strengthening the resilience of this system requires planned interventions, cross-sectoral coordination, and local community engagement. Providing training opportunities for residents and enhancing their participation in tourism development are vital to ensuring that economic benefits remain within local communities, thereby aligning tourism growth with environmental conservation and social well-being (Kiani et al., 2018: p.97).

The results of this study are consistent with the findings of Yang, who emphasized the ecological pressures of tourism on the Yellow River basin; Mohammadpour, who highlighted cultural values and socio-cultural dualities; Irani and colleagues, who underscored the importance of supporting local

communities for rural and urban–regional development; and Tavakolinia et al., who identified the destructive effects of land-use changes and intensified construction in the Rudbar Qasran tourism region. The novelty of the present research lies in its causal–analytical environmental assessment using a scoring method, applied for the first time in the southern Alborz foothills.

In conclusion, achieving sustainable development in the southern Alborz foothills is only possible through comprehensive planning, integrated management, and active participation of all stakeholders. In this pathway, the DPSIR framework serves as a scientific and practical tool for guiding policies, controlling pressures, and managing resources—ensuring not only environmental conservation but also improving the quality of life for local residents and promoting responsible tourism in the region.

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Authors contributions

The authors equally contributed to the preparation of this article.

Conflict of interest

The authors declare no conflict of interest.

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سنجش اکوتوریسم پایدار در پایکوه جنوبی البرز با استفاده از چهارچوب DPSIR

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چکیده مبسوط

۱. مقدمه

اکوتوریسم در قرن بیست و یکم به عنوان گردشگری طبیعت‌محور جایگزینی برای گردشگری انبوه، با هدف یکپارچه‌سازی حفاظت محیط زیست با توسعه اجتماعی-اقتصادی محلی، اهمیت فزاینده‌ای یافته است. دامنه‌های جنوبی کوه‌های البرز، به ویژه منطقه امتداد یافته از کن تا دارآباد در نزدیکی تهران، به دلیل ویژگی‌های غنی اکولوژیکی، فرهنگی و زیرساختی خود، رشد سریع گردشگری را تجربه کرده‌اند. با این حال، فقدان برنامه‌ریزی منجر به تخریب محیط زیست شده است. این مطالعه چارچوب تحلیلی DPSIR (نیروهای محرک - فشارها - وضعیت - پیامد - پاسخ) را برای ارزیابی سیستماتیک پیامدهای محیط زیستی اکوتوریسم در این منطقه به کار می‌گیرد. هدف اصلی پژوهش حاضر، شناسایی زنجیره‌های علت و معلولی و تحلیل محیط زیستی اکوتوریسم به منظور ارائه راه حل برای کاهش اثرات زیانبار حاصل از گردشگری طبیعت‌محور بر محیط زیست با استفاده از چارچوب علی DPSIR (نیروی محرک، فشار، وضعیت، اثر، پاسخ) در پایکوه جنوبی البرز (روستاهای قدیمی کن تا دارآباد) است. این چارچوب توسط آژانس محیط‌زیست اروپا برای تبیین روابط میان انسان و محیط‌زیست ارائه شده و در این پژوهش برای تحلیل پیامدهای اکوتوریسم در محدوده مورد مطالعه به کار رفته است.

۲. روش تحقیق

نوع مطالعه از لحاظ روش شناسی پژوهش، روش توصیفی-تحلیلی با تأکید بر روابط (علی-معلولی) است که داده‌ها به صورت کیفی جمع‌آوری شده و پس از کمی شدن مورد تحلیل قرار گرفته‌اند. این پژوهش از نظر هدف از نوع تحقیقات کاربردی است. از روش کتابخانه‌ای برای تدوین مبانی نظری و پیشینه پژوهش و شناخت منطقه مطالعاتی استفاده شده است و برای گردآوری داده‌ها روش میدانی (پرسشنامه محقق ساخت و مصاحبه) به کار رفته است. جامعه آماری پژوهش را ۳۰ نفر از افراد متخصص از جمله اساتید و خبرگان کلیدی حوزه

گردشگری تشکیل داده‌اند که با روش دلفی انتخاب شده‌اند. به منظور تحلیل داده‌ها از آمار توصیفی و روش امتیازدهی (scoring) در سه بعد: شدت، مقیاس و برگشت‌پذیری پیامدها استفاده شده است. دامنه فضایی محدوده شهری-روستایی از کن تا دارآباد، واقع در شمال تهران است.

۳. یافته‌های تحقیق

این مطالعه موارد زیر را شناسایی کرد:

- ۱۰ نیروی محرک از جمله رشد جمعیت، گسترش شهرنشینی، آب و هوای جذاب و سرمایه‌گذاری محلی در گردشگری.
- ۸ عامل فشار از جمله استفاده بی‌رویه از منابع طبیعی، تغییر کاربری اراضی، آلودگی، فرسایش و افزایش ترافیک.
- ۱۰ شاخص وضعیت مانند اختلال در اکوسیستم، تحول معماری، محدودیت‌های زیرساختی و تغییرات فرهنگی.
- ۹ پیامد اصلی از جمله تخریب محیط زیست، رقیق شدن فرهنگ، وابستگی اجتماعی-اقتصادی به گردشگری فصلی و افزایش خطرات طبیعی.
- ۹ استراتژی پاسخ مانند برنامه‌ریزی فضایی (تنظیم کاربری اراضی)، احیای اکوسیستم، مشارکت ذینفعان، سیاست‌های سرمایه‌گذاری پایدار و مدیریت یکپارچه منابع.

مدل DPSIR به طور مؤثری پیوندهای علی بین پویایی گردشگری و تغییرات زیست‌محیطی را نشان می‌دهد. نیروهای محرک شناسایی شده در منطقه پایکوه جنوبی البرز، ترکیبی از عوامل طبیعی (مانند جاذبه‌های گردشگری و آب و هوا) و انسانی (مانند رشد جمعیت و سرمایه‌گذاری) است. این عوامل از یک سو باعث رونق اقتصادی و اجتماعی منطقه شده‌اند، اما از سوی دیگر، فشارهای محیط زیستی قابل توجهی نیز ایجاد کرده‌اند. تغییرات اقلیمی در سالهای اخیر که موجب افزایش درجه حرارت و کاهش بارندگی شده است بر تغییر

* نویسنده مسئول:

دکتر اسماعیل قادری

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- افزایش پسماند و کاهش کیفیت منابع آب (مثل رودخانه درکه) از پیامدهای مستقیم گردشگری کنترل نشده‌اند.
- مشارکت پایین نهادهای محلی و کمبود آموزش، باعث کاهش اثرگذاری سیاست‌های حفاظت و مدیریت شده‌اند.
- پتانسیل‌های اقتصادی و فرهنگی منطقه، در صورت سیاست‌گذاری صحیح، می‌توانند نقش مهمی در توسعه پایدار گردشگری و معیشت جامعه محلی ایفا کنند.

دستیابی به اکوتوریسم پایدار در دامنه‌های جنوبی البرز مستلزم برنامه‌ریزی یکپارچه، حکمرانی مشارکتی و سیاست‌گذاری حساس به محیط زیست است. چارچوب DPSIR ابزاری قوی برای تشخیص مشکلات زیست‌محیطی و تدوین مداخلات چند سطحی ارائه می‌دهد. همسویی استراتژیک بین مقامات محلی، آژانس‌های محیط زیست و جوامع برای کاهش فشارها، احیای اکوسیستم‌ها و تضمین منافع عادلانه از گردشگری ضروری است.

کلیدواژه‌ها: اکوتوریسم، مدل DPSIR، ارزیابی زیست‌محیطی، دامنه‌های جنوبی البرز، گردشگری پایدار.

تشکر و قدردانی

پژوهش حاضر برگرفته از رساله دکترای سید سپهر اعرابی، گروه گردشگری، دانشکده مدیریت و حسابداری، دانشگاه علامه طباطبائی، تهران، ایران است.

شکل و نوع گردشگری به عنوان عامل محرک تاثیر گذاشته است. در محدوده مطالعاتی (منطقه ۱ و بخشی از مناطق ۲ و ۵) به دلیل عبور از مناطق مسکونی با تراکم نسبتاً زیاد از جمله آلاینده‌های هوا که با فعالیت‌های انسانی حاصل شده است، منجر به فشارهایی گردیده (ترکیبی از فعالیتهای انسانی و توسعه ناپایدار) که به طور مستقیم بر سلامت اکوسیستم تأثیر گذاشته است تهدیدات محیط زیستی کلیدی شامل آلودگی آب و از دست دادن تنوع زیستی است که با هجوم فصلی بازدیدکنندگان و توسعه بدون ضابطه تشدید می‌شود. فرسایش هویت فرهنگی و تنش‌های اجتماعی نیز به عنوان پیامدهای غیرمادی مهم ظاهر شدند. با وجود این چالش‌ها، منطقه از طریق حکمرانی هماهنگ و ظرفیت‌سازی، پتانسیل بالایی برای گردشگری پایدار دارد.

۴. بحث و نتیجه گیری

منطقه شمیرانات با روستاهای قدیمی و با برخورداری از تنوع زیستی، چشم‌اندازهای کوهستانی، فرهنگ بومی و دسترسی مناسب (از طریق مترو، خطوط حمل و نقل عمومی و خصوصی و پیاده‌راه‌ها)، ظرفیت بالایی برای توسعه اکوتوریسم پایدار دارد. با این حال، بررسی انجام‌شده با استفاده از چارچوب تحلیلی DPSIR (محرک، فشار، وضعیت، اثر، پاسخ) و روش امتیازدهی نشان می‌دهد که:

- ساخت‌وساز در مناطق پاکبوهی بدون ضابطه منجر به برهم خوردن تعادل اکولوژیکی شده است.

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