

# Impact Analysis of Ecological Environment Pressure on the Sustainable Development of Northwest Tourism Economy

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## ABSTRACT

Ecological environment pressure is an important factor restricting the sustainable development of the tourism economy in the northwest region. This paper constructs an index system and measurement model for ecological environment pressure and empirically analyzes five provinces and regions in the northwest based on data from 2013 to 2023. The results show that the overall ecological environment pressure in the northwest region is at a moderately high level, with significant regional differences and temporal variations, mainly due to rapid population growth, sustained high economic growth, and unreasonable industrial structure. Further analysis reveals that intensified ecological environment pressure not only affects the quality of life of local residents but also constrains the sustainable development of regional economy and society, including the tourism industry. Therefore, this article proposes comprehensive countermeasures such as strict population control, optimizing industrial structure, vigorously promoting energy conservation and emission reduction, strengthening ecological protection and restoration, encouraging environmental protection technological innovation, and improving the legal and policy system, to continuously alleviate ecological environment pressure and create favorable conditions for the sustainable development of regional tourism economy.

## KEYWORDS

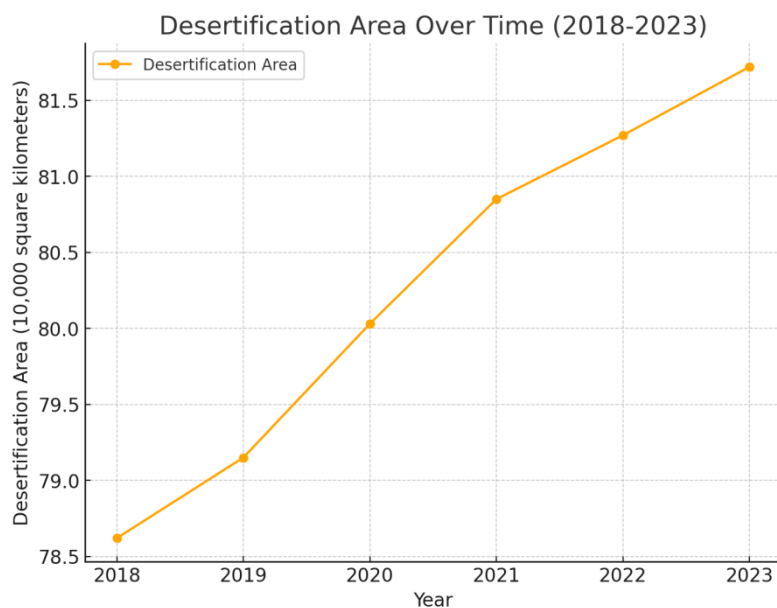
Ecological environment pressure; Index system; Measurement model; Tourism economy; Sustainable development; Northwest region

## 1. INTRODUCTION

The tourism industry, as a green and low-carbon industry, is an important force driving the sustainable development of the economy and society in the northwest region. However, the aggravation of ecological environment pressure in the northwest region has seriously hindered the sustainable development of the tourism economy [1]. Factors such as rapid population growth, sustained high economic growth, and unreasonable industrial structure have led to increasing intensity of resource exploitation and utilization, increasingly prominent environmental pollution issues, and enormous pressure on the ecological environment in this region. The deterioration of the ecological environment not only directly affects the quality of tourism resources and the experience of tourists but also indirectly impacts the quality of life of tourism practitioners, thus threatening the foundation of sustainable development of the tourism economy. Therefore, scientifically measuring the ecological environment pressure in the northwest region, analyzing its impact on the sustainable development of the tourism economy, and proposing corresponding countermeasures are of great significance for promoting high-quality development of the regional tourism industry and realizing the goals of ecological civilization construction and sustainable economic and social development [2].

## 2. CURRENT SITUATION ANALYSIS OF ECOLOGICAL ENVIRONMENT PRESSURE IN THE NORTHWEST REGION

As an important ecological security barrier in China, the northwest region has prominent advantages in natural resources endowment but also faces severe ecological environment pressure. In recent years, with rapid economic and social development, rapid population growth, accelerated urbanization, and continuous improvement of industrialization levels have led to intensified resource consumption and increasingly serious environmental pollution, resulting in continuously increasing ecological environment pressure [3]. According to data from the National Bureau of Statistics, in 2022, the total energy production in the northwest region accounted for approximately 23.1% of the national total, but the total energy consumption accounted for only 12.2% of the national total, indicating that the contradiction between energy supply and demand remains prominent. At the same time, the northwest region faces severe water scarcity issues. In the first half of 2023, Gansu, Ningxia, Xinjiang, and other places suffered from severe droughts, with the per capita water resources accounting for only about one-fifth of the national average level. Additionally, the northwest region also faces a series of ecological environment problems such as land desertification, grassland degradation, and decreasing biodiversity [4]. Taking Xinjiang as an example, according to the "Statistical Bulletin of National Economic and Social Development of Xinjiang Uygur Autonomous Region," the annual average concentration of PM<sub>2.5</sub> in Xinjiang in 2022 was 33 micrograms per cubic meter, exceeding the national secondary standard; the area of desertification in Xinjiang continues to expand, with the latest statistics in 2023 showing a desertification area of 817,200 square kilometers, accounting for 40.3% of the total land area of Xinjiang, as shown in Figure 1.



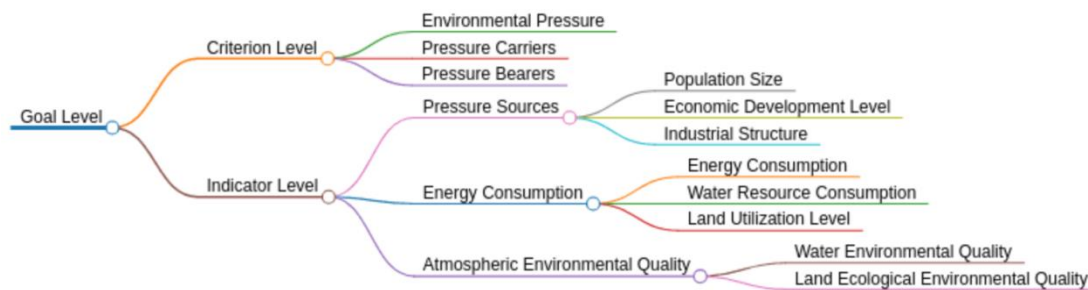
**Figure 1.** Trends in Desertification Area in Northwest China

The exacerbation of ecological environment pressure in Northwest China not only affects the quality of life of local residents but also constrains the sustainable development of the regional economy. Therefore, strengthening ecological environment protection and achieving efficient and sustainable utilization of resources are essential prerequisites for the economic and social sustainable development of Northwest China.

### 3. ECOLOGICAL ENVIRONMENT PRESSURE INDEX SYSTEM AND MEASUREMENT MODEL CONSTRUCTION

#### 3.1. Construction of the Ecological Environment Pressure Index System

Constructing a scientifically reasonable index system for ecological environment pressure is the foundation for measuring ecological environment pressure. Based on relevant domestic and foreign research and considering the actual situation in Northwest China, this study constructs an ecological environment pressure index system from three aspects: pressure sources, pressure carriers, and pressure receptors [5]. The pressure source indicators include population size, economic development level, industrial structure, etc., reflecting the sources of pressure on the ecological environment. The pressure carrier indicators include energy consumption, water consumption, land use intensity, etc., reflecting the transmission pathways of ecological environment pressure. The pressure receptor indicators include air environment quality, water environment quality, land ecological environment quality, etc., reflecting the ultimate receptors of ecological environment pressure. The specific index system is shown in Figure 2.



**Figure 2.** Ecological Environment Pressure Index System in Northwest China

This index system comprehensively reflects the sources, transmission pathways, and ultimate manifestations of ecological environment pressure in Northwest China, laying the foundation for further measuring ecological environment pressure.

#### 3.2. Construction of the Ecological Environment Pressure Measurement Model

Based on the construction of the ecological environment pressure index system, it is necessary to establish a reasonable measurement model to quantitatively evaluate ecological environment pressure [6]. In this study, the entropy method is used to assign weights to each indicator, and a weighted comprehensive ecological environment pressure index model is constructed. The model formula is as follows:

$$EPI = \sum_{i=1}^n (W_i \times X_i) \quad (1)$$

Where: EPI is the comprehensive index of ecological environment pressure.  $W_i$  is the weight of the  $i$ -th indicator, determined using the entropy method.  $X_i$  is the standardized value of the  $i$ -th indicator.  $n$  is the number of indicators.

This model can comprehensively and objectively reflect the overall level of ecological environment pressure in Northwest China. Based on this, quantitative analysis and comparison of ecological environment pressure in different regions and periods can be further conducted, providing references for the formulation of relevant policies and measures.

## 4. EMPIRICAL ANALYSIS

### 4.1. Study Area and Data Sources

This study focuses on the five provinces and autonomous regions in Northwest China (Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang) during the period from 2013 to 2023. Relevant data mainly come from the National Bureau of Statistics, provincial statistical yearbooks, statistical bulletins, and annual reports released by ecological environment departments [7]. Specific sources include population size and economic development level data from local statistical yearbooks, industrial structure data from national sources, energy consumption and water consumption data from national and local statistical yearbooks, land use data from the China Land and Resources Yearbook, and environmental quality data from the Ministry of Ecology and Environment and local ecological environment bulletins.

### 4.2. Calculation of Ecological Environment Pressure

Ecological environment pressure is an important indicator for evaluating the environmental conditions of a region or country [8]. This study constructs an index system covering aspects such as population pressure, economic pressure, resource utilization pressure, and environmental pollution pressure, and standardizes the original data while assigning different weights. After standardizing the collected raw data and assigning different weights, the comprehensive index of ecological environment pressure for each region and each year can be obtained. The specific results are shown in Table 1.

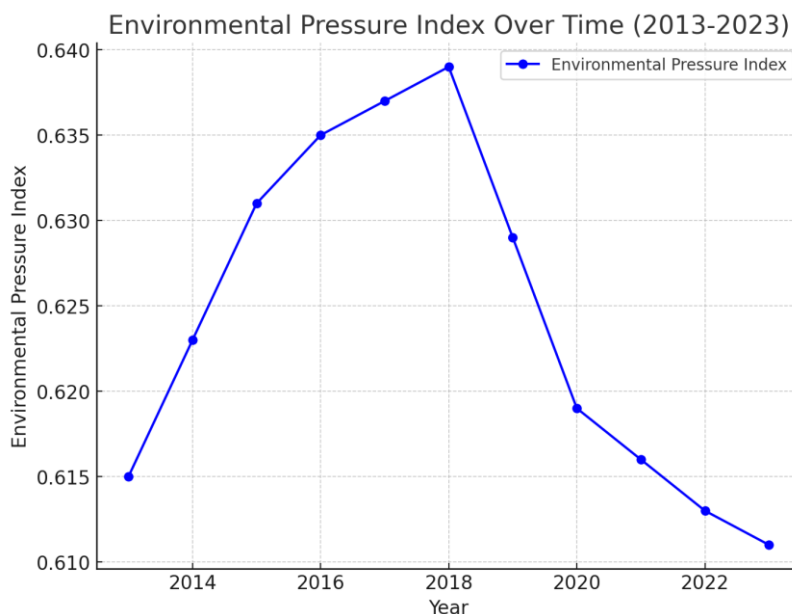
**Table 1.** Ecological Environment Pressure Index in Five Provinces and Autonomous Regions of Northwest China

Year	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
2013	0.562	0.632	0.477	0.594	0.615
2014	0.571	0.641	0.485	0.602	0.623
2015	0.579	0.649	0.489	0.611	0.631
2016	0.587	0.657	0.491	0.619	0.635
2017	0.594	0.664	0.492	0.624	0.637
2018	0.601	0.671	0.493	0.627	0.639
2019	0.593	0.663	0.482	0.617	0.629
2020	0.586	0.652	0.469	0.605	0.619
2021	0.58	0.645	0.461	0.596	0.616
2022	0.575	0.641	0.457	0.592	0.613
2023	0.573	0.638	0.452	0.589	0.611

From an overall perspective, the ecological environment pressure index in Northwest China ranges from 0.452 to 0.638, indicating a moderately high level and reflecting a significant ecological environment pressure in the region. There are significant differences in pressure among different provinces, with Gansu being the highest and Qinghai being the lowest. Looking at the time trend, in most areas, the pressure increased from 2013 to 2018 and then showed varying degrees of decline from 2018 to 2023.

### 4.3. Analysis of the Impact of Ecological Environment Pressure

The ecological environment pressure in Northwest China mainly stems from factors such as rapid population growth, sustained high-speed economic development, and unreasonable industrial structure, resulting in issues such as excessive energy consumption, water resource depletion, and heavy environmental pollution [9]. Taking Xinjiang as an example, in 2023, Xinjiang's ecological environment pressure index was 0.611, which, although lower than in 2018, still remains at a relatively high level, as shown in Figure 3.



**Figure 3.** Changes in Ecological Environment Pressure Index in Xinjiang

The main reasons for this are the continuous population growth, sustained rapid economic development, and dominance of the secondary industry in Xinjiang in recent years. As shown in the table below, the permanent resident population in Xinjiang increased from 22.68 million in 2013 to 27.98 million in 2023, an increase of 23.4%. In 2023, the added value of the secondary industry accounted for 43.2% of GDP, significantly higher than the national average level. This has led to an increase in energy consumption and water resource consumption in Xinjiang. In 2023, total energy consumption increased by 7.5% year-on-year, agricultural water consumption reached 22.56 billion cubic meters, and industrial wastewater discharge amounted to 3.78 billion tons.

**Table 2.** Key Ecological Environment Pressure Factors in Xinjiang

Indicator	2013	2023	Change
Permanent Resident Population (10,000 people)	2268	2798	23.40%
Proportion of Secondary Industry Added Value to GDP	38.60%	43.20%	4.60%
Total Energy Consumption (Year-on-Year Growth)	-	7.50%	-
Agricultural Water Usage (100 million cubic meters)	198.2	225.6	13.80%
Industrial Wastewater Discharge (100 million tons)	31.5	37.8	20.00%

Therefore, strict control of population growth, optimization of industrial structure adjustment, and increased efforts in energy conservation and emission reduction are key to alleviating ecological environment pressure in Xinjiang and the entire Northwest region. Only by adhering to the concept of green development and strengthening ecological civilization construction can we effectively alleviate ecological environment pressure and achieve high-quality economic and social development [10].

## 5. STRATEGIES FOR SUSTAINABLE DEVELOPMENT OF TOURISM ECONOMY IN NORTHWEST CHINA

To alleviate the increasingly severe ecological environment pressure in Northwest China and achieve sustainable development of the tourism economy, the author proposes the following strategies: Strictly control the population growth rate, scientifically plan urbanization layout, and reduce the pressure of population on resources and the environment.

Actively adjust and optimize the industrial structure, vigorously develop the modern service industry, especially tourism, and reduce the exploitation and destruction of resources and the environment. Adhere to the path of green and low-carbon development, intensify efforts in energy conservation and emission reduction, promote transformation in energy consumption and water resource utilization methods, and reduce resource consumption intensity.

Simultaneously, increase efforts in ecological protection and restoration, continuously improve the quality of the atmospheric, water, and land environments, and create a favorable ecological environment for the development of tourism. Emphasize the application of technological innovation in environmental governance, encourage the research and development as well as the promotion of environmental protection new technologies, products, equipment, and materials, and promote the industrialization of ecological environmental protection. Strengthen the leading role of the government, clarify the division of responsibilities among departments, establish and improve laws, regulations, and standards systems, enhance policy measures and regulatory mechanisms, and guide and promote the green transformation and development of the tourism economy. Only by adopting comprehensive and multi-pronged approaches to continuously alleviate ecological environment pressure can the tourism economy in Northwest China truly achieve sustainable development.

## 6. CONCLUSION

As an important ecological security barrier in China, Northwest China faces multiple pressures on its ecological environment, including population growth, rapid economic development, and unreasonable industrial structure, leading to issues such as excessive exploitation of resources and aggravated environmental pollution. This study has constructed corresponding index systems and measurement models, and empirical analysis reveals that the ecological environment pressure in the region is generally at a moderately high level, with significant regional differences and temporal variations, mainly due to rapid population expansion, sustained high economic growth, and unreasonable industrial structure. This not only affects the quality of life of residents but also constrains the sustainable development of the regional economy and society, including the tourism industry. Therefore, Northwest China urgently needs to adopt comprehensive measures from strict population control, optimization of industrial structure, vigorous energy conservation and emission reduction, strengthened ecological protection and restoration, encouragement of environmental technology innovation, to improvement of legal and policy systems, to continuously alleviate ecological environment pressure, create favorable conditions for sustainable development of the tourism economy, and achieve high-quality coordinated development of ecological tourism and ecological economy.

## REFERENCES

- [1] Adebayo T S, Oezkan O. Investigating the influence of socioeconomic conditions, renewable energy and eco-innovation on environmental degradation in the United States: A wavelet quantile-based analysis [J]. *Journal of cleaner production*, 2024(Jan.1):434.
- [2] Jiang Y, Shi B, Su G, et al. Spatiotemporal analysis of ecological vulnerability in the Tibet Autonomous Region based on a pressure-state-response-management framework [J]. *Ecological Indicators*, 2021, 130:108054-.

- [3] Raman R, Pattnaik D, Lathabai H H, et al. Green and sustainable AI research: an integrated thematic and topic modeling analysis [J]. *Journal of Big Data*, 2024, 11(1).
- [4] Huang X S, Huang J Q, Yan Y G, et al. Inverse analysis on dynamic shear modulus of earth-rockfill dam foundation based on the influence of dynamic earth pressure [J]. *Rock and Soil Mechanics*, 2023, 44(10):2889-2898.
- [5] Qiyang H .Analysis on Coupling Coordination between Tourism-economic Development and Eco-environment of the Forest Parks in Fuzhou City [J]. *Forestry Economics*, 2019.
- [6] Li W, Qi J, Huang S, et al. A pressure-state-response framework for the sustainability analysis of water national parks in China [J]. *Ecological Indicators*, 2021, 131:108127-.
- [7] Jaybhaye R G, Badhe Y P, Kapurkar R M ,et al. Identification and Assessment of Eco-tourism Potential Villages in Eco-Sensitive Zone of Northern Part of the Western Ghats, Maharashtra [J]. *Geographical review of India*, 2022(1/2):84.
- [8] Shaogui X U, Shiqiao F, Yongping G. A Study on the Sustainable Development Path of Shaanxi Eco-Tourism from the Perspective of Targeted Poverty Alleviation [J]. *Ecological Economy*, 2019.
- [9] Gnanadhas F, Sundaramoorthy S, Natarajan S. Assessing the bioactive potential of low?cost textile dyes extracted from brown seaweeds and their dyeing properties [J]. *Environmental Science and Pollution Research*, 2023(60):30.
- [10] Fianto A Y A, Andrianto N. Sustainable tourism development from the perspective of digital communication [J]. *Jurnal Studi Komunikasi (Indonesian Journal of Communications Studies)*, 2022.