

ANALYSIS OF THE ECOLOGICAL EFFICIENCY OF ECOTOURISM**Sabina Ilhomshoyevna Izomova**

Master's student, Asian International University

<https://doi.org/10.5281/zenodo.20398399>

Abstract: The results of environmental monitoring indicate several persistent challenges in the development of ecotourism. The level of environmental certification of tourism infrastructure remains at only 12 percent, waste management systems have not yet been fully established along ecotourism routes, and local communities receive merely 23–28 percent of ecotourism revenues. Despite these limitations, ecotourism continues to serve as an important instrument for environmental conservation, biodiversity protection, and sustainable regional development.

Keywords: ecotourist, ecotourism, environmental resources, environmental sustainability, safari tourism, driving factors, international ecotourism services, autonomous infrastructure.

Introduction

Ecotourism is an environmentally responsible form of travel aimed at conserving nature and improving the welfare of local communities. Unlike conventional tourism, it emphasizes minimizing environmental impacts, preserving biodiversity, and supporting local populations. According to the United Nations World Tourism Organization (UNWTO), the global tourism sector accounts for approximately 8–10 percent of annual carbon dioxide emissions worldwide. Consequently, evaluating the ecological efficiency of ecotourism has become an important scientific and practical issue. This study examines the environmental indicators of ecotourism, international experiences, and its development potential in Central Asia, particularly in Uzbekistan.

The concept of ecotourism was first introduced in 1983 by the Mexican environmentalist Hector Ceballos-Lascurain. Later, in 1990, the International Ecotourism Society (TIES) defined ecotourism as responsible travel to natural areas that conserves the environment, supports the well-being of local people, and promotes education and interpretation. Modern scientific literature describes ecotourism as a tourism model based on minimizing environmental impacts, conserving ecosystems, protecting local community interests, increasing environmental awareness, ensuring economic sustainability, and respecting cultural heritage.

Methodological Approaches to Measuring Ecological Efficiency

Several scientific methodologies have been developed to assess the ecological efficiency of ecotourism. One of the most widely used approaches is the Carrying Capacity Model, which determines the maximum number of visitors that a destination can accommodate without causing ecological degradation. This model incorporates physical carrying capacity, ecological carrying capacity, and effective management capacity. Ecological carrying capacity is calculated using the equation:

$$ECC = PCC \times Cf$$

where Cf represents the correction factor.

Another important approach is Ecological Footprint Analysis. The ecological footprint measures the biologically productive land and water area required to support tourism-related activities. In ecotourism studies, the ecological footprint per tourist is calculated according to the following formula:

$$EF = (\text{Transportation} + \text{Accommodation} + \text{Food} + \text{Activities}) / \text{Biocapacity}$$

Research findings indicate that the ecological footprint of conventional tourism ranges from 2.5 to 4.8 global hectares per visitor, whereas ecotourism reduces this figure to approximately 0.8–1.4 global hectares.

Life Cycle Assessment (LCA) is another widely applied methodology. Based on ISO 14040 and ISO 14044 standards, LCA evaluates the environmental impacts of tourism products throughout their entire life cycle. This method provides an objective and comprehensive assessment of the environmental performance of ecotourism projects.

The ecological efficiency of ecotourism is commonly evaluated through indicators such as carbon footprint, water consumption efficiency, waste generation and recycling rates, energy consumption, the share of renewable energy use, biodiversity conservation indices, soil erosion rates, land-cover changes, and impacts on water quality.

Empirical studies demonstrate significant environmental advantages of ecotourism compared with conventional tourism. Average carbon emissions in conventional tourism reach approximately 850 kilograms per tourist, whereas ecotourism generates only about 120 kilograms, representing an 85 percent reduction. Water consumption decreases from approximately 340 liters per night to 85 liters, while daily waste generation declines from 2.8 kilograms to only 0.4 kilograms. Furthermore, ecotourism contributes substantially more to local economies, generating approximately 72 percent local economic participation compared with only 18 percent in conventional tourism. In terms of biodiversity conservation, conventional tourism often produces negative ecological effects, whereas ecotourism generally maintains neutral or positive environmental outcomes.

International Experience in Ecotourism Development

Costa Rica is widely recognized as one of the most successful examples of ecotourism development. More than one-quarter of the country's territory is designated as protected natural areas. In 2022, ecotourism contributed approximately 8.2 percent to national GDP. The success of Costa Rica's model is largely attributed to effective public-private partnerships, a comprehensive sustainability certification system known as the Certificate for Sustainable Tourism, and the active involvement of local communities. Empirical research has shown that ecotourism activities in protected areas generate 3.5 times more economic value per hectare than conventional agricultural activities while simultaneously supporting biodiversity conservation. Forest regeneration rates in protected regions have reached approximately 1.5 percent annually.

Kenya's Maasai Mara region provides another notable example. Through a community-based natural conservation model, more than 40 percent of tourism revenues are directly allocated to local Maasai communities. This approach has significantly reduced poaching activities and contributed to wildlife conservation. Studies indicate that poaching levels declined by approximately 67 percent following the implementation of community-based tourism initiatives.

Bhutan offers a unique model based on the philosophy of Gross National Happiness. The country follows a high-value, low-volume tourism strategy, requiring visitors to pay a sustainability fee of approximately 200 US dollars per day. Revenue generated through this mechanism is invested in environmental conservation, education, and healthcare programs. As a result, Bhutan has achieved carbon-negative status while maintaining forest coverage across approximately 72 percent of its territory.

Ecotourism Potential in Central Asia and Uzbekistan

Central Asia possesses substantial ecotourism potential due to its rich biodiversity, diverse landscapes, and unique cultural heritage. More than one-quarter of the region's plant species are endemic. Rare wildlife species, including the Central Asian brown bear, snow leopard, and Marco Polo sheep, inhabit the region. The Amu Darya and Syr Darya river basins, the Kyzylkum and Karakum deserts, and the Pamir-Alay and Tien Shan mountain systems represent valuable ecological resources suitable for sustainable tourism development.

Uzbekistan also possesses significant opportunities for ecotourism development. Major ecotourism destinations include the Ugam-Chatkal National Nature Park, which covers 574.6 thousand hectares and contains more than 1,500 plant species; the Zarafshan National Nature Park, known for its unique juniper forests and medicinal plants; the Nuratau Mountain-Desert Reserve, which serves as a habitat for numerous rare animal species; the Aral Sea coastal zone, which offers unique opportunities for ecological and geological research; and the Kyzylkum Desert, which provides an exceptional environment for studying desert ecosystems.

According to data from the Ministry of Ecology, Environmental Protection and Climate Change of the Republic of Uzbekistan, the number of visitors to ecotourism destinations increased by 2.3 times between 2020 and 2023. Nevertheless, environmental monitoring reveals several challenges. Environmental certification has been obtained by only 12 percent of tourism facilities, comprehensive waste management systems remain underdeveloped along ecotourism routes, and local communities currently receive only 23–28 percent of total tourism revenues.

Ecotourism and Climate Change

Climate change presents a dual challenge for ecotourism. On one hand, ecosystem degradation resulting from climate change threatens the natural attractions upon which ecotourism depends. On the other hand, tourism activities themselves contribute to greenhouse gas emissions. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), a global temperature increase of 1.5°C could place approximately 8 percent of tourism destinations at significant environmental risk, while a 2°C increase could threaten about 21 percent of tourism sites worldwide.

This relationship necessitates the integration of climate adaptation and mitigation strategies into ecotourism planning. Developing carbon-neutral tourism routes, expanding the use of renewable energy sources, implementing climate monitoring and early-warning systems, and establishing ecological corridors and buffer zones around protected areas can enhance the resilience and sustainability of ecotourism destinations.

Conclusion

Ecotourism demonstrates considerably higher ecological efficiency than conventional tourism. Lower carbon emissions, reduced water consumption, decreased waste generation, stronger support for local economies, and improved biodiversity conservation collectively confirm its contribution to sustainable development. International experiences from Costa Rica, Kenya, and Bhutan provide valuable evidence that environmentally responsible tourism can simultaneously promote economic growth and environmental protection.

Uzbekistan possesses significant natural resources and ecological assets that can support the expansion of ecotourism. However, achieving sustainable growth in this sector requires improvements in environmental certification systems, waste management infrastructure, community participation mechanisms, and climate adaptation measures. The implementation of comprehensive and scientifically grounded ecotourism strategies can contribute significantly to environmental conservation, regional economic development, and the achievement of long-term sustainability objectives.

References:

1. Buckley, R. (2009). *Ecotourism: Principles and Practices*. CAB International, Wallingford.
2. Ceballos-Lascurain, H. (1996). *Tourism, Ecotourism, and Protected Areas*. IUCN, Gland.
3. Stronza, A. (2007). *The Business of Nature Tourism*. Earthscan Publications, London.