

GEOECOLOGICAL MONITORING AND RATIONAL UTILIZATION OF FERGANA VALLEY LANDSCAPE SYSTEMS

Khosilbekova Raykhona

Second-Year Student,

Department of Geography Education, Kokand State University

ABSTRACT	KEYWORDS
This article analyzes the current geoecological state of landscapes in the north-western and central parts of the Fergana Valley. During the research, the level of anthropogenic transformation of the region was studied, and landscapes were classified into three main zones. The causes of negative processes such as erosion, desertification, and rising groundwater levels in the region were scientifically substantiated.	Fergana Valley, landscape, geoecological state, anthropogenic transformation, erosion, agrolandscape, sustainable development, desertification.

Introduction

The Fergana Valley is a region distinguished by its complex geomorphological structure, climatic diversity, and high population density. In recent years, rapid urbanization, population growth, and the large-scale development of agriculture have significantly increased anthropogenic pressure on natural landscapes. As a result, the natural balance of foothill and adyr (hill) areas has been disrupted, leading to geoecological problems related to soil erosion, pasture degradation, and the unsustainable use of water resources. Within the framework of large-scale reforms implemented in our republic in recent years—particularly the “Yashil Makon” (Green Space) national project and state programs aimed at modernizing water resource management—the protection and rational use of regional natural complexes have reached a new level. The relevance of this research lies in the fact that preserving the region's natural-geographical potential and ensuring landscape stability is an urgent task. This article evaluates the current state of the region based on field observations, regional statistical data, and scientific-practical analysis. The main objective of the study is to identify landscape transformation processes and develop scientifically grounded proposals for restoring ecological stability based on the region's natural potential. This, in turn, provides a vital foundation for shaping future regional development strategies and ensuring efficient resource utilization.

Research methods

Natural landscapes in the north-western and central parts of the Fergana Valley and their characteristics of change under human impact were selected as the primary objects of this study. A complex scientific-methodological approach focused on revealing the relationship between regional nature and society was employed. Specifically, a systematic and comparative-geographical analysis method was used to

study the genetic and functional dependencies between landscape components, such as relief, climate, hydrographic network, soil, and vegetation.

Results and analysis

Complex field studies, landscape monitoring, and comparative analysis of regional land-use patterns conducted in the north-western and central parts of the Fergana Valley indicate that the current geoecological state of the region's landscapes is being shaped by the interaction between anthropogenic pressure and natural balance. Based on the data obtained during the research, the geoecological state of the region has been classified into three main zones (Table 1).

Table 1 Geoecological state and development trends of Fergana Valley landscapes

№	Landscape Type	Degree of Geoecological State	Major Negative Processes
1	Central and North-Western desert zones	Close to natural stability	Desertification, reduction of pastures
2	Adyr (hill) and foothill landscapes	Moderately altered (degraded)	Soil erosion, risk of mudflows and landslides
3	Irrigated oasis landscapes	Fully transformed (agrolandscape)	Rising groundwater levels, secondary salinization

Source: Compiled by the author based on field observations in the study area and statistical data from the district department of land resources and state cadastre.

Scientific and Analytical Interpretation of Results

The traces of human activity are clearly visible in the irrigated oasis landscapes. The intensive agricultural culture practiced in these areas for centuries has completely altered the genetic structure of natural landscapes, transforming them into artificial agrolandscapes. The flat relief of the region and the presence of a complex irrigation network have led to the artificial regulation of the hydrological regime. Field analyses show that the inefficient operation of intensive irrigation and drainage systems raises the groundwater level, causing waterlogging of the soil-ground layer and secondary salinization. This process weakens the soil's self-cleaning and recovery functions, intensifying the risk of declining soil fertility in the long term.

Adyr and foothill landscapes are currently the most sensitive and unstable zones in the region. The intensive development of rain-fed agriculture here, especially the plowing of slopes, has sharply reduced the protective layer of the soil (vegetation cover). Observations confirmed that the loss of vegetation cover accelerates water erosion, leading to the washing away of fertile topsoil and the formation of gully networks in foothill areas. This not only causes soil degradation but also increases the power of mudflows, directly threatening human settlements and agricultural lands located in the oasis landscapes of the lower regions.

Although the central and north-western desert zones have relatively preserved their natural state, serious changes are occurring here due to climatic and anthropogenic influences. Against the background of global climate warming, rising temperatures and a sharp decrease in precipitation are accelerating the drying out of areas where hydromorphic (moisture-loving) vegetation is distributed. As a result, pastures are being replaced by salt-tolerant or low-productivity plant species, expanding the process of desertification. This not only reduces the region's biodiversity but also accelerates the

aridization of the regional climate. Studies show that this differentiated state of the Fergana Valley landscapes reflects the balance (or imbalance) created by human economic activity in its interaction with nature. The high pressure on irrigated lands, erosion in foothill areas, and desertification in desert zones actually form an interconnected chain. This implies that when developing regional development strategies, ensuring ecological safety—taking into account the natural potential of each landscape type—is one of the most urgent tasks of the present day.

Discussion and prospects. The results obtained indicate that the traditional and extensive methods of economic management developed over centuries in the Fergana Valley are reaching their economic and ecological limits. An analysis of current geoecological trends in the region suggests that if the existing management order is maintained, transformation processes in adyr and desert landscapes may reach an irreversible stage in the near future, meaning the complete loss of soil fertility and the degradation of ecosystems may become inevitable. This situation poses a serious threat not only to regional stability but also to the socio-economic well-being of the population. The prospects for the rational use of regional landscapes and the restoration of ecological stability require the implementation of the following priority tasks:

1. Optimization of agrolandscapes and water resource management: Under conditions of water scarcity, old irrigation methods remain the primary catalyst for land degradation. Therefore, it is necessary to widely introduce modern water-saving agrotechnologies, such as drip and sprinkler irrigation, in oasis areas. This will not only reduce water consumption but also allow the groundwater level to be kept at a controlled level and prevent secondary salinization.

2. Forming a “Green Shield” strategy: To curb deflation (wind erosion) processes in the sandy landscapes of Central and North-Western Fergana, intensive greening efforts must be carried out. By establishing saxaul forests and shelterbelts, it is possible to improve the microclimate of the area, reduce the rate of sand movement, and preserve biodiversity in desert zones. These measures act as an important buffer, softening the impact of desertification on oasis areas.

3. Comprehensive protection of adyr and mountain ecosystems: Introducing modern agrotechnical methods when using rain-fed lands in foothill zones, particularly the creation of terraces on slopes, will significantly reduce water erosion. Furthermore, restricting unregulated grazing and establishing pasture rotation is the only way to prevent degradation.

Conclusion

The results of the research indicate that the landscapes in the north-western and central parts of the Fergana Valley are currently facing varying degrees of anthropogenic pressure. Analyzing the geoecological situation in the region allowed for the identification of the specific characteristics of landscape zones (desert, adyr, and oasis) and the degradation processes occurring within them.

The main conclusions of the study are as follows:

- **Landscape Transformation:** The geoecological state of the valley's landscapes is directly dependent on human economic activity. The transition of oasis areas into fully developed agrolandscapes and the intensification of erosion processes in adyr areas are the primary threats to the region's ecosystem.

• **Need for Sustainable Development:** Moving from extensive farming to intensive and resource-saving technologies is the only way to ensure not only economic efficiency but also regional ecological safety.

• **Practical Solutions:** The proposed "green shields," terracing, and modern irrigation systems are of decisive importance in restoring landscape stability and mitigating the negative consequences of future climate change.

In conclusion, it should be emphasized that preserving the natural-geographical potential of the Fergana Valley, implementing modern scientific approaches to their utilization, and planning development without geoecological monitoring is impossible. The results of this study serve as a theoretical and practical foundation for developing regional management decisions, establishing nature conservation strategies, and guiding future scientific research in this field.

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