

**THE IMPACT OF ECONOMIC ACTIVITIES ON THE ACCELERATION OF
DESERTIFICATION PROCESSES IN THE NAVOI REGION**

Parmonova Negina Akramovna

Abstract: Desertification is one of the most critical environmental problems in arid and semi-arid regions of Uzbekistan, and the Navoi region is among the areas most severely affected. This study investigates the impact of economic activities — including agriculture, industry, and livestock farming — on the acceleration of desertification in the Navoi region between 2010 and 2024. Using a combination of satellite remote sensing (Landsat 7 and 8), field observations, and statistical analysis, the research identifies significant ecological changes caused by human intervention. The results revealed a steady decline in vegetation cover, as shown by a 28% reduction in the NDVI index, and an increase in soil salinity levels by over 100% during the study period. Expansion of irrigated lands and industrial zones has contributed to soil degradation, salinization, and loss of biodiversity. The findings emphasize the urgent need for sustainable land management strategies, including rational water use, reforestation with drought-resistant plants, and rotational grazing systems. The study concludes that integrating environmental monitoring with regional economic planning is essential to mitigate the negative effects of human activities and ensure ecological stability in the Navoi region.

Keywords: Navoi region; desertification; land degradation; economic activity; soil salinity; NDVI; sustainable land management; remote sensing; Central Asia; environmental monitoring.

Introduction

Desertification is one of the most serious environmental problems in arid and semi-arid regions, and it poses a significant threat to the ecological stability and socio-economic development of Uzbekistan. In recent decades, the **Navoi region** has experienced an intensification of desertification processes caused by both natural and anthropogenic factors. Among these, **economic activities**, such as excessive land use for agriculture, overgrazing, irrational water consumption, and industrial development, have had the most direct and damaging impact on the soil and vegetation cover [1,2].

The Navoi region, located in the central part of Uzbekistan, is characterized by a **continental arid climate** with scarce rainfall and high evaporation rates. Historically, the area was covered with sparse desert vegetation and used for extensive livestock grazing. However, the rapid expansion of agriculture and industrial enterprises—especially mining and chemical industries—has led to **land degradation, salinization, and loss of soil fertility**. These processes have intensified due to the unsustainable use of natural resources, deforestation, and poor irrigation management [3,4].

The socio-economic development of the region has brought both benefits and challenges. While new enterprises have provided employment and improved local infrastructure, they have also **accelerated ecological imbalance**. Dust storms, reduction in vegetation cover, and decreased biodiversity are now commonly observed phenomena in the Navoi region. The transformation of pastures and agricultural lands into degraded desert areas is becoming increasingly visible, especially in areas surrounding large industrial complexes [5].

Previous studies in Central Asia have shown that the main drivers of desertification include **mismanagement of water resources, over-cultivation, and overgrazing** [6,7]. In Navoi, these factors are compounded by the climatic vulnerability of the region, making it a **hotspot for desertification risk**. Despite numerous governmental programs aimed at combating land degradation, their effectiveness has often been limited by inadequate monitoring systems and insufficient coordination between environmental and economic sectors [8].

Therefore, this research aims to **analyze the impact of economic activities on the acceleration of desertification processes** in the Navoi region, to identify the main anthropogenic drivers, and to propose sustainable land management strategies. Understanding these interrelations is crucial for developing effective environmental policies and ensuring the ecological security of Uzbekistan's arid territories [9,10].

Materials and Methods

This study was conducted to assess the impact of economic activities on the acceleration of desertification processes in the Navoi region of Uzbekistan. The research utilized a combination of field observations, remote sensing analysis, and statistical evaluation to determine the extent and causes of land degradation. The Navoi region, located in the central part of Uzbekistan, is characterized by an arid and semi-arid climate with low annual precipitation ranging between 100 and 200 millimeters, and extremely high summer temperatures often exceeding 40°C. These climatic conditions make the region highly vulnerable to soil erosion, salinization, and vegetation loss. The research period covered the years from 2010 to 2024, allowing the identification of long-term trends in land use, vegetation dynamics, and economic development.

Satellite images from the Landsat 7 and Landsat 8 missions were obtained from the USGS Earth Explorer database for the years 2010, 2015, 2020, and 2024. These images were used to assess changes in land use and vegetation cover using the Normalized Difference Vegetation Index (NDVI). The images were processed and analyzed with ArcGIS 10.8 and ENVI 5.3 software to perform supervised classification and detect the transformation of agricultural land, pastures, industrial zones, and barren territories. Topographic maps and land-use data were also collected from the State Committee on Ecology and Environmental Protection of Uzbekistan, while meteorological data on temperature, precipitation, and wind speed were obtained from the Navoi Regional Hydrometeorological Service.

Field studies were carried out in Karmana, Kanimekh, and Nurata districts, which are the areas most affected by desertification. During the fieldwork, soil samples were collected to measure salinity levels and determine soil texture. Vegetation types and density were recorded to evaluate the degree of degradation. The field surveys also included observations of overgrazing, water scarcity, and human-induced land disturbances.

Socio-economic data were obtained from the Navoi Regional Department of Statistics, including information on industrial output, livestock numbers, irrigation systems, and agricultural land expansion. These data were analyzed to explore the correlation between economic development indicators and environmental degradation. Statistical methods, such as correlation and regression analysis, were employed to determine the relationship between anthropogenic activities and desertification indicators, including soil fertility loss and NDVI reduction.

To ensure the validity of the research findings, expert consultations were held with specialists from the Institute of Soil Science and Agrochemistry of Uzbekistan and the Department of Ecology at Navoi State University. Their professional insights helped to interpret the quantitative results and contextualize them within the broader framework of environmental management policies.

Overall, this methodological approach provided a comprehensive understanding of how agricultural expansion, overgrazing, and industrial activities have accelerated the process of desertification in the Navoi region, highlighting the urgent need for sustainable land use strategies and ecological monitoring systems.

Results and Discussion

The results of the study revealed that desertification in the Navoi region has been significantly influenced by **anthropogenic factors**, particularly intensive agricultural practices, livestock overgrazing, and industrial expansion. Analysis of satellite imagery and field observations indicated a marked decline in vegetation cover, an increase in salinized soils, and the spread of barren lands between **2010 and 2024**. The **Normalized Difference Vegetation Index (NDVI)** values showed a continuous downward trend, reflecting the degradation of natural vegetation due to unsustainable land management.

According to the **land-use classification**, agricultural areas expanded by approximately 17% during the study period, mainly due to irrigation projects and new farmlands. However, this expansion occurred at the expense of natural pastures and semi-desert ecosystems. Excessive water use and poor drainage systems led to increased soil salinity, particularly in low-lying regions near the Zarafshan River. Industrial zones also grew rapidly, with mining and chemical enterprises becoming major contributors to land degradation and air pollution.

The field data demonstrated that soil salinity increased from an average of **2.3 g/L in 2010** to **4.9 g/L in 2024**, while vegetation density decreased by nearly **28%** in the same period. The deterioration of soil fertility has resulted in lower agricultural productivity and increased vulnerability of local communities to environmental stress.

The table below summarizes key environmental and socio-economic indicators observed during the study period:

Indicator	2010	2015	2020	2024	Change (%)
Average NDVI value	0.42	0.38	0.34	0.30	-28.6%
Salinity level (g/L)	2.3	3.1	4.0	4.9	+113%
Vegetation cover area (thousand ha)	245	225	195	176	-28.1%
Industrial land area (thousand ha)	35	41	47	53	+51.4%
Livestock population (thousand heads)	680	720	770	820	+20.6%

Indicator	2010	2015	2020	2024	Change (%)
Agricultural land expansion (thousand ha)	110	120	126	129	+17.3%

The data show that **industrial and agricultural growth**, though beneficial economically, has come with substantial ecological costs. The reduction in NDVI and vegetation cover indicates that land degradation is progressing steadily. Moreover, the increase in livestock numbers has intensified **pasture overuse**, particularly in the **Kanimekh and Nurata districts**, where soil erosion and desert expansion are most severe.

These findings align with similar studies conducted in Central Asia, which highlight the direct relationship between economic pressure and land degradation [1,2]. The observed environmental changes in the Navoi region confirm that **unsustainable economic activity is the primary driver of desertification**. The consequences are not limited to the environment; they also include a decline in agricultural productivity, increased water scarcity, and higher risks of dust storms that affect both rural and urban populations [3].

To mitigate these issues, it is crucial to introduce **sustainable land-use management strategies**, such as rotational grazing systems, efficient irrigation techniques (drip irrigation), and reforestation of degraded lands with drought-resistant species. Strengthening environmental monitoring programs and raising local awareness about the impacts of resource overexploitation are also essential for restoring ecological balance in the Navoi region.

Conclusion

The study clearly demonstrates that the acceleration of desertification in the **Navoi region** is closely linked to **intensive economic activities**, including agricultural expansion, industrial development, and livestock overgrazing. Over the last decade, these human-induced pressures have caused significant **degradation of soil quality, loss of vegetation cover, and salinization of arable lands**, thereby threatening the ecological and socio-economic sustainability of the region.

The analysis of remote sensing data and field observations revealed a substantial decline in vegetation (NDVI decreased by almost 30%) and a sharp increase in soil salinity (over 100% growth since 2010). These findings confirm that the ongoing exploitation of natural resources without proper management has disrupted the environmental equilibrium. In particular, the expansion of irrigated agriculture and industrial zones has intensified water scarcity and soil degradation, while overgrazing has accelerated the spread of barren and sandy territories.

It is essential that **sustainable land management practices** be integrated into the region's economic planning. Measures such as **rational use of irrigation water, rotational grazing, soil restoration, and afforestation with drought-resistant plants** should become a priority. Moreover, the establishment of continuous **environmental monitoring systems** and the involvement of local communities in ecological protection programs are vital for ensuring long-term stability.

In conclusion, combating desertification in the Navoi region requires a **comprehensive, interdisciplinary approach** that balances economic growth with environmental preservation. Only through coordinated efforts between governmental agencies, scientific institutions, and local populations can the trend of desertification be reversed, ensuring the sustainable development of this ecologically vulnerable region.

References

1. Abdullaev, I., & Karimov, A. (2021). *Water Use and Land Degradation in Central Asia: Challenges and Opportunities for Sustainable Management*. Environmental Earth Sciences, 80(3), 1–14.
2. Rasulov, B., & Tursunov, K. (2020). *Assessment of Desertification Processes in Arid Regions of Uzbekistan Using Remote Sensing Methods*. Journal of Arid Environments, 182, 104–118.
3. UNCCD (United Nations Convention to Combat Desertification). (2019). *The Global Land Outlook: Central Asian Regional Report*. Bonn, Germany: UNCCD Secretariat.
4. Khasanov, M., & Yusupov, R. (2022). *Impact of Anthropogenic Factors on Land Degradation in Semi-Arid Ecosystems of Uzbekistan*. Central Asian Journal of Environmental Science and Technology Innovation, 3(2), 45–54.
5. Sirojiddinov, J., & Niyazmetova, D. (2023). *Industrial Development and Its Ecological Consequences in the Navoi Region*. Uzbek Journal of Ecology, 7(1), 33–40.
6. FAO (Food and Agriculture Organization of the United Nations). (2020). *Land Degradation Neutrality and Sustainable Land Management in Central Asia*. Rome: FAO Publications.
7. Karimova, Z., & Usmanova, N. (2021). *Climate Change and Its Impact on Soil Fertility in Arid Regions of Uzbekistan*. Journal of Climate and Soil Studies, 5(4), 122–130.
8. Yuldashev, A., & Mukhamedov, S. (2018). *Sustainable Agricultural Practices as a Measure to Prevent Desertification in Central Asia*. Agricultural Research and Development Journal, 12(2), 88–97.
9. Jalolov, T., & Abdurahmonov, N. (2022). *Assessment of Environmental Sustainability in Navoi Industrial Zone*. Uzbek Academy of Sciences Reports, 9(3), 57–65.
10. UNDP Uzbekistan. (2023). *Environmental Monitoring and Land Use Planning in the Navoi Region: Policy Recommendations*. Tashkent: United Nations Development Programme.