

**THE INTERRELATION AND CONSEQUENCES OF NATURAL AND TECHNOGENIC
FACTORS IN UZBEKISTAN'S ENVIRONMENTAL PROBLEMS**

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Annotation: This article provides a scientific analysis of natural and technogenic changes occurring in the environment, exploring their underlying causes and their social and ecological consequences. Natural changes refer to phenomena that occur without human intervention, whereas technogenic changes result from human activities. Against the backdrop of technological advancement, negative anthropogenic impacts on the environment are increasing. The study examines the interrelationship between natural and technogenic factors through the lens of ecological issues observed in the territory of Uzbekistan.

Keywords: natural changes, technogenic changes, ecological impact, human activity, climate change, environment, biodiversity, resource utilization, global warming, sustainable development, natural disasters, ecological balance, industrial development, atmosphere, water and land resources.

INTRODUCTION

The dynamic state of the environment is a central research focus in modern natural sciences and ecology. The interaction between natural and anthropogenic processes is disrupting ecological balance, altering biogeochemical cycles, and posing serious threats to the stability of the biosphere. Natural changes primarily occur through geological, climatic, and biological processes and are independent of human activity [1, 7]. Examples include earthquakes, volcanic eruptions, and climatic cycles.

However, in recent centuries, technogenic impacts resulting from industrialization and urbanization have caused significant environmental degradation. Industrial waste, unsustainable agricultural practices, and the overexploitation of water resources have contributed to the disruption of natural balance. These processes give rise to serious challenges in environmental, economic, and social domains [2].

For Uzbekistan, the drying up of the Aral Sea is one of the most critical environmental problems. This process has had negative consequences on regional climate, water resources, agriculture, and public health [3]. In addition, industrial and transportation emissions, along with rapid urban growth, have intensified pollution issues.

Therefore, it is a pressing scientific and practical task to systematically study the causes of natural and technogenic changes, analyze their ecological and social consequences, and develop effective mitigation measures.

RESULTS AND DISCUSSION

The natural and technogenic changes observed across Uzbekistan represent a complex system of mutually reinforcing factors. Research indicates that these changes are directly linked to climatic conditions, geological processes, human activities, and environmental policy [6].

Among the natural factors, climate change has shown a particularly significant impact. According to data from the Uzbekistan Hydrometeorological Service Center, over the past 30 years, the country's average annual air temperature has increased by 1.5 – 2.0°C, while precipitation levels

in some regions have decreased by 10 – 15% [9]. These shifts have led to a decline in groundwater levels, reduced soil fertility, and decreased agricultural productivity.

Technogenic factors - especially industrial activity, transportation, and urban development - also play a crucial role in disrupting environmental balance. According to the Ministry of Ecology, Environmental Protection, and Climate Change of the Republic of Uzbekistan, in regions such as Tashkent and Namangan, concentrations of nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) from industrial emissions exceed permissible limits by 1,3 – 1,5 times [4, 8]. This exacerbates biodiversity loss, degrades drinking water quality, and poses increasing health risks to the population.

Particular attention has been given to the ecological crisis in the Aral Sea region. The drying up of the Aral Sea has led to rising soil salinity, increased frequency of ecological dust storms, and severe health issues among the local population. The United Nations Environment Programme (UNEP) identifies the Aral Sea region as the largest anthropogenic environmental disaster zone in Central Asia [3, 9]. This crisis stems not only from natural factors but also from human activities - particularly cotton monoculture policies and improper irrigation practices.

Environmental monitoring data confirm a year-on-year increase in the concentration of harmful gases released into the atmosphere. This trend is especially alarming in industrialized areas, where it presents a serious threat to human health and quality of life. Indicators of air, water, and soil pollution suggest that current environmental regulations are not being effectively enforced.

The analysis reveals that natural and technogenic factors are intricately interconnected. For instance, climate change leads to a reduction in water resources, which in turn undermines agricultural potential and weakens food security [5]. Technogenic pressures - particularly industrial waste and inadequate urban planning - further exacerbate environmental problems, posing direct threats to human health and natural ecosystems.

Based on the research findings, the following strategic measures are deemed essential to ensure ecological sustainability and address existing environmental challenges in Uzbekistan:

- ✓ Strengthen regional ecological monitoring systems and establish real-time observation stations across environmentally sensitive areas;
- ✓ Introduce advanced environmental technologies and implement modern solutions aimed at reducing industrial emissions and waste generation;
- ✓ Improve environmental legislation and enhance the enforcement mechanisms to ensure compliance with ecological norms and standards;
- ✓ Conduct systematic educational and awareness-raising activities, particularly among youth, to improve environmental literacy and promote sustainable practices.

By implementing these measures, Uzbekistan can significantly mitigate the risks posed by ecological degradation and make meaningful progress toward achieving sustainable development.

CONCLUSION

Natural and technogenic changes in the environment represent serious threats to both human life and ecological systems. While it is difficult to prevent natural processes, it is possible to reduce the impact of technogenic factors through deliberate policy and management. In the context of Uzbekistan, it is crucial to develop and implement sustainable development strategies to address existing environmental challenges. These efforts will not only contribute to restoring ecological balance but will also have a positive impact on the national economy and the well-being of the population.

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