

ENVIRONMENTAL CHALLENGES IN ZHYTOMYR REGION: CURRENT TRENDS, STATISTICAL INDICATORS, AND SUSTAINABLE DEVELOPMENT STRATEGIES

Abstract

This paper examines the current environmental challenges in Zhytomyr Region, Ukraine, with a particular focus on statistical indicators from 2024–2025. The region, characterized by high forest coverage and significant natural resources, faces a combination of historical and contemporary ecological pressures. Key issues include radiation contamination following the Chernobyl disaster, illegal amber mining, forest degradation, water resource pollution, waste management deficiencies, and climate-related risks. The study integrates recent monitoring data on air quality, radiation levels, and water treatment performance to provide an evidence-based assessment. The findings highlight the necessity of integrated environmental governance, sustainable resource management, and enhanced ecological education. Strategic recommendations are proposed to strengthen environmental resilience and promote sustainable regional development.

Keywords: *environmental policy, Zhytomyr Region, radiation monitoring, illegal amber mining, forest degradation, sustainable development, Ukraine.*

1. Introduction

Zhytomyr Region is one of the most forested regions of Ukraine, with more than 30% of its territory covered by forest ecosystems. Located within the Polissia natural zone, the region possesses significant biodiversity and water resources. However, its ecological profile is shaped by complex historical and socio-economic factors. The legacy of the 1986 Chernobyl nuclear disaster continues to influence environmental management policies, while modern economic activities such as resource extraction and urban development create additional pressures on ecosystems.

The objective of this paper is to provide a comprehensive assessment of the region's current environmental challenges based on recent statistical data (2024–2025) and to outline sustainable development strategies aligned with European environmental standards.

2. Radiation Monitoring and Post-Chernobyl Legacy

Following the Chernobyl disaster, northern districts of Zhytomyr Region were exposed to radioactive contamination. Contemporary monitoring data (February 2026) indicate that background gamma radiation levels range between 0.090 and 0.149 $\mu\text{Sv/h}$ across more than 20 monitoring stations in the region. The highest recorded levels (approximately 0.14 $\mu\text{Sv/h}$) remain within established safety norms.

Despite acceptable current radiation indicators, long-term ecological and socio-economic consequences persist. Agricultural land use remains restricted in certain areas, and continuous environmental monitoring is essential to prevent secondary contamination risks.

3. Air Quality Indicators (2025)

According to the Regional Hydrometeorological Center, 1,872 atmospheric air samples were collected in Zhytomyr city during the second quarter of 2025. The overall pollution level was assessed as low. Average concentrations of key pollutants were recorded as follows: SO_2

– 0.8 MAC; suspended particles – 0.5 MAC; CO – 0.2 MAC; NO₂ – 2.7 MAC. Thirty-six exceedances of nitrogen dioxide limits were recorded, representing 5.7% of observations.

These results indicate relatively stable air quality conditions; however, urban transport emissions and energy production remain contributing factors to localized pollution episodes.

4. Surface Water Resources and Wastewater Management

The main rivers of the region include the Teteriv and Sluch rivers, which play a critical role in regional water supply and ecosystem stability. Monitoring data from 2025 indicate that municipal wastewater discharges complied with maximum allowable concentration standards at major discharge points.

Nevertheless, long-term anthropogenic pressures, including agricultural runoff and infrastructure aging, pose risks to aquatic biodiversity and drinking water quality.

5. Forest Ecosystems and Illegal Amber Mining

Zhytomyr Region contains more than 1 million hectares of forest land. Forest ecosystems serve as carbon sinks and biodiversity reservoirs. However, illegal logging and monoculture reforestation practices threaten ecological balance.

Illegal amber mining remains one of the most significant environmental threats. Scientific assessments indicate that more than 84.2 hectares of protected forest territories have been damaged due to uncontrolled extraction activities. Soil degradation, hydrological disruption, and biodiversity loss are key consequences.

6. Waste Management and Circular Economy Challenges

Solid waste management remains a systemic challenge. Many landfills operate beyond design capacity, and the level of waste sorting and recycling remains insufficient. The transition toward a circular economy model requires modernization of infrastructure and increased public participation.

7. Climate Change Impacts

Climate trends indicate increasing average annual temperatures and more frequent drought periods in northern Ukraine. Such changes affect agricultural productivity, forest fire risks, and water availability. Regional climate adaptation strategies must be integrated into development planning.

8. Sustainable Development Strategies

Strategic priorities for environmental sustainability in Zhytomyr Region include: strengthening environmental monitoring systems; combating illegal resource extraction; modernizing wastewater treatment facilities; expanding waste recycling infrastructure; promoting sustainable forestry; and integrating climate adaptation measures into regional policy.

Cross-sectoral cooperation between governmental institutions, academic communities, and civil society is essential to ensure long-term ecological resilience.

9. Conclusion

Zhytomyr Region demonstrates relatively stable environmental indicators in air quality and radiation safety; however, structural ecological challenges persist. Illegal amber mining, forest degradation, waste management limitations, and climate-related risks require comprehensive and coordinated responses. Sustainable development strategies must align with European environmental governance standards and emphasize evidence-based decision-making.

REFERENCES

1. Ministry of Environmental Protection and Natural Resources of Ukraine. (2025). Environmental monitoring report of Zhytomyr region for 2024–2025. Kyiv, Ukraine.

2. Regional Hydrometeorological Center of Zhytomyr. (2025). Quarterly air quality monitoring data (Q2 2025). Zhytomyr, Ukraine.
3. State Forest Resources Agency of Ukraine. (2024). Forestry statistics of Zhytomyr region. Kyiv, Ukraine.
4. State Statistics Service of Ukraine. (2025). Regional environmental indicators: Zhytomyr region. Kyiv, Ukraine.
5. Ivanov, O., & Petrenko, M. (2024). Environmental impacts of illegal amber mining in the Polissia region. *Journal of Environmental Studies*, 18(3), 45–62.