

ASSESSMENT OF THE ECOLOGICAL STATUS OF WATER BASINS AND THEIR SUSTAINABLE MANAGEMENT

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ANNOTATION: This article highlights modern methods for assessing the ecological status of water basins and principles of their sustainable management. The sources of pollution in rivers, lakes, and reservoirs, ecological indicators, and monitoring methods are analyzed. Additionally, approaches such as Integrated Water Resources Management (IWRM), ensuring ecological safety, and rational use of water resources through public participation are discussed. The article emphasizes the importance of maintaining the sustainability of aquatic ecosystems and strategies for adapting to climate change.

KEYWORDS: water basin, ecological monitoring, pollution, sustainable management, integrated water resources, water quality, ecological safety, water resources, climate change

INTRODUCTION

Water resources are one of the fundamental pillars of human life, and their quality and quantity directly impact global ecological, economic, and social stability. In recent years, the ecological condition of water basins has been deteriorating, particularly due to pollution in rivers, lakes, and reservoirs, loss of biodiversity, and disruptions to hydrological regimes. These issues arise from industrial waste, the use of chemical fertilizers and pesticides in agriculture, insufficient urban sewage systems, and the effects of global climate change.

Systematic assessment of the ecological status of water basins and their sustainable management is one of the pressing environmental issues of our time. This article analyzes methods for assessing the condition of water basins, key polluting factors, and effective approaches to sustainable management.

METHODOLOGY

The research was conducted based on the following methods:

1. **Ecological monitoring methods** – Physical-chemical indicators (pH, nitrates, phosphates, O₂, BOD) and biological indicators (bioindicator organisms) of water quality in rivers, lakes, and reservoirs were measured.
2. **Geographic Information Systems (GIS)** – Remote sensing and GIS software were used for spatial analysis of the condition of water basins.
3. **Socio-economic analysis** – The level of water usage, the impact of industrial and agricultural entities, and public water usage habits were studied.
4. **Comparative method** – Management strategies and ecological approaches were compared with international practices (e.g., the EU Water Framework Directive).

RESULTS

- In most of the studied regions, moderate to high levels of pollution in water basins were identified. Particularly, nitrate and phosphate levels exceeded permissible limits in areas with active agricultural practices.
- Biological monitoring revealed a decline in bioindicator organisms, indicating disruption in ecosystem balance.
- Insufficient integration in water resource management led to lack of coordination between national and regional authorities regarding water quality control.
- GIS analysis identified the exact locations of pollution sources in the water basins, aiding in the development of targeted management measures.
- Climate change has led to drought and reduced water volumes in some water basins.

DISCUSSION

A number of indicators are important in assessing the ecological condition of water basins. These include physical-chemical indicators (pH, oxygen levels, ammonia, nitrates), biological indices (based on macroinvertebrate species), and hydromorphological criteria. For example, BOD (biochemical oxygen demand) and COD (chemical oxygen demand) play a key role in determining the level of organic pollution in water.

Ecological monitoring indicates that in many water basins in Uzbekistan, including the Amu Darya and Syr Darya basins, there has been an increase in nitrogen and phosphorus levels and a decrease in oxygen levels. This intensifies the process of eutrophication, i.e., excessive growth of aquatic plants and algae, which in turn reduces aquatic life sustainability and negatively affects biodiversity in water bodies.

The following approaches play an important role in the sustainable management of water basins:

- **Integrated Water Resources Management (IWRM):** This approach combines hydrological, ecological, economic, and social aspects.
- **Control of pollution sources:** Treatment of industrial waste, use of environmentally friendly technologies in agriculture.
- **Strengthening legal and institutional frameworks:** Implementing environmental norms that regulate water quality in practice.
- **Public and stakeholder involvement:** Promoting rational use of resources through cooperation and increased environmental awareness.

Sustainable management is effective only when it is conducted not just with technical measures, but in combination with legal, economic, and educational approaches. Therefore, it is essential to develop long-term and region-specific strategies based on the results of ecological assessments of water basins.

CONCLUSION

Assessment of the ecological status of water basins and their sustainable management is among the pressing global environmental issues today. Research results show that the main problems of water basins are related to numerous pollution sources, weak monitoring systems, and improper use of water

resources. Therefore, it is important to manage water resources based on integrated approaches and to strengthen public participation and government policy.

To ensure the ecological sustainability of water basins, it is necessary to:

- Implement continuous ecological monitoring systems;
- Enhance coordination among water-using sectors;
- Use environmentally safe technologies in agriculture;
- Improve public environmental awareness.

In the future, managing water resources under the conditions of climate change will become even more urgent. Therefore, relying on scientifically grounded and systematic approaches will be a crucial factor in ensuring the sustainability of water basins and water security.

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