DIKTAS II

Implementation of the strategic action program (SAP) of the Dinaric karst aquifer system: improving groundwater governance and sustainability of related ecosystems.

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GROUNDWATER GOVERNANCE DIAGNOSTIC ANALYSIS (CGGDA) FOR MONTENEGRO

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Key insights from chapters 2-4: Actors; Legal framework; Policy and plans

- **Actors in groundwater governance**: Groundwater management in Montenegro is implemented through the cooperation of several state institutions, including the Ministry of Agriculture, Forestry and Water Management, the Ministry of Ecology, and the Water Administration. Local governments, public utilities, scientific institutions, and international organizations also participate in monitoring, protection, and sustainable use of water resources.
- **Legal and regulatory setting at the state, regional and local level:** Groundwater management in Montenegro is regulated by several key laws, primarily the Water Law, which defines the use, protection, and monitoring of water resources. Complementary legislation—including the Laws on Geological Research, Environmental Protection, Nature Protection, and Financing of Water Management—sets the framework for groundwater research, pollution prevention, biodiversity conservation, and funding of sustainable water management activities. Montenegro's legal framework, harmonized with the EU Water Framework and Groundwater Directives, promotes sustainable, integrated water management based on the river basin approach, ensuring protection, monitoring, and rational use of surface and groundwater resources.
- **Specific karst regulations:** Sanitary protection zones for karst water sources in Montenegro are established by the Rulebook on the Determination and Maintenance of Sanitary Protection Zones and Belts of Water Supply Sources, which defines three protection zones based on karst aquifer characteristics, pollutant transport, and hydrogeological conditions, while monitoring of groundwater quality is conducted twice a year through chemical, physicochemical, and microbiological analyses.
- **Knows gaps**:Although Montenegro's legal framework for groundwater management is largely aligned with EU directives, it lacks detailed regulations for karst aquifers and groundwater-dependent ecosystems, including classification of groundwater reserves, integrated surface–groundwater management, and measures against overexploitation and salinization. The absence of standardized monitoring, ecological quality criteria, and formal recognition or protection of GDEs represents key gaps that hinder effective and sustainable groundwater management.
- **Protection & Management:** Vulnerability of groundwater recognized. Integrated management approach promoted. Specific measures for karst aquifers & GWDE under developed.

Key insights from chapters 5-7: Adherence to EU directives; Knowledge, information and awareness; Socio-economic setting and challenges

- **Role, services and significance of groundwater:** Groundwater is a crucial source of drinking water in Montenegro, supplying about 92% of the population, supporting economic sectors such as industry, energy, and agriculture, and enhancing community resilience during droughts. It also sustains groundwater-dependent ecosystems, directly affects drinking water quality, and holds significant potential for geotourism development and the preservation of natural heritage in the Dinaric Karst.
- **Monitoring scope**: Groundwater monitoring includes water quality (physico-chemical, specific pollutants) and biodiversity indicators (microbiology).
- **Definition of GWDE**: The protection of groundwater (GW) and groundwater-dependent ecosystems (GWDE) has a legal basis in the Water Law and wastewater discharge regulations, but specific guidelines for groundwater and karst areas are lacking. To improve the RBMP in Montenegro, it is necessary to develop karst-specific methodologies, integrate GWDE, and enhance the linkage of surface and groundwater data.
- **Data exchange and institutional coordination**: Some data on groundwater are available through institutional reports (IHMS and EPA), but a systematized, transparent, and comprehensive database is lacking. It is necessary to improve inter-institutional cooperation, standardization, and public access to information for more effective water management and planning.
- **Degree of development of sanitation infrastructure, wastewater and waste treatment**: Sewerage systems and wastewater treatment plants exist mainly in larger cities, but their coverage and functionality are uneven, while many rural and tourist settlements still rely on untreated septic tanks, increasing the risk of groundwater contamination. During the tourist season, existing facilities become seasonally overloaded, further compromising the quality of surface and groundwater.

National SWOT Analysis

Strengths

1. Legal and strategic framework
There is a Water Law and accompanying subordinate regulations governing the use, protection, and monitoring of groundwater and surface waters.
The Water Management Strategy (2017) and River Basin Management Plans (2021) apply the principles of EU directives (WFD, GWD).
Institutional responsibility is distributed across multiple ministries and agencies, enabling multi-layered oversight.
2. Existing monitoring network
The national monitoring program covers surface and groundwater.
The monitoring is partially harmonized with EU requirements and covers public drinking water sources as well as key rivers and aquifers.
3. Quality and significance of groundwater
The Dinaric karst provides high-quality drinking water.
Groundwater supports key economic sectors: tourism, agriculture, industry, and energy.
Groundwater-dependent ecosystems (GDEs) contribute to biodiversity conservation and ecosystem stability.
4. International cooperation
Implemented international projects (GEF/UNDP, IPA projects).
Experience exists in applying WFD and GWD principles, including chemical status assessment and identification of at-risk aquifers.

Weaknesses

1. Limited monitoring and lack of data
The monitoring network is insufficiently spatially covered.
The water regime and the status of GDEs have not yet been assessed.
Data are stored across different institutions (IHMS, EPA, GSM), making integration and trend analysis difficult.
2. Institutional challenges
Weak coordination between sectors and institutions.
Collaboration with the private sector is sporadic and unregulated.
Insufficient involvement of local communities and the public in water management decisions.
3. Regulatory and legal gaps
Karst aquifers and GDEs are not explicitly recognized in legislation.
Control of sanitary protection zones of water sources is inconsistent.
Integration of water protection into spatial and sectoral plans is limited.
4. Resource and infrastructure challenges
Land-use changes. Urbanization processes.
Rural and mountainous areas rely on local springs and individual wells.
Lack of adequate wastewater and solid waste treatment facilities in rural and tourist areas.
Limited human resources and funding for continuous monitoring and analysis.
5. Socio-economic pressures
Seasonal tourism and urbanization increase pressure on water sources.
Agriculture and the use of fertilizers/pesticides lead to diffuse pollution.
Climate change.

Opportunities

1. Modernization of the monitoring system
Centralized database for integrated management of groundwater and surface waters.
Expansion of the monitoring network, including indicators for GDEs, ecological flows, and hydrogeological assessments.
Implementation of GIS and remote sensing technologies to assess the dynamics of karst aquifers.
Strengthening transboundary cooperation.
2. Regulatory opportunities
Introduction of regulations for the preparation of hydrogeological reports on groundwater reserves.
Amendment of legislation for the special protection of karst aquifers and GDE.
Consistent application of sanitary protection zones and control of water abstraction.
Integration of water protection into tourism, agriculture, and urban planning.
Implementation of NATURA 2000.
3. Economic and ecological initiatives
Application of nature-based solutions for water protection (afforestation, land conservation, spring revitalization).
Development of sustainable tourism and agriculture to reduce pressure on groundwater.
Alignment of macroeconomic policies with water protection and sustainable development goals.

Threats

1. Intensive anthropogenic pressures
Seasonal tourism, urbanization, and inadequate infrastructure increase the risk of pollution.
Agriculture (fertilizers and pesticides) and unregulated irrigation threaten the quantity and quality of aquifers.
Unmanaged wastewater and solid waste systems contribute to contamination.
2. Natural and climatic factors
The heterogeneity of karst aquifers and high spatial variability complicate planning.
Droughts and climate change reduce available resources and increase the risk of salinization in coastal springs.
3. Institutional and regulatory uncertainty
Insufficient implementation of the legal framework and plans in practice.
Weak coordination among institutions leads to duplication of research and inefficient management.
4. Socio-economic risks
Uncontrolled development of infrastructure, energy, and tourism without integrated water protection threatens the long-term status of aquifers.
Lack of investments in rural and karst areas reduces the resilience of local communities and ecosystems.

Governance Gaps/Weaknesses in Groundwater Management

1. Monitoring and Data

- Insufficient spatial and temporal coverage of monitoring, especially in karst aquifers.
- Limited data on chemical status.
- Non-integrated databases – data are stored across multiple institutions without a centralized platform.
- Lack of standardization and automated data exchange among public institutions and the private sector.

2. Institutional and Regulatory Weaknesses

- Inadequate coordination among responsible institutions and sectors (water management, health, environment, agriculture, energy).
- Karst aquifers and GDE are not explicitly recognized and protected in legislation.
- Weak implementation and control of sanitary protection zones for water sources.

3. Infrastructure and Resources

- Insufficient coverage of water supply and sewerage systems in rural and mountainous areas.
- Inadequate wastewater treatment and solid waste management systems.
- Limited human, technical, and financial resources for continuous monitoring and analysis.

4. Socio-Economic Pressures

- Seasonal tourism and urbanization increase exploitation and pollution risk.
- Diffuse pollution from agriculture and inadequate septic systems.
- Climate change – longer dry seasons and increased risk of salinization of coastal water sources.

Opportunities for improvement

1. Modernization and Integration of Monitoring Systems

- Centralized database integrating surface and groundwater, including GDE.
- Expansion of monitoring networks and introduction of GIS and automated sensors for better karst aquifer monitoring.

2. Strengthening Institutional Capacities

- Standardization of procedures for data exchange between public and private sectors.
- Training of specialists in hydrogeology, ecology, and data analysis.
- Engagement of local communities and public participation in water management and source protection.

3. Regulatory and Legal Opportunities

- Amendment of legislation for explicit protection of karst aquifers and GDE.
- Consistent application and control of sanitary protection zones.
- Integration of groundwater protection into spatial and sectoral plans (tourism, agriculture, urbanization).

4. **Economic and Ecological Initiatives**

- Development of sustainable tourism, agriculture, and nature-based solutions (afforestation, land and source protection).
- Alignment of macroeconomic policies and investments with groundwater and GDE conservation.
- Pilot projects and financial incentives for local initiatives to preserve water resources and ecosystems.

Thank you

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