DINATAS

Protection and Sustainable Use of the Dinaric Karst Transboundary Aquifer System

PROTECTION AND SUSTAINABLE UTILIZATION OF GROUNDWATER RESOURCES IN THE REPUBLIC OF CROATIA

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Hydrogeology

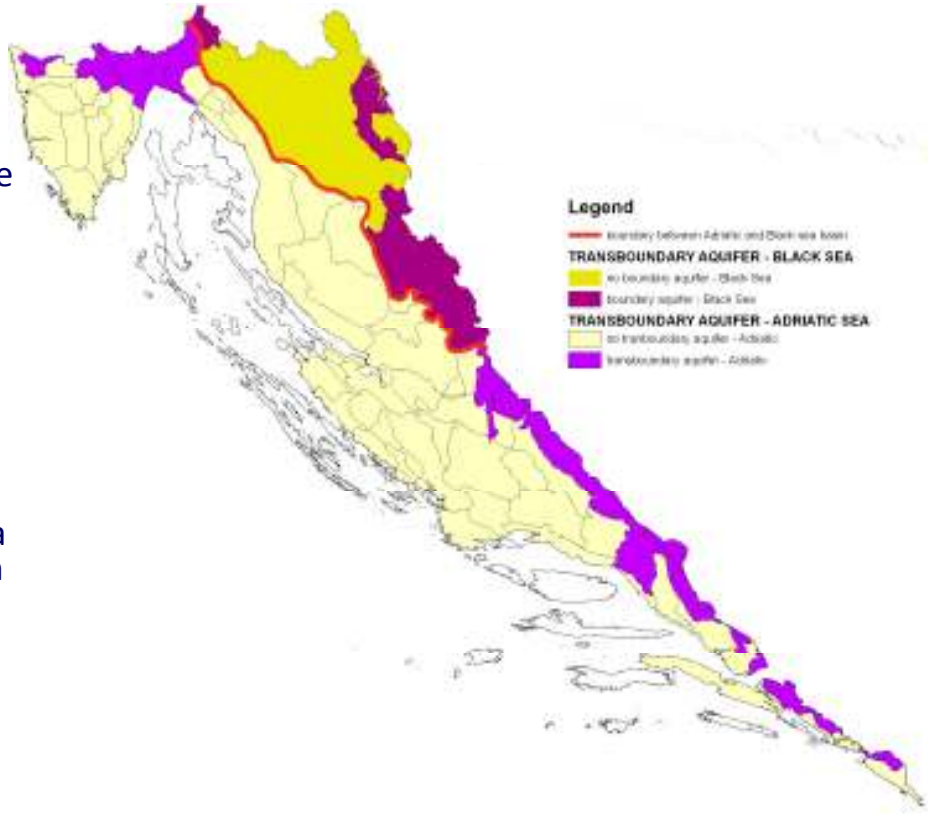
- Dinaric mountain range: the divide between the Black Sea basin and the Adriatic Sea basin
  - Karst part of the Black Sea basin: Kupa and Una river basin
  - Adriatic Sea basin: Littoral-Istrian river basins and Dalmatian river basins
- Main characteristics: the vast thickness of the carbonate deposits
- Rocks of lower permeability may act as lateral or partial barriers and could have a influence on groundwater dynamics
- The principal retention zones are formed within mountain massifs
- Important morphological features: mostly created during the Lower Pleistocene and Holocene

Hydrogeological map

Transboundary aquifers

- In the border area of HR and B&H: transboundary aquifers of very large dimensions
- Black Sea basin:
  - Border with Sl: transboundary aquifer in the area of Gorski kotar, with the majority of recharge area located in Croatia and the majority of discharge in Slovenia
  - Border with B&H: transboundary aquifers in the areas of Banovina and Lika (Plitvice lakes and Krbavsko field)
- Adriatic Sea basin:
  - Border area with Sl:
    - transboundary aquifers, where parts of recharge areas of abstraction sites in Istria, Kvarner bay, town of Rijeka and Bakar bay are located in Slovenia,
    - transboundary aquifers near the Draganja River in Istria whose recharge areas are in Croatia and discharge areas in Slovenia
  - Border area with B&H:
    - abstraction sites with very high yields on Croatian side
    - majority of recharge areas in Bosnia-Herzegovina

Transboundary aquifers



Sociological considerations

- The countries in the Dinaric karst region have many possibilities for development based on the wise exploitation of karstic areas
  - High tourist potential
  - Tourism - one of the major sources of economic growth
- Major sociological factors:
  - Karstic area must be evaluated as a specific value, as “nature as itself”, protected and saved from human impact and overexploitation
  - Major stakeholders – the people who live in a karstic areas – have to be consulted on the use of natural resources
    - there is a need for the respect for the transboundary aspects of the natural resources represented by karstic areas taken as specific natural and cultural phenomena
    - local population understands the “dynamics of nature and life” and the need how to adapt to the seasonal changes (flood, draught) that are caused by the transboundary influences
  - Karstic areas are specific “bases” for life not only for local population in karstic areas, but for the wider population as well
  - Natural environment are a unique complex resource, which supports all activities in local, national and also within the transboundary areas

Potential threats in karstic areas

- Future types of economic activities could endanger – locally and transboundary – the fragile karstic water systems
  - potential economic developments should be taken into account with high caution
- Tourism: rapid development may endanger – locally and transboundary – the fragile karstic ecosystems
  - Measures that should be taken into account:
    - take into consideration the carrying capacity of the environment (nature parks and national parks) due to the impacts of thousands of tourists. An excessive number of tourists may:
      - degrade the basic phenomenon,
      - produce a negative impact in general
      - in the longer run – prevent visits to these special places or to the places that depends on the karstic areas
    - assess the value of natural environment
      - must be done before planning any kind of future investments, changes and plans in karstic areas
      - if the primary value – phenomenon is endangered and/or (partially or totally) destroyed and degraded, the quality of life is irreversibly changed

TDA – legal and institutional framework and policy

- Transboundary Diagnostic Analysis (TDA) was performed within the project "Protection and Sustainable Use of the Dinaric Karst Aquifer System" (DIKTAS)
- TDA included a comprehensive overview of the legal and institutional framework and policy in the whole region, supported by
  - relevant national and international regulatory documents, laws and guidelines on transboundary aquifers
  - national and regional Dinaric Karst Aquifer System SWOT analysis

National SWOT analysis

Strengths	**Weaknesses**
- Croatia has a long tradition of water management - the administrative capacity for effective (ground)water management is significant - Croatia has national strategy for water management, which is harmonized with the requirements set in EU Water Framework Directive and of the Groundwater Directive - strategic groundwater reserves that are of national importance for Croatia are delineated and clearly stated in the Water Management Strategy - with the adoption of the new *Water Act* and *Water Management Financing Act* a transposition of the fundamental principles, objectives and measures from the EU Directives, in particular the *Water Framework Directive*, is substantially completed - polluter pays principle is embedded in all new water management acts and regulations -	- economic valuing of groundwater and groundwater dependent ecosystem functions is missing - no legal or policy document in Croatia adequately define and prescribe the integration of environmental and resource costs into the development of pricing policies - principle of cost recovery is not fully implemented nor in Croatian regulations nor in water management practice, regarding the introduction of the environmental and resources costs - strategic reserves of groundwater in Croatia are not legally defined nor in the Water Act nor in related bylaws - the areas (water bodies) intended for the abstraction of drinking water are not properly defined in legislative documents - status of all types of groundwater protected areas is not clearly defined in spatial planning documents - ....
Opportunities	**Threats**
- to use of EU funds, particularly structural and cohesion funds (on the basis of well prepared project proposals) for co-financing (ground)water projects - to start with realization of interdisciplinary scientific project on valuation of groundwater resources and ecosystem services, taking into account methodology proposed by ten faculties of Zagreb and Split Universities and results of past and current international scientific (FP) projects - to build interdisciplinary research topics with significant stakeholders in the region in order to meet the transboundary (ground)water policy and (ground)water management needs -	- *Water Management Strategy* is only partly harmonized with other sectoral (national) strategies, which may threaten the implementation of the groundwater protection measures - the impact of climate change and changes in land use on (ground)water resources is unknown - causes of adverse change in quantitative and qualitative characteristics of groundwater are not fully identified or understood, especially in karst aquifers - River basin management plan is not yet adopted, which may cause the problems with timely implementation of measures - program of measures is not adequately defined in the *Water Act* or subordinate legislation (including draft RBMP), which may cause a problems with its implementation - ....

Shortcomings of legal framework in Croatia Examples

- Water Management Strategy:
  - does not define specific goals for transboundary waters
  - is only partly harmonized with other sectoral strategies, which are adopted years ago and are obsolete
- Sectoral strategies (e.g. energy development strategy, strategy of industrial development, territorial development strategy) rarely estimate real demand for water and water pollution potential of sectoral activities
- Principle of cost recovery is not fully transposed either in national regulations or in water management practices, with regards to implementation of the environmental and resource costs in water pricing policies
- Strategic reserves of groundwater in Croatia are not legally defined nor in the Water Act nor in related bylaws
- New *Rulebook on conditions for establishing sanitary protection zones* (Official Gazette no. 66/11; 47/13) is not based on economic criteria and the most acceptable combination of basic and supplementary measures as defined in the WFD

Stakeholder analysis – experience from DIKTAS project

- Purpose of stakeholder analysis:
  - identification and characterization of the key stakeholders in protection and sustainable management of groundwater resources
  - identification of the issues and problems with regard to the management of the Dinaric Karst aquifer system
- Stakeholders included in TDA:
  - Ministry of Agriculture and other relevant Ministries
  - Croatian Waters
  - National and Nature Parks
  - Public institutions for managing of protected areas and touristic destinations, regional authorities, NGOs working with nature and ecosystems, representatives of hydropower and agricultural sector
  - Scientific institutions
- Methods used for gathering and processing information:
  - expert opinion and expert knowledge
  - web-based survey
  - workshop
  - structured interviews

Key issues perceived by stakeholders

- Unsustainable/insufficient municipal solid and waste water management
- Unsustainable tourism development
- Over-exploitation of the water resources leading to decline of groundwater levels due to:
  - lack of regulation of the hydro-energy sector in relation to water use
  - absence of an adequate abstraction regime for drinking water supply
  - Use of water for irrigation of agricultural land and for recreational purposes
- Construction of dams, linked to disturbance of the water balance and quality
- Water management issues:
  - inadequate institutional framework
  - failure to use modern management and assessment methods and tools
  - lack of awareness of stakeholders and decision makers
  - lack of financial resources
  - outdated systems and procedures for planning and management
  - insufficient monitoring and research, lack of data and scientific knowledge
  - insufficient legislation and its insufficient implementation and enforcement
  - insufficient or lack of institutional communication and cooperation among countries sharing the resource

Instead of conclusion: possible solutions to problems

- Identify proximal, intermediate and fundamental causes of environmental problems ,which might endanger sustainable groundwater management and protection!
- Turn the attention of the water governance bodies to the management of water demand by measures such as:
  - water pricing mechanisms,
  - reduction of water losses, water reuse and recycling,
  - increasing the efficiency of domestic, agricultural and industrial water uses
  - water saving campaigns supported by public education
- Ensure capacity building for public administration and strengthen the role of public participation in taking decisions!
- Take into consideration solutions proposed by stakeholders:
  - Implement the pollution control management!
  - Systematically and thoroughly monitor natural resources!
  - Implement comprehensive management plans!
  - Raise the awareness of the stakeholders and decision makers!
  - Restrict harmful activities to the environment and water resources!

Thank you for your attention