

Workshop on the protection of groundwater as a source of drinking water in karst area

Malinska, Island Krk (Croatia)

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COASTAL AQUIFERS MANAGEMENT IN CROATIA



ZELIMIR PEKAS, Croatian Waters
ZAGREB, Croatia

CROATIA



- terrestrial area 56.538 sq km
- territorial sea area 31.071 sq km
- length of coastline 5.835 km
- 1.185 islands (66 inhabited)
- Croatia population 4.44 million (census 2001)

INSTITUTIONAL ASPECTS OF WATER MANAGEMENT IN CROATIA

- The Water Act and the Water Management Financing Act, both enacted in 1995 and amended in 2005, define the legal framework of water management in Croatia.
- The long-term strategic planning document in the field of water management is the Strategy of Water Management.
- The Strategy of Water Management is harmonized with other sectoral strategies, and generally complies with the requirements set in EU Water Framework Directive .

Water Management Institutions

Two government institutions have direct responsibility for water management in Croatia:

- **Ministry for Regional Development, Forestry and Water Management**
- **Croatian Waters (Hrvatske Vode), national water agency**

Ministry for Regional Development, Forestry and Water Management - Water Management Directorate (WMD)

is responsible for:

- administrative and other issues related to integrated management of water resources and water management systems
- incorporating water resources management and development into overall economic development framework.
- in the field of water protection, it is responsible for protection of drinking water sources and the sea from land-based pollution sources.
- for planning and coordinating development and construction of large water supply and wastewater collection and treatment systems
- for monitoring of surface waters and groundwater

Croatian Waters

as the national water agency

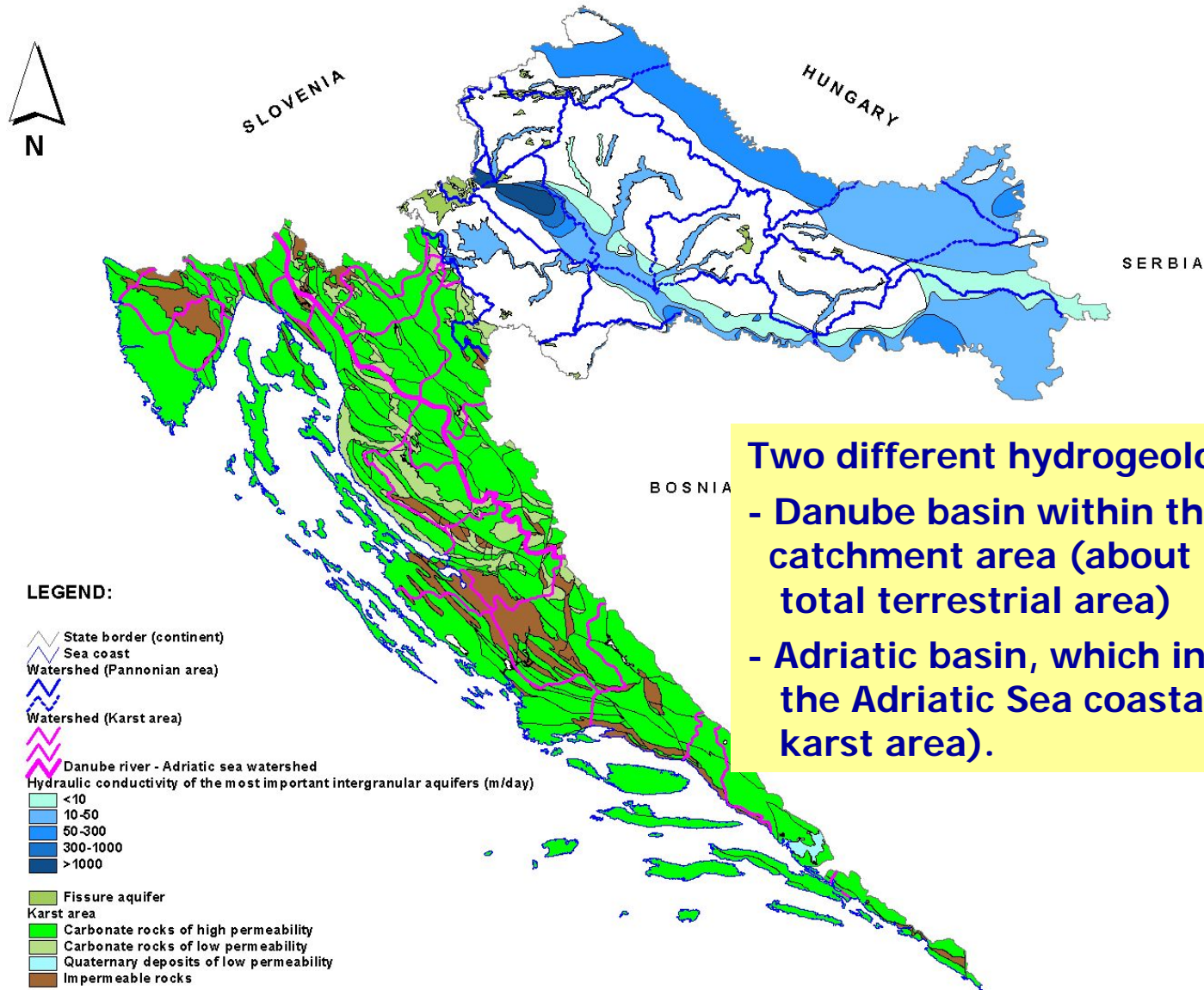
- has overall responsibility for performing activities related to management of national and local waters
- development of river basin management plans
- closely cooperates with local water companies in municipalities and counties
- coordinates and finances implementation of water quality monitoring of surface waters performed by authorized laboratories

Other Responsible Institutions

1. Ministry of Environmental Protection, Physical Planning and Construction
2. Ministry of Health and Social Welfare (drinking water quality)
3. Ministry of the Sea, Tourism, Transport and Development
4. Ministry of Finance

On the local level, municipal and county authorities are responsible for design and implementation of infrastructure projects, including water supply and wastewater collection and treatment systems.

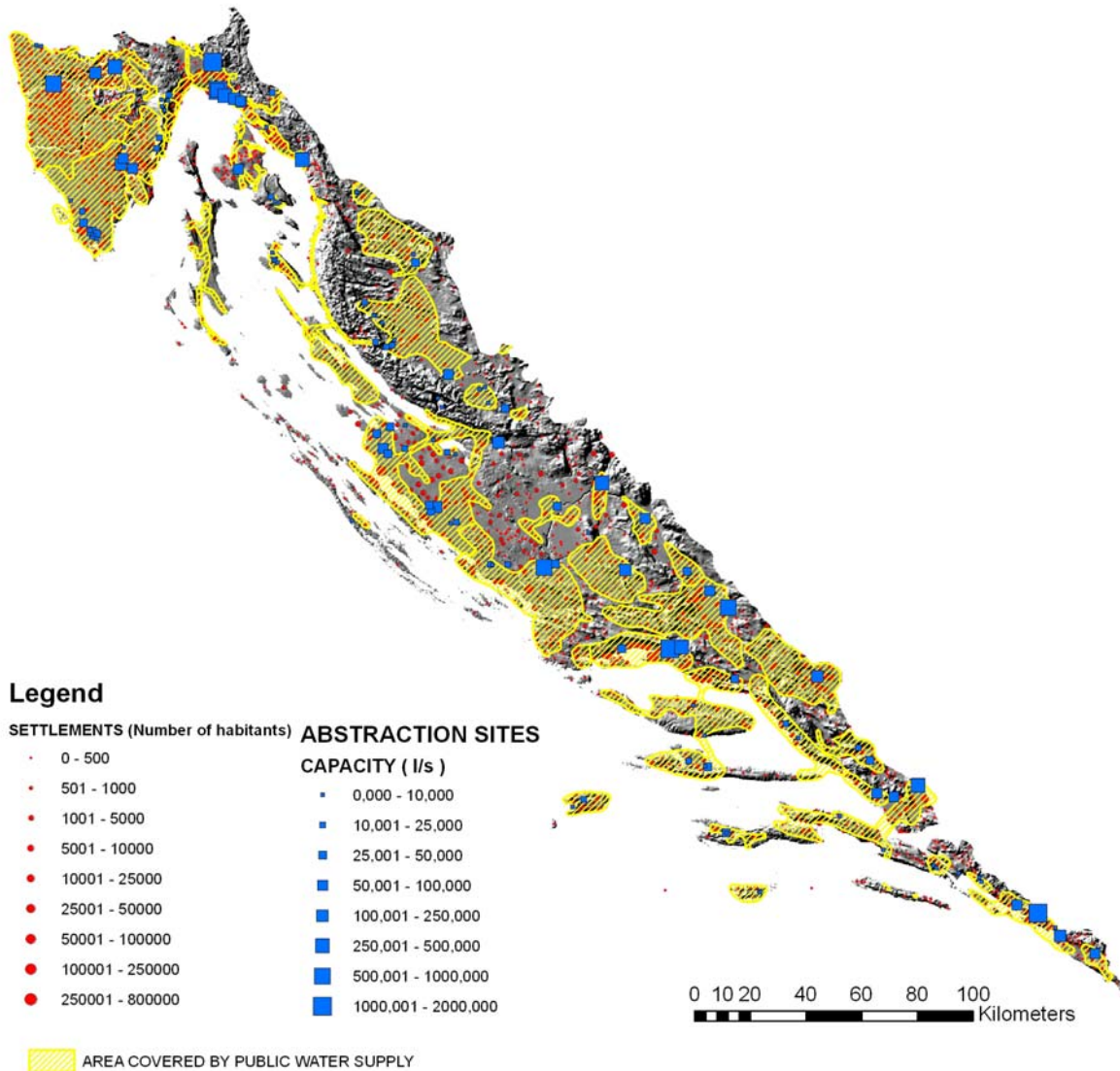
BASIC DATA



Two different hydrogeological units:

- Danube basin within the Black Sea catchment area (about 62 % of total terrestrial area)
- Adriatic basin, which includes the Adriatic Sea coastal area (mostly karst area).

UTILIZATION OF GROUNDWATER



DEVELOPMENT OF PUBLIC WATER SUPPLY SYSTEMS DEPENDS ON:

- POSITION OF SETTLEMENTS
- UNEVEN DISTRIBUTION OF RESOURCES
- TERRAIN RELIEF

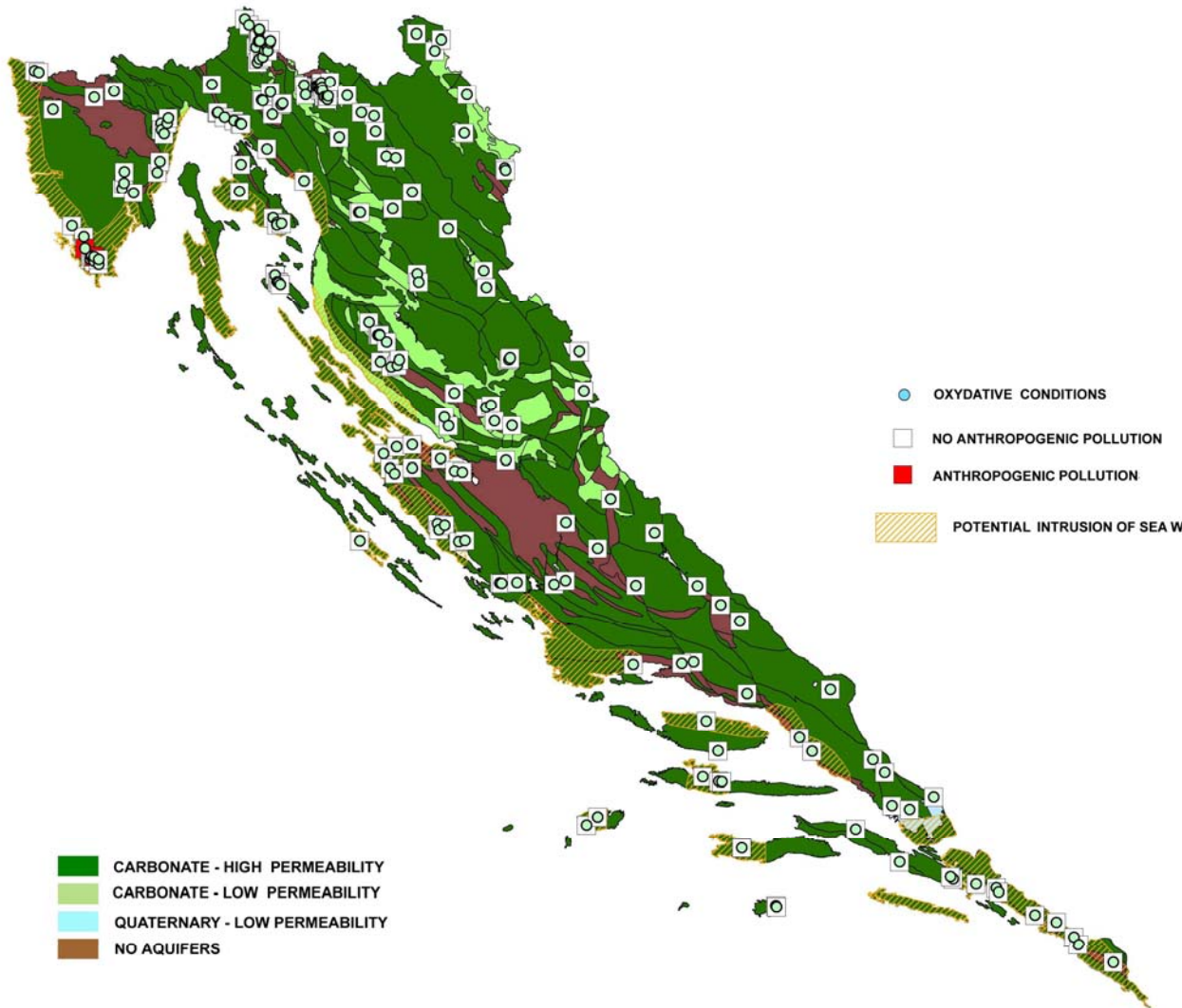
RESULTS:

- 86 % POPULATION COVERED BY PUBLIC WATER SUPPLY SYSTEMS
- PLANNED 90% COVERAGE BY 2015

PROBLEMS:

- LARGE DIFFERENCE IN DRINKING WATER DEMAND DURING TOURIST SEASON (UP TO 10 TIMES HIGHER)

QUALITY OF GROUNDWATER



- **GROUNDWATER QUALITY IS MONITORED AT ABSTRACTION SITES**
- **NATIONAL MONITORING SYSTEM IS UNFINISHED**
- **GROUNDWATER QUALITY IS GENERALLY VERY GOOD**

PROBLEMS:

- **INCREASED TURBIDITY AND MYCROBIOLOGICAL POLLUTION DURING FIRST RAINS, AFTER A LONG DRY PERIOD**

PROTECTION OF DRINKING WATER SOURCES

main condition of drinking water source protection -
establishment of water protection zones of the source and
implementation of planned protection measures

LEGAL FRAMEWORK OF PRESENT PROTECTION

- Water Act (95/05)
- Regulation on the establishment of sanitary protection zones for drinking water sources (2002)

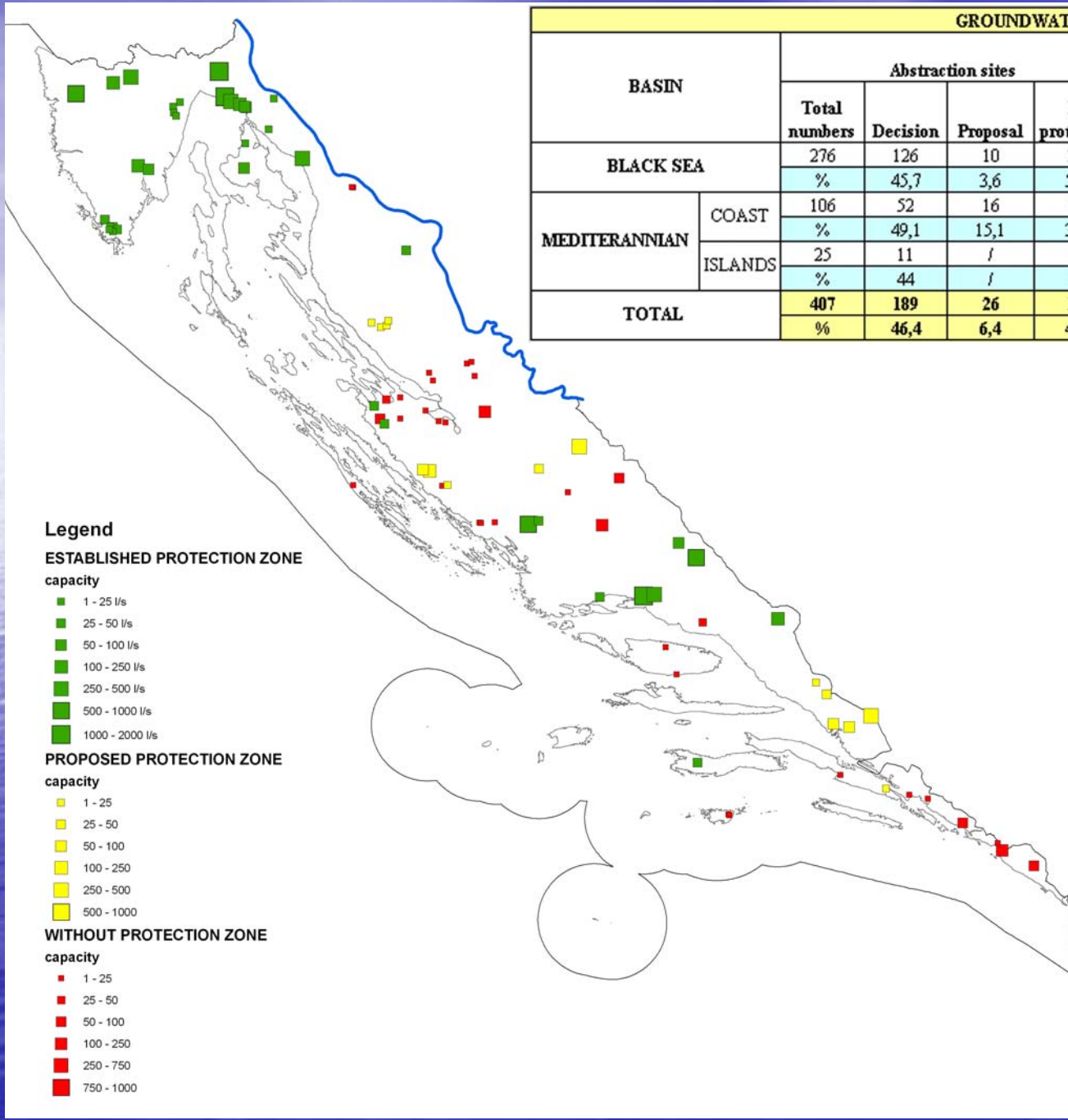
History

- Protection started in the 1970s
- First regulation in 1986
- Protection in karst areas (Article 4) – criteria for protection zones were defined by individual investigators for specific situations on case-by-case basis

Criteria for the definition of protection zones

Protection Zone		Groundwater flow toward pumping station	Apparent groundwater velocity (cm/s)	Necessary hydrogeological basis
Zone of strict protection regime	I A	Immediate area of pumping station	Must be fence protected	S 1:1,000
	I B	Immediate surface catchment	Must be marked with signs	S 1:1,000
Zone of strict restriction	II	24 h	Catchment's discharge zone > 3 cm/s	S 1:5,000
Zone of restriction and control	III	1 to 10 days	Assumed catchment's retention zone (GW flow velocity 1 to 3 cm/s)	S 1:25,000
Zone of limited protection	IV	10 to 50 days	GW flow velocity < 1 cm/s	S 1:50,000
Zone of special protection	Water protection reserve	Main recharge area	Mountainous area. Assumed catchment's recharge zone	S 1:50,000

- Multidisciplinary Commission for establishment of protection zones
- Decisions on protection zones are made by county assemblies
- **Transboundary problems - Harmonization**



GROUNDWATER											
BASIN	Abstraction sites				Decision		Proposal		No protection		
	Total numbers	Decision	Proposal	No protection	Q _{use} (l/s)	Q _{con} (l/s)	Q _{use} (l/s)	Q _{con} (l/s)	Q _{use} (l/s)	Q _{con} (l/s)	
BLACK SEA	276	126	10	140	10433	15079	170	182	1956	7605	
	%	45,7	3,6	50,7	83,1	65,9	1,4	0,8	15,5	33,3	
MEDITERRANIAN	COAST	106	52	16	38	7977	11297	905	1392	876	2247
		%	49,1	15,1	35,8	81,8	75,6	9,3	9,3	8,9	15,1
	ISLANDS	25	11	/	14	267	274	/	/	158	226
		%	44	/	56	63	55	/	/	37	45
TOTAL		407	189	26	192	18677	26650	1075	1574	2989	10078
		%	46,4	6,4	47,2	82,2	69,6	4,7	4,1	13,1	26,3

Legend

ESTABLISHED PROTECTION ZONE

capacity

- 1 - 25 l/s
- 25 - 50 l/s
- 50 - 100 l/s
- 100 - 250 l/s
- 250 - 500 l/s
- 500 - 1000 l/s
- 1000 - 2000 l/s

PROPOSED PROTECTION ZONE

capacity

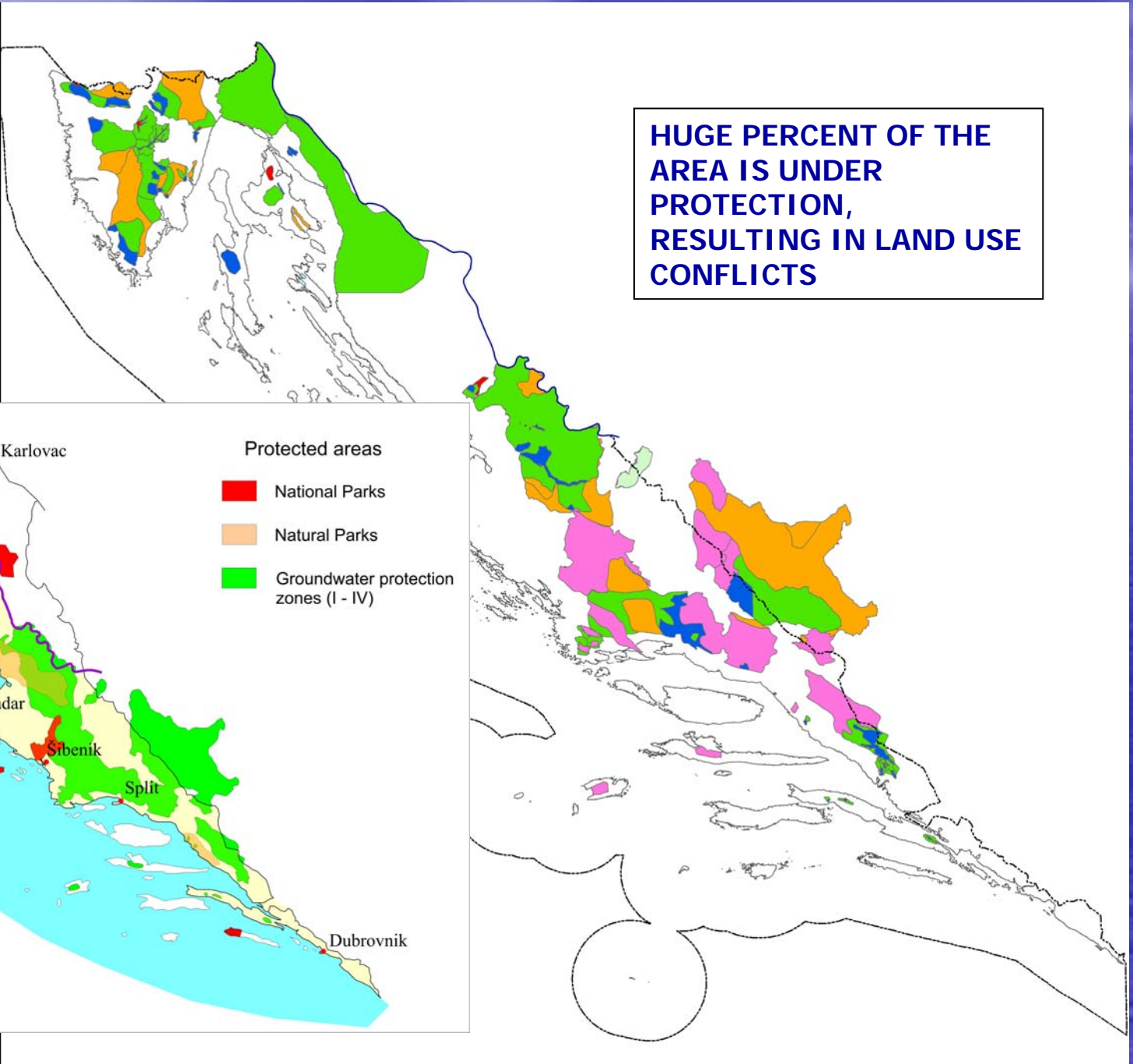
- 1 - 25
- 25 - 50
- 50 - 100
- 100 - 250
- 250 - 500
- 500 - 1000

WITHOUT PROTECTION ZONE




capacity

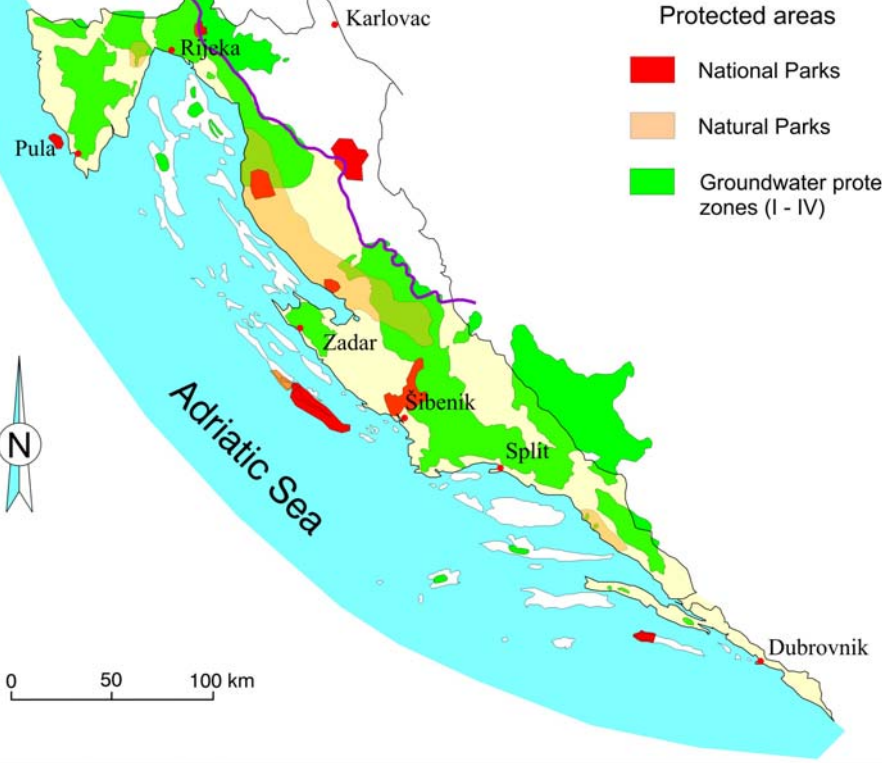
- 1 - 25
- 25 - 50
- 50 - 100
- 100 - 250
- 250 - 750
- 750 - 1000

HUGE PERCENT OF THE AREA IS UNDER PROTECTION, RESULTING IN LAND USE CONFLICTS

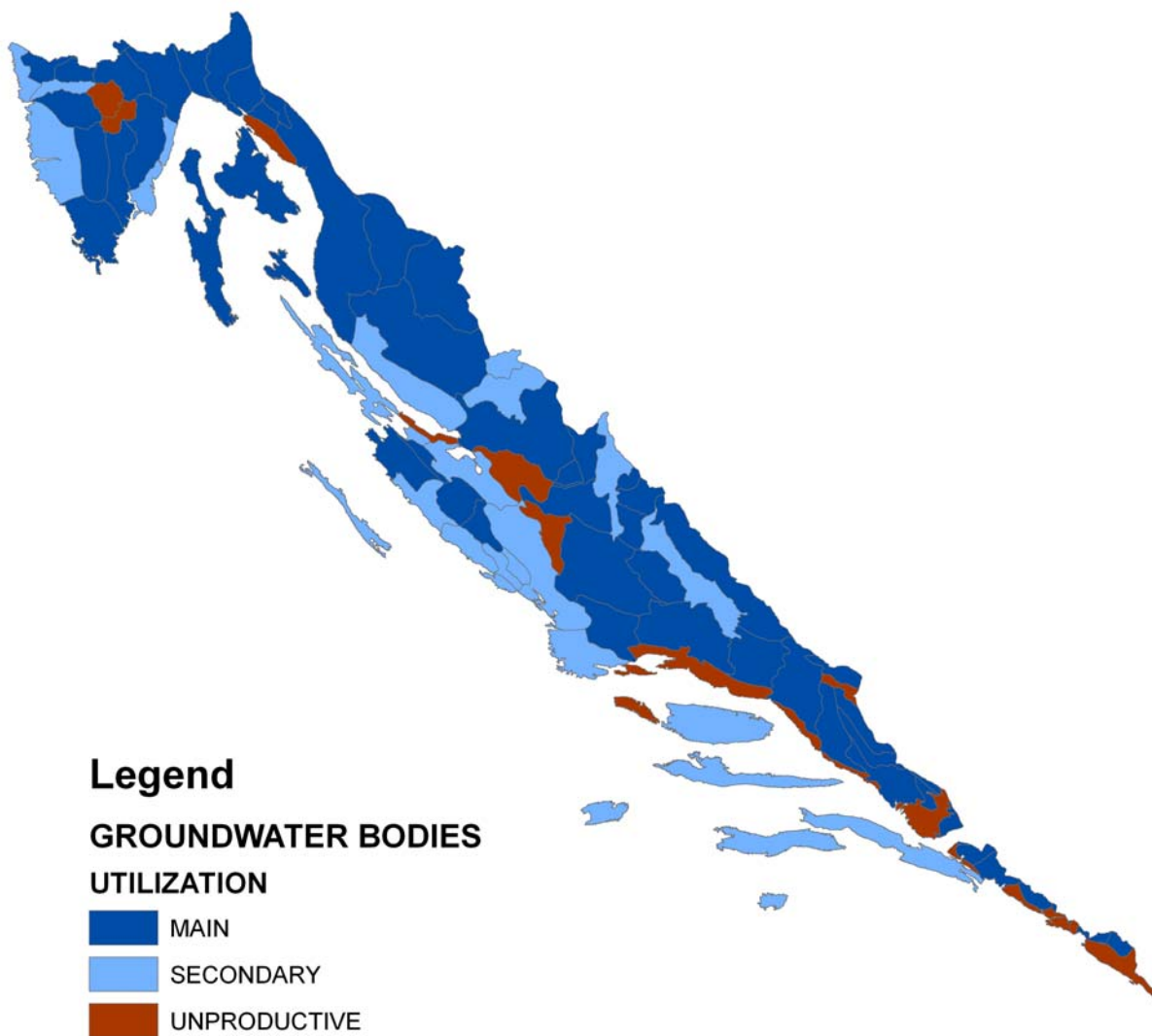


Protected areas

-  National Parks
-  Natural Parks
-  Groundwater protection zones (I - IV)



IMPLEMENTATION OF EU WATER FRAMEWORK DIRECTIVE IN CROATIA



- IMPLEMENTATION OF EU WFD STARTED IN 2002
- INITIAL GWB CHARACTERIZATION CARRIED OUT ON THE BASIS OF AVAILABLE DATA AND EXPERT ASSUMPTIONS
- GROUPING OF GWB'S PERFORMED
- RISK ASSESSMENT

ONGOING PROJECTS:

- MONITORING ESTABLISHMENT
- FURTHER CHARACTERIZATION OF GWB'S WHICH ARE DETERMINED AS AT RISK
- DEVELOPMENT OF MANAGEMENT PLANS

UNESCO

INTERNATIONAL HYDROLOGICAL PROGRAMME

PROJECT: "Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem – Regional Component: Implementation of agreed actions for the protection of the environmental resources of the Mediterranean Sea and its coastal areas,

COMPONENT 1

Integrated approaches for the implementation of the SAPS and NAPS: ICZM (Integrated Coastal Zone Mangement), IWRM (Integrated Water Resource Mangement) and management of coastal aquifers,

SUB-COMPONENT 1.1

"Management of Coastal Aquifers and Groundwater"

The aim of Sub-Component 1.1 is to discuss and demonstrate immediate and long term national coastal management issues, cost-effective development opportunities and capacities for regional dissemination as well as replicate the found solutions across the Mediterranean region.

The First Workshop on Mediterranean Coastal Aquifers programme, "Regional Strategies to manage and protect Mediterranean coastal aquifers" was organised in Chia-Laguna, Sardinia, Italy, 23-24 September 2006.

The Second Workshop on The "Management of Coastal Aquifers and Groundwater" was held in Zagreb, Croatia, 18 – 19 June 2007, with a field trip organized on 20 June. The participants included the UNESCO representatives as well as numerous Italian and Croatian experts.

The expected outcomes of the Workshop were to find opportunities for activities/demonstrations in Croatia for regional replication and dissemination/exchange and capacity building for regional replication.

The work was organized in two groups.

Group I. had the task to develop the consolidated work-plan for full UNESCO Sub-component 1.1: " Management of Coastal Aquifers, Groundwater and Land",

Group II. had to prepare the work-plan for aquifer vulnerability mapping and hydrogeological characterisation, and propose potential pilot aquifers and demonstrations.

RECOMMENDATIONS OF THE SECOND WORKSHOP

WORKING GROUP 1: Consolidated workplan for full UNESCO component “Management of Coastal Aquifers and Groundwater”

The group concluded that the workplan should include the following issues:

1. River basins (catchment areas) – areas of special interest are transboundary RBs
2. Sub-regions – Adriatic (Eastern Coast), North Africa, Middle East
3. Exchange and capacity building, including networks, forums, etc.
4. Full recognition of importance of replications (model application)
5. Inventory assessment of coastal aquifer resources in Croatia
6. Exchange of risk assessment studies in the Mediterranean
7. Approximation (harmonization) of the European system and directives (WFD) – integrated Mediterranean system
8. New issues and specific objectives within the objectives of the Project
9. Ecohydrology and integrated water resources
10. Considerations of impacts of climate change on coastal aquifers and coastal ecosystems
11. Land-based sources – interaction between continental and sea water (seepage of pollutants into the sea, eutrophication)
12. Vulnerability to emerged and submerged coastal pollution

RECOMMENDATIONS OF THE SECOND WORKSHOP

Addressing the specific situation in Croatia, the group made the analyzed the present state and issues of interest:

1. Existing National Water Protection Plan (Croatia)
2. Involvement of the Marine and Coastal Protection Unit - Ministry of Environmental Protection, Physical Planning and Construction into the Project
3. Ecohydrology – the Neretva River delta (wetlands) – coastal aquifer system
4. Potential replication in Albanian coastal wetlands
5. Establishment of optimal monitoring system for coastal GW
6. Sustainable management of coastal aquifers as a factor of coastal areas development

Due to the possible selection of Croatia as the location for the pilot project, the following suggestions were made:

1. Croatia – case of adaptation to the EU directives, coastal River Basin concept
2. Legislation for coastal aquifer protection and land use, with particular attention to water supply for small communities
3. Considerations of common guidelines, including institutional organization at regional level, for coastal aquifers, groundwater, surface waters and land
4. Coordination mechanism for the Project implementation

RECOMMENDATIONS OF THE SECOND WORKSHOP

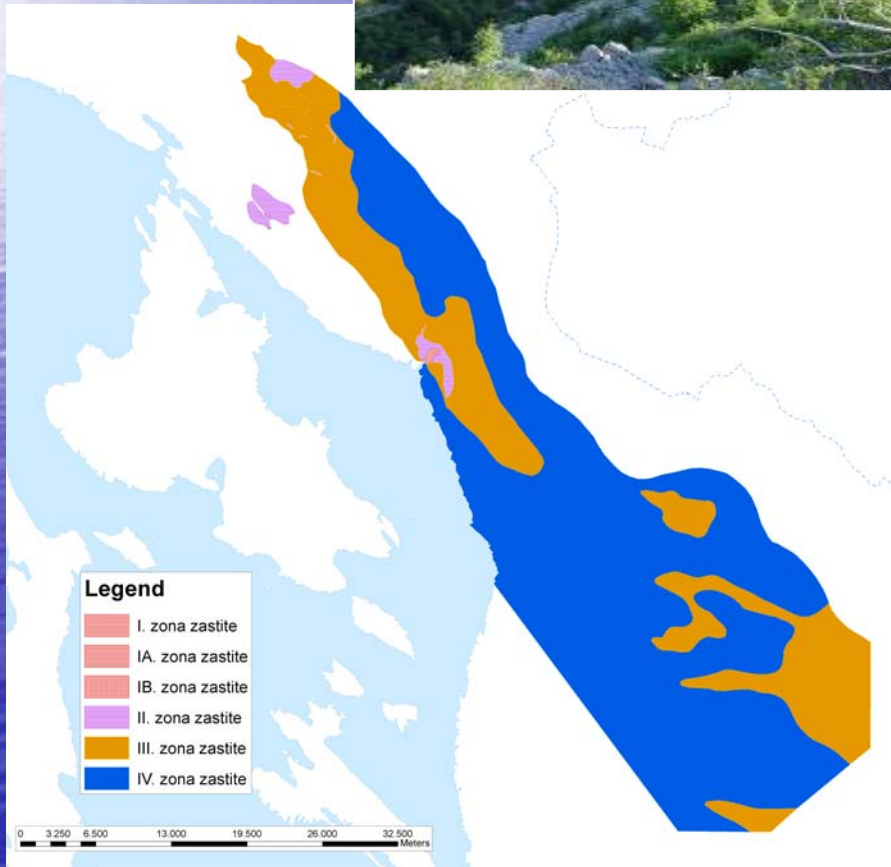
Working group 2: “Vulnerability mapping and hydrogeological characterization – pilot aquifers and demonstrations”

Group 2 considered mostly technical aspects of the topic, and suggested the following list of activities:

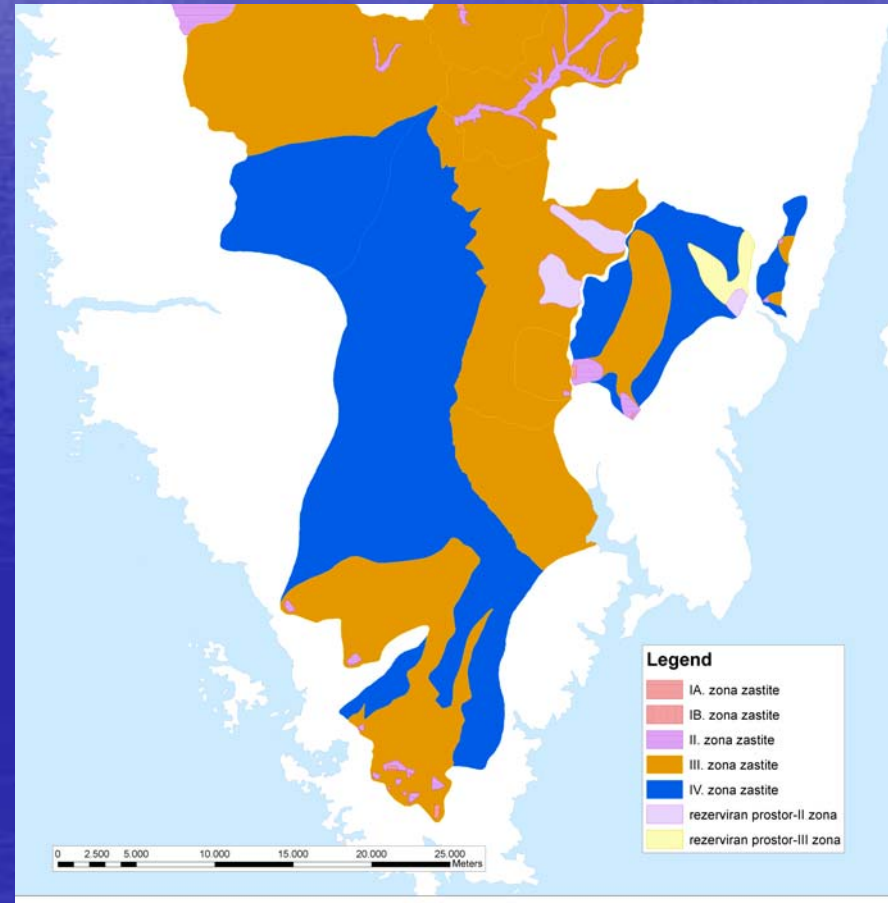
1. Preparation of a check-list of data and attributes of data (resolution, type of data support, etc.)
2. Preparation of state-of-the-art availability of data quantity and quality, gaps, and necessary data to assess potential risks and vulnerability (Croatian partners in general) – preliminary work
3. A working meeting with Croatian, Italian and other Mediterranean experts to study the feasibility of the proposed pilot projects – proposed date: beginning of 2008
4. Short training courses on vulnerability mapping and risk assessment for technical staff and experts from Croatian institutions, including universities
5. Elaboration of vulnerability maps in the selected case study and technological tools (GIS, databases, Internet map service, etc.)
6. Elaboration of methodological approach for assessment of risk and uncertainty based on the experience acquired within the case study
7. Organization of ad hoc and coordination meetings between partners
8. Organization of regional workshops for dissemination of results and best experiences in view of regional replication

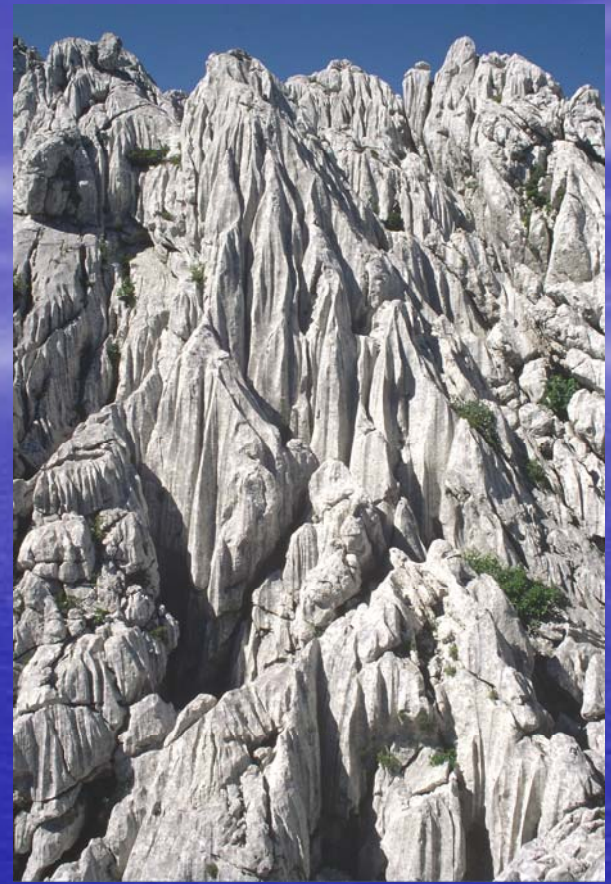
POTENTIAL PILOT PROJECT AREAS:

1. THE CATCHMENT AREA OF NOVLJANSKA ŽRNOVNICA



2. THE PULA AREA





THANK YOU
FOR YOUR ATTENTION

