

ISARM 2010 International Conference  
Side event: GEF and UNESCO-IHP  
December 2010

GEF-UNDP-UNESCO  
*Protection and Sustainable Use of  
the Dinaric Karst Aquifer System  
(DIKTAS)*

A. MERLA & N. KUKURIC



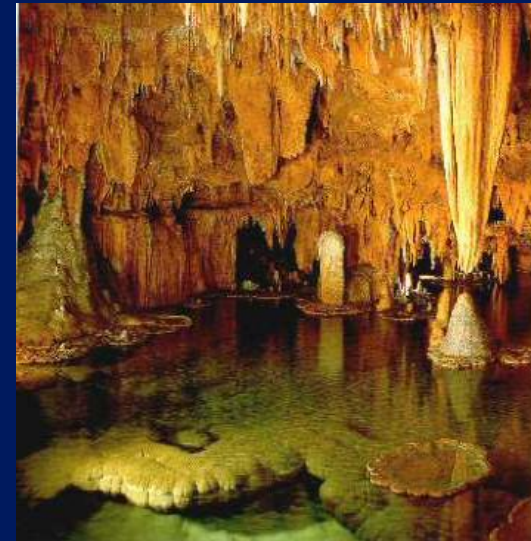
# Wat is karst?

- The term “karst” is applied to a specific geological environment and morphology that develops wherever limestone formations, or other carbonate rocks, constitute the bulk of the geological substratum of a region and outcrop over extensive areas.
- Due to their solubility, these rock formations develop high permeability along fractures and faults, with the formation of bare, rocky surfaces, sinkholes, caverns and underground streams.



# Wat is Karst?

- **Karst” hydrogeology is characterized by high fracture controlled permeability, almost total absence of surface drainage (which has been largely diverted into subterranean routes), high infiltration rates and rapid underground flows of groundwater.**



# Karst Waters

- A lot of rain: max. annual precipitation measured at Crkvice, in the karst above the Gulf of Kotor, is 4928 millimetres.



**Trebisnjica, last winter**



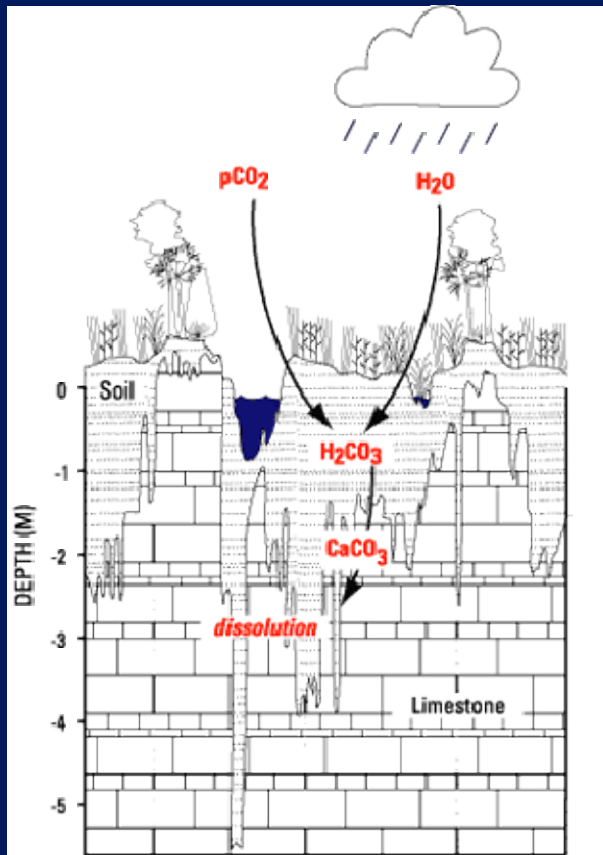
# Karst Waters

- But when a summer comes we need to search for water..



# Karst: Why and How?

- A special type of geologic environment that is formed by the dissolution and corrosion of soluble rocks, such as limestone and dolomite.





# Karst: Why and How?

- Various theories of karst development, various types, various models...

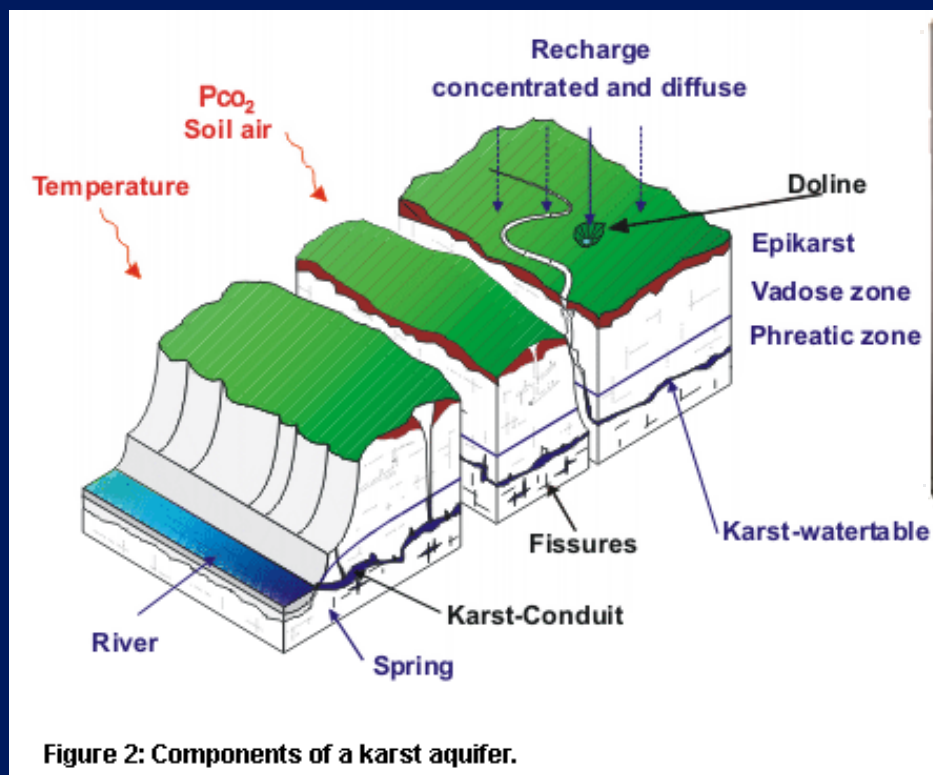
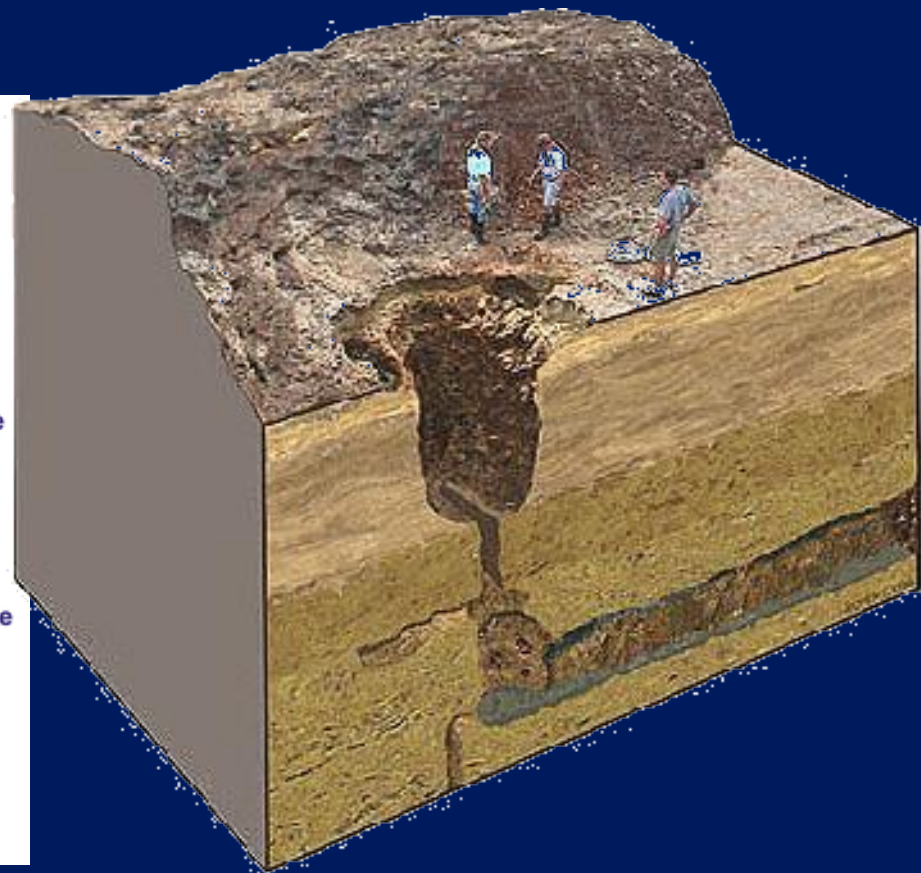
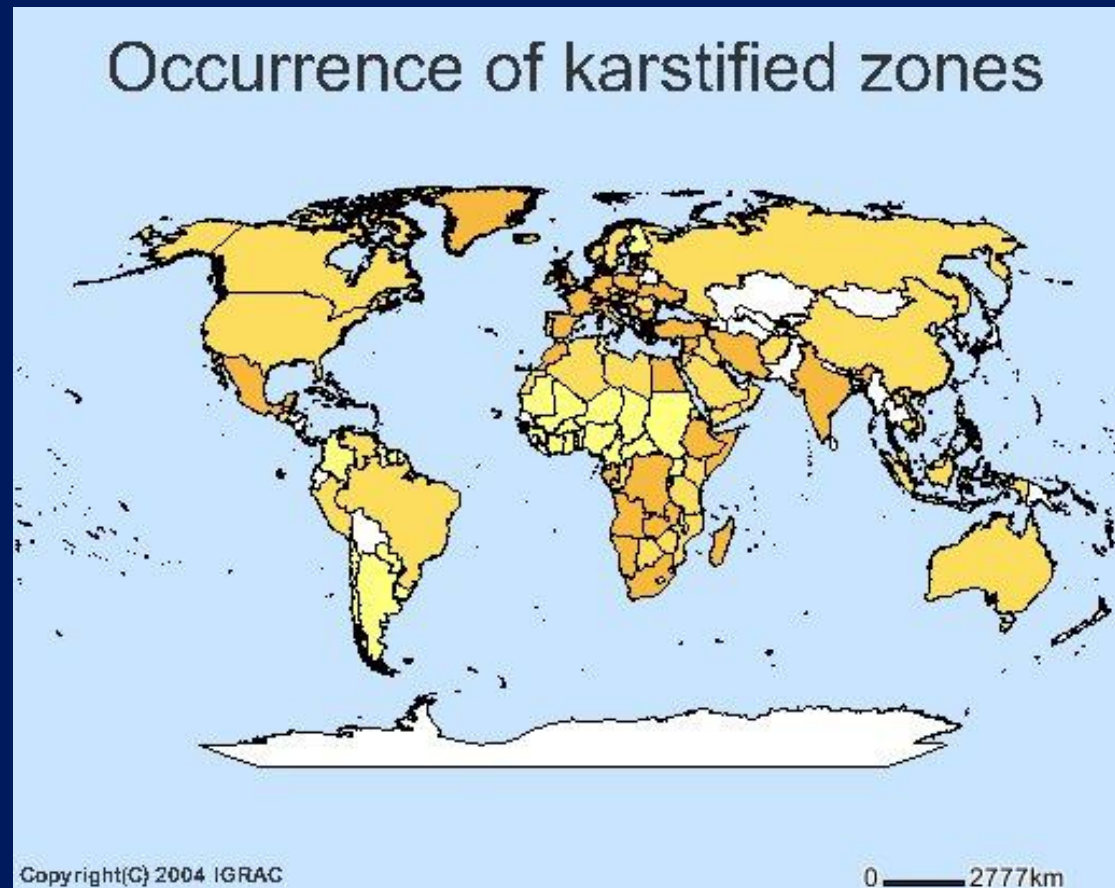


Figure 2: Components of a karst aquifer.



# Karst: Where?

- More than 25 percent of the world's population either lives on or obtains its water from karst aquifers





# Karst: Where?

- **Example: In the United States, 20 percent of the land surface is karst and 40 percent of the groundwater used for drinking comes from karst aquifers**

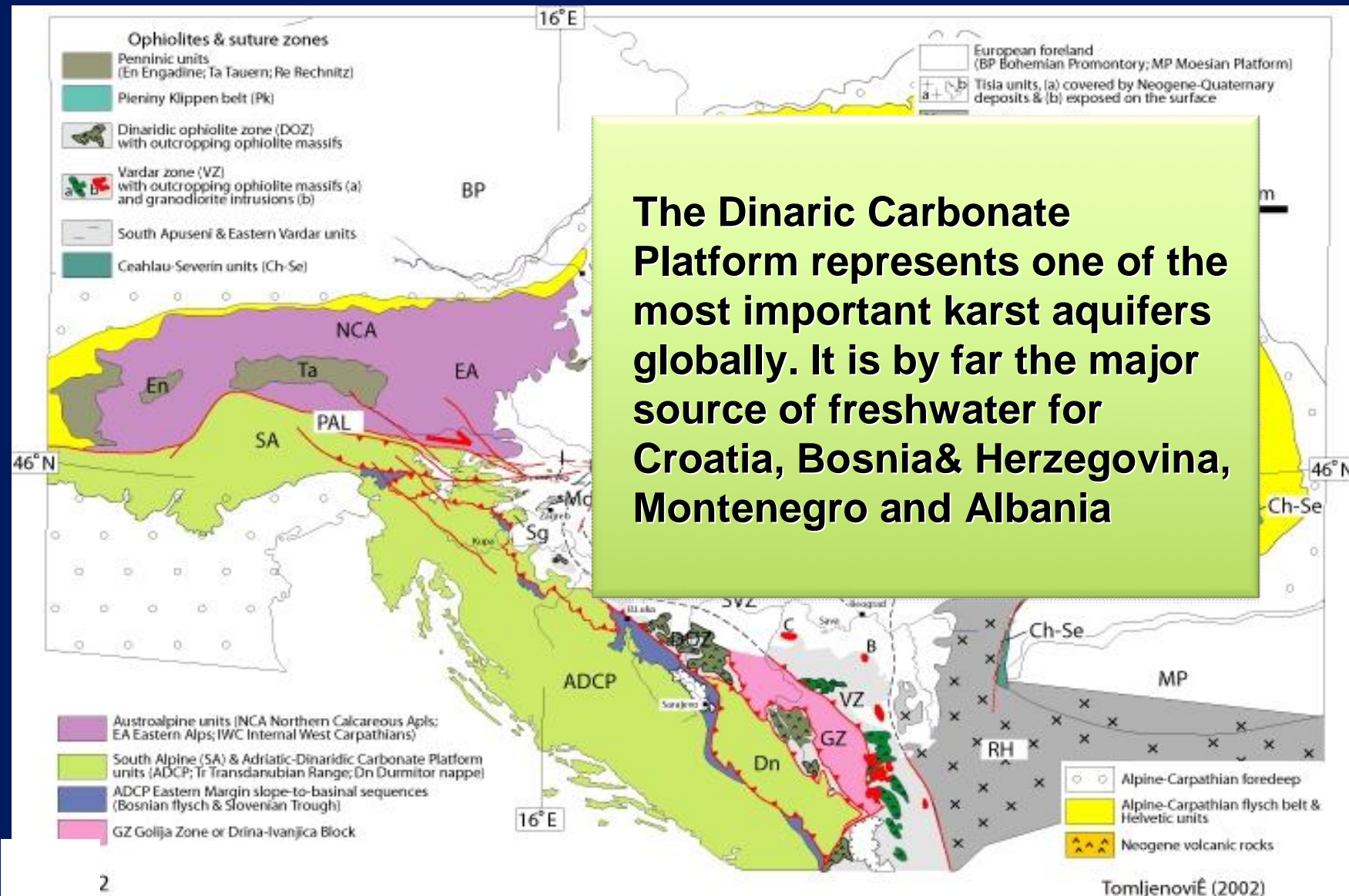


# Karst Challenges

- **The impacts of human activities (and climate change)**
  - **Environmental impact**
    - severe spring discharge change, groundwater quality deterioration, endemic fauna endangering, waste disposal failures, induced seismicity, induced sinkholes, ground subsidence, etc...
  - **Socio-economical & political impact**
- **Limited knowledge on karst hydrogeological systems and their behaviour**



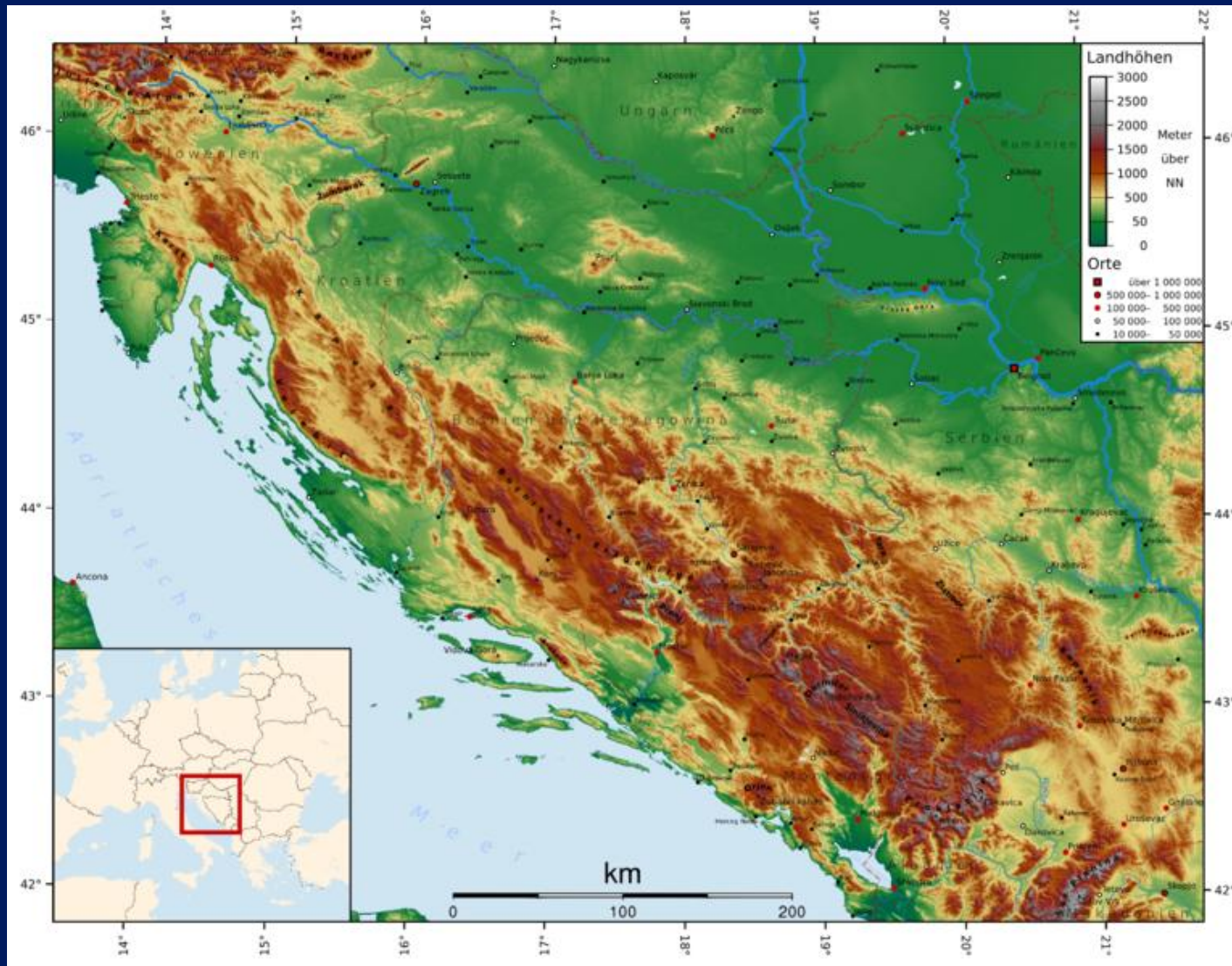
# THE PROJECT AREA



**The Dinaric Carbonate Platform represents one of the most important karst aquifers globally. It is by far the major source of freshwater for Croatia, Bosnia & Herzegovina, Montenegro and Albania**



# Dinaric Alps



# Dinaric Alps



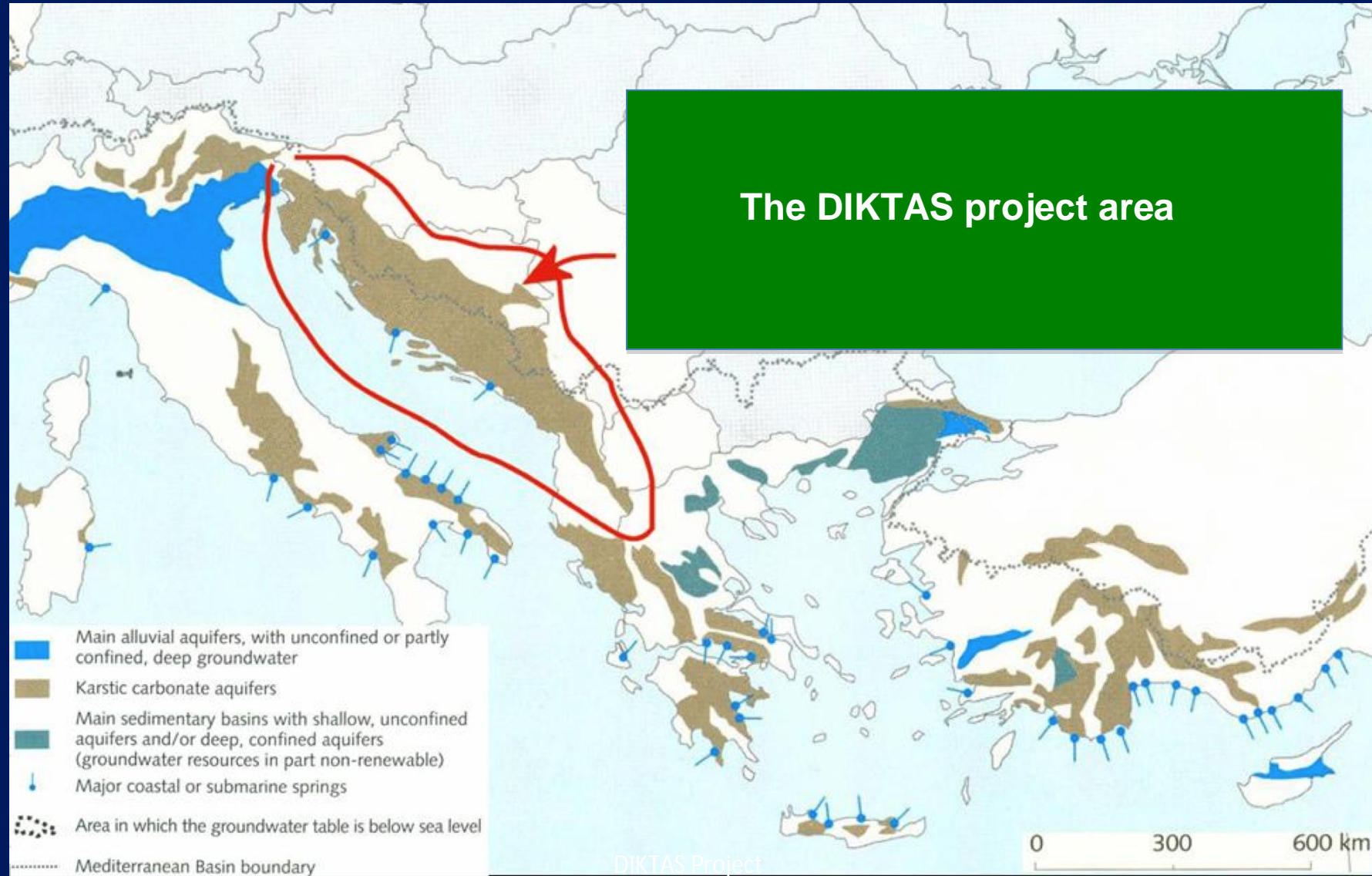


# Dinaric karst





## Karst aquifers are widespread in the Mediterranean region



**The dominant groundwater flow is towards the Adriatic Sea, while the northern part drains to the Sava river basin.**

**The gradient is steep, descending from well over 1000 m of altitude, down to 100-200 m asl, creating a very favorable environment for hydropower generation.**





## The Karstic Landscape of the Project Area



**Groundwater eventually enters the coastal area through few rivers (Neretva, Cetina, Trebisnjica, and others) and more importantly through strong submarine groundwater flows that characterize the coastal areas of Istria and Dalmatia.**



**The total amount of groundwater entering the coastal environment with its load of nutrients and other contaminants is not known, but certainly very large: it is estimated that karstic groundwater is the largest source of freshwater entering the Adriatic Sea.**



**Identifying clear distinctions between groundwater and surface water in a karstic geological environment is hardly feasible and probably meaningless in terms of water resources management.**

**The simple setting up of River Basin Authorities or Agencies in application of international guidelines, or of the EU Framework Directive, will not *per se* allow the integrated surface-groundwater management essential to reach sustainability.**



# The regional challenge

The rise of several new sovereign states from what was once one nation determined complex transboundary inter-linkages that impact water use and water sharing for power generation, agricultural, domestic and other purposes between bordering countries.





## Transboundary Issues in DIKTAS region

(i) lack of full understanding of the the resource, and of recognition of the system boundaries

(ii) lack of a conceptual framework for balancing the various demands on the resources;

(iii) the lack of harmonized multi-country policies regulating land-use and physical planning throughout the karstic region in view of the aquifer's high vulnerability to contamination;

(iv) the negative impacts of hydraulic infrastructure that are causing conflicts among user/regions/countries;

(v) the potential impacts of climate change, such as excessive variability in rainfall patterns, flooding etc.



# HOW WE GOT HERE

The Dinaric Karst Aquifer recognized as a transboundary system

Country experts agree on need for project and on overall project framework

Country officials recognize and endorse UNDP/UNESCO initiative Vs GEF

Preparation Phase lasted one year, from November 2008 to October 2009, with meetings in Podgorica, Sarajevo, Zagreb

Final Preparation meeting in Venice October 2009

Approval of Project Concept (PIF) by the GEF Council, 4/2008

Countries agree on Project Document and commit to co-financing contribution

GWP/GEF Roundtable on Shared Groundwater in SE Europe Brdo, Slovenia, 2007

UNDP as Implementing Agency entrusted to UNESCO IHP the execution of Project Preparation

UNESCO ISARM Conference - South Eastern Europe - Thessaloniki 2004

UNESCO Dinaric Karst Workshop - Belgrade 2006

# THE PROJECT'S GLOBAL OBJECTIVES

The project is the first ever attempted globally to introduce sustainable integrated management principles in a transboundary karstic freshwater aquifer of the magnitude of the Dinaric Karst System.

The Dinaric Karst Aquifer System, shared by many countries and one of the world's largest represents an ideal opportunity for applying new and integrated management approaches to these unique freshwater resources and ecosystems.





**At the global level the project aims at focusing the attention of the international community on the huge but vulnerable water resources contained in karst aquifers which are widespread globally, but poorly understood.**

# THE PROJECT'S REGIONAL OBJECTIVES

1

To improve in all countries sharing the aquifer, the understanding of the groundwater resources of the Dinaric Karst Aquifer System

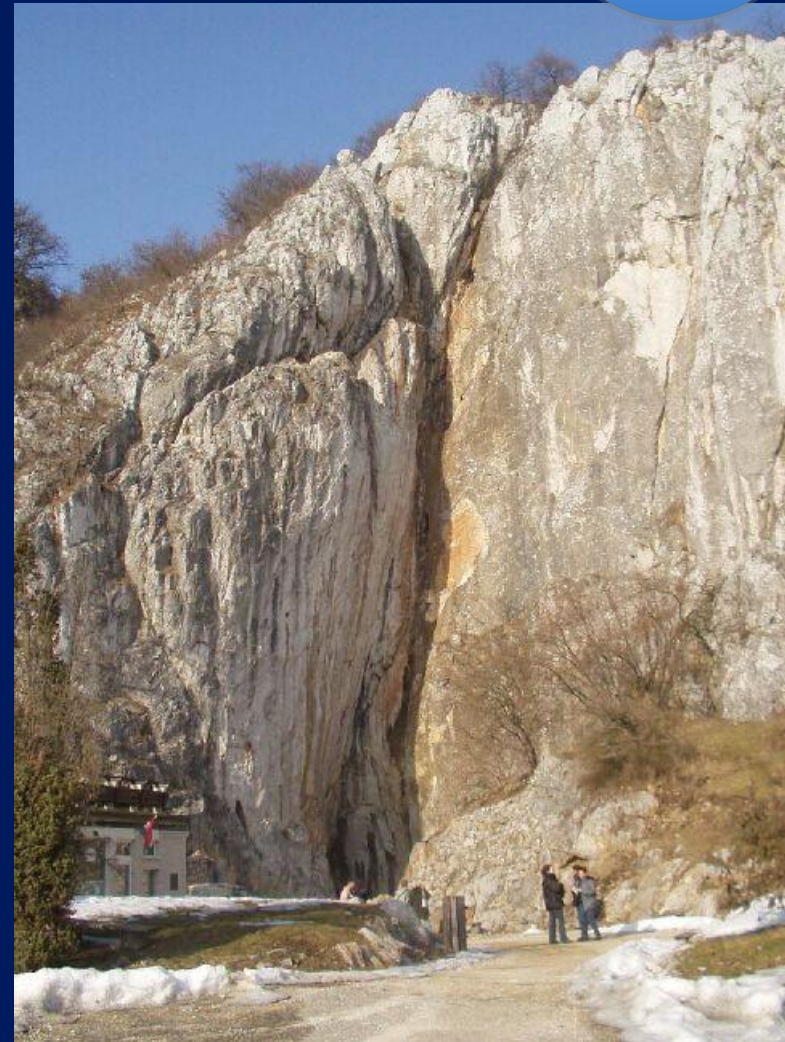




# THE PROJECT'S REGIONAL OBJECTIVES

2

To facilitate the equitable and sustainable utilization of the water resources of the Dinaric Karst Aquifer System





## THE PROJECT'S REGIONAL OBJECTIVES

3

To protect the unique groundwater dependent ecosystems that characterize the Dinaric Karst region





The wetlands of the  
Neretva Delta



## EXPECTED OUTCOME 1

COUNTRIES RECOGNIZE  
THE KARST AQUIFER  
SYSTEM AS A SHARED  
AND HIGHLY  
VULNERABLE RESOURCE,  
AND AGREE TO TAKE  
STEPS TO DEAL WITH ITS  
TRANSBOUNDARY  
IMPLICATIONS





**A Transboundary Diagnostic Analysis (TDA)  
prepared and approved by countries:  
transboundary problems and root causes  
identified and options for interventions to address  
national and trans-boundary problems proposed**

## **Map of the Dinaric Karst Aquifer System TDA - Transboundary Diagnostic Analysis**



**Testing of management models or approaches at the local level with increased awareness, improved management capacity, and knowledge generated and utilized by local communities**

Cooperation with the GEF Small Grants Program

Pilot demonstration sites/areas/sub-systems of the DIKTAS



Baseline conditions identified, and environmental status indicators agreed upon and adopted:  
Countries agree on a common vision for the DIKTAS, and join forces in a long term monitoring effort

**SHARED VISION**

**ENVIRONMENTAL  
STATUS INDICATORS**





## EXPECTED OUTCOME 2

THE STRENGTHENED COLLECTIVE KNOWLEDGE AND COORDINATION AMONG DEVELOPMENT PLANS OF COUNTRIES, PROJECTS, AGENCIES AND DONORS, IMPROVES SUSTAINABILITY OF THE RESOURCE

**ESTABLISHMENT OF A  
CONSULTATION AND  
INFORMATION  
EXCHANGE BODY (CIE)**



## SYSTEMATIC COORDINATION WITH OTHER PROJECTS IN THE REGION

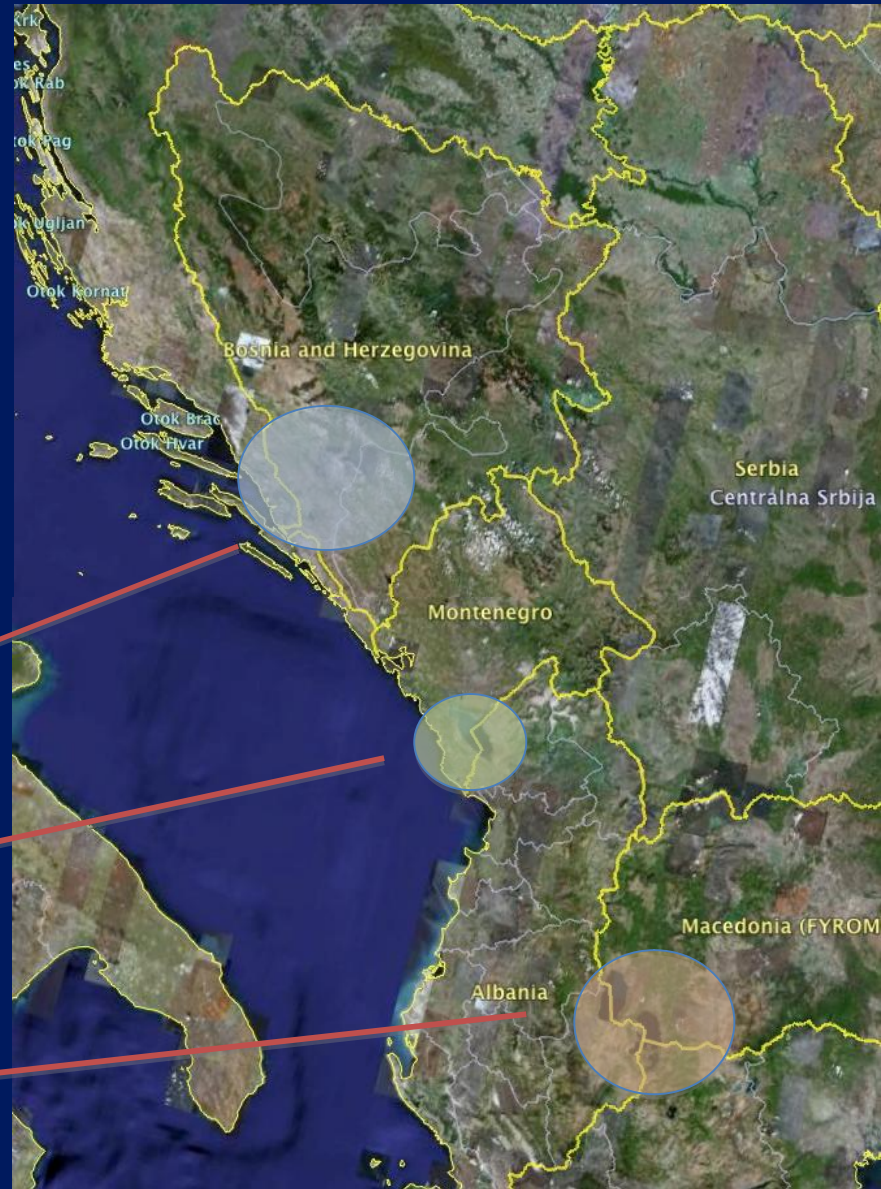
Among them the  
following GEF funded  
activities

Mediterranean Coastal Aquifers , a  
Component of the Mediterranean  
Partnership – UNEP-UNESCO

Neretva and Trebisnjica  
Basin Management –  
World Bank

Lake Skadar/Shkodra  
Ecosystem Protection –  
World Bank

Lake Ohrid and Prespa  
Management – World  
Bank



## EXPECTED OUTCOME 3

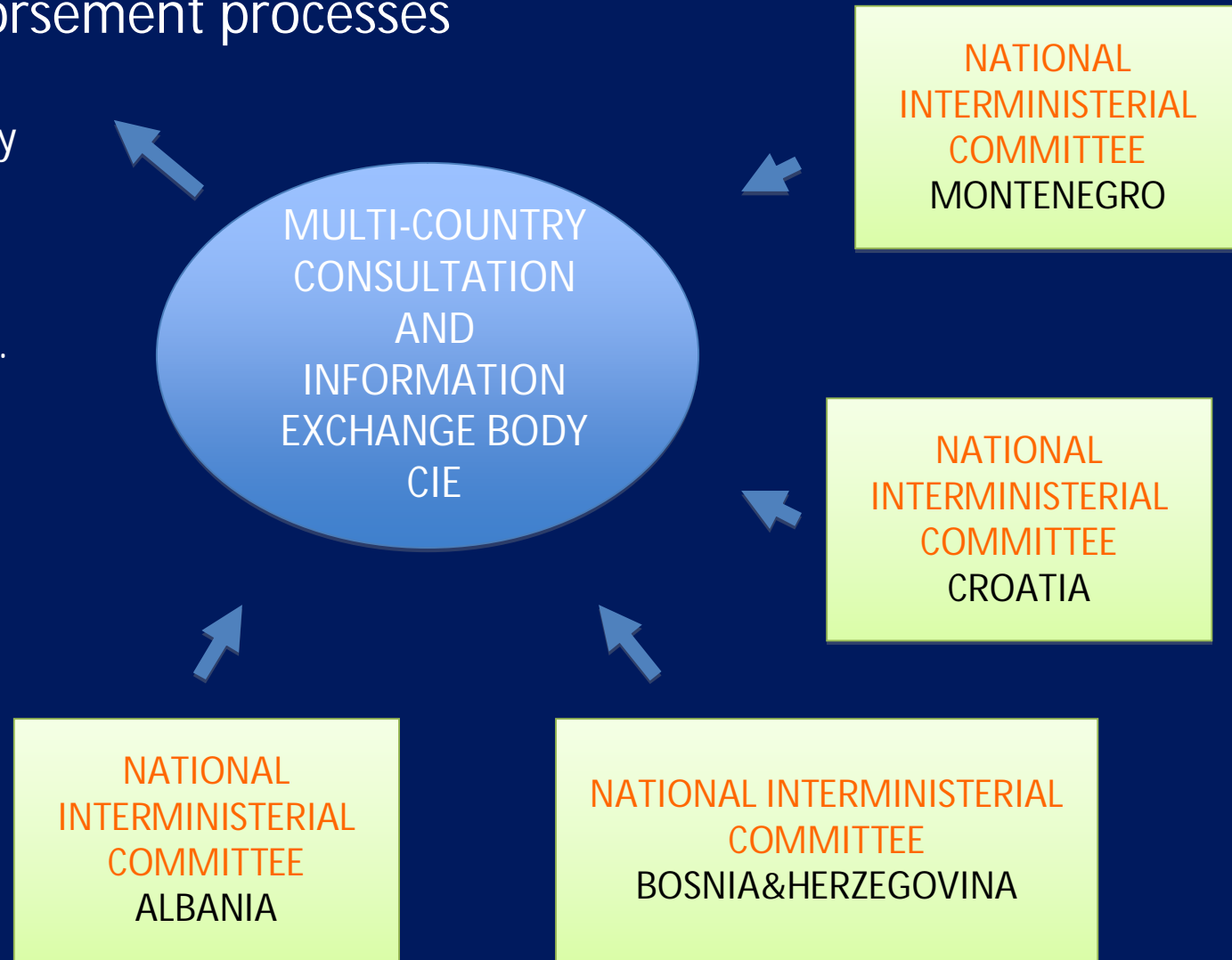
POLITICAL COMMITMENT  
REACHED AMONG  
COUNTRIES ON  
IMPLEMENTING PRIORITY  
LEGAL, INSTITUTIONAL AND  
POLICY REFORMS FOR THE  
PROTECTION AND  
EQUITABLE UTILIZATION OF  
THE KARST AQUIFER SYSTEM





# TDA Approval and Strategic Action Program endorsement processes

Commitment to Environmental Quality Objectives (EQO), Environmental Status Indicators and their long term monitoring.



# EXPECTED OUTCOME 4

LONG TERM SUSTAINABILITY OF ACHIEVEMENTS ENHANCED THROUGH PUBLIC AND POLITICAL AWARENESS CAMPAIGNS, STAKEHOLDER INVOLVEMENT AND REPLICATION MECHANISMS



Edwards Aquifer Authority

The Edwards Aquifer  
Manage, Enhance, Protect

Today's Level 681.9  
(Brewer County index Well)  
Update on 11/7/2007

Go to Other Wells and Springflow Rates

**EDWARDS AQUIFER AUTHORITY BOARD APPOINTS NEW GENERAL MANAGER**  
Robert W. Adams  
Long-time Deputy GM Danielson Named to Fill Top Post

**SAN ANTONIO (August 14, 2007)**  
The Edwards Aquifer Authority Board of Directors, at its regular meeting August 14, voted to name Robert W. Adams as the agency's next general manager. Danielson will succeed Robert Adams, who announced his resignation earlier this summer. Adams will officially assume the responsibilities of general manager November 1, 2007. A formal employment contract is approved. In the meantime, Pullis will continue to serve as general manager through the end of the month to facilitate the transition in leadership. More

The Edwards Aquifer Authority manages, enhances, and protects the Edwards Aquifer, one of the major groundwater systems in Texas serving approximately 1.7 million people. This expansive, natural underground water resource extends 180 miles from Brackettville in Kinney County to Kyle in Hays County. While the Edwards Aquifer serves as the primary source of water to a growing region of south central Texas, it also supports a unique ecosystem of aquatic life, including several threatened and endangered species. Cities, towns, rural communities, and farm and ranch lands all depend on the aquifer's water for household, agricultural, industrial and recreational purposes. This diversity of uses illustrates the vital role the aquifer plays in sustaining the lives and livelihoods of residents in the Edwards Aquifer region.

**MEETINGS, HEARINGS & WORKSHOPS**

- Board Meetings
- Committee Meetings
- Meetings and Hearings
- Authority Workshops

**RULES**

- Hazardous Materials Storage

**JUST ADDED**

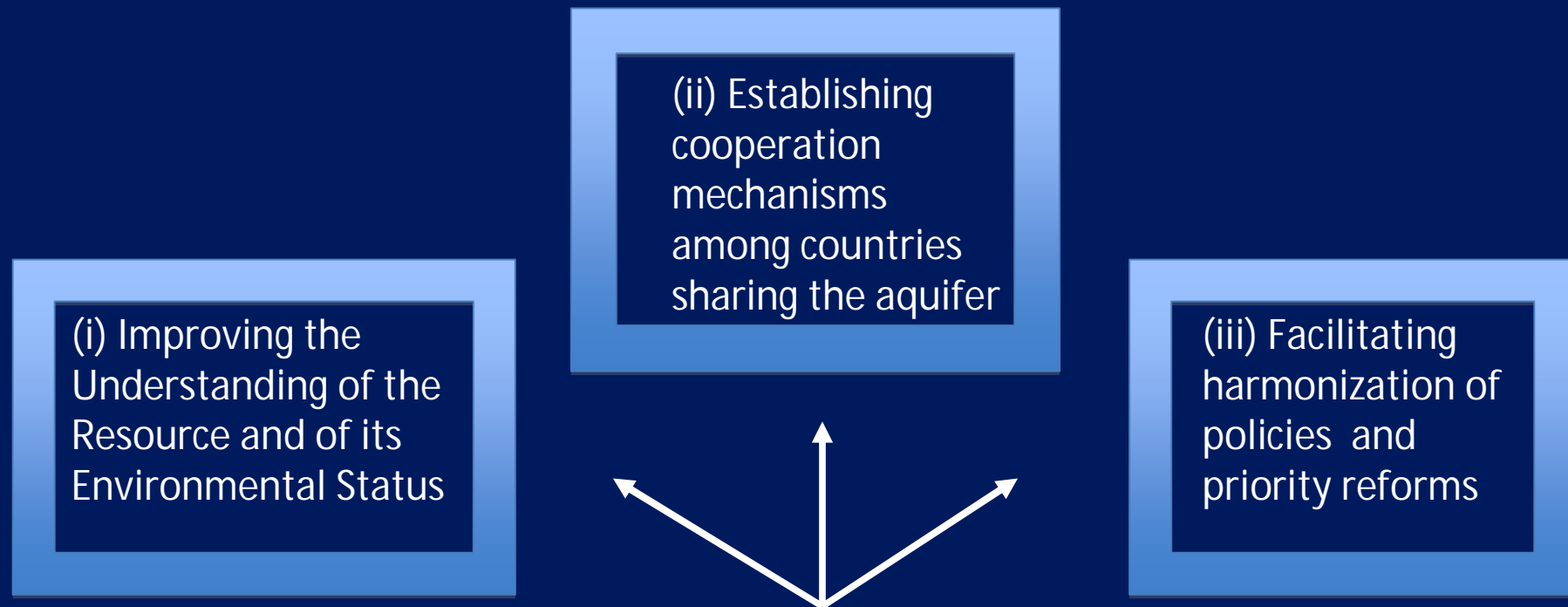
- Dr. Calvin Alexander Lecture
- Notice of Public Hearings
- 2008 Proposed Budget
- EAA Act
- Article 12
- Well Registration Form
- Fringe Management Cost Share Program
- 2006 Annual Report

**PHOTO GALLERY**

Go to Photo Gallery

<http://edwardsaquifer.org/index.asp>

The Stakeholder Participation, Consultation and Communication Strategy represents a key element of the project, and will be instrumental in the achievement of all project objectives and outcomes.



**Stakeholder Participation, Consultation and Communication**



# Bridging the people

