

# RECENT ADVANCES IN TRANSBOUNDARY GROUNDWATER MANAGEMENT IN THE BALKANS

by

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<http://www.inweb.gr>





# PRESENT AND FUTURE WATER SITUATION FOR WORLD POPULATION

**Enough Water Available**  
92 %

**Enough Water Available**  
58 %

**Water Deficiency**  
3%

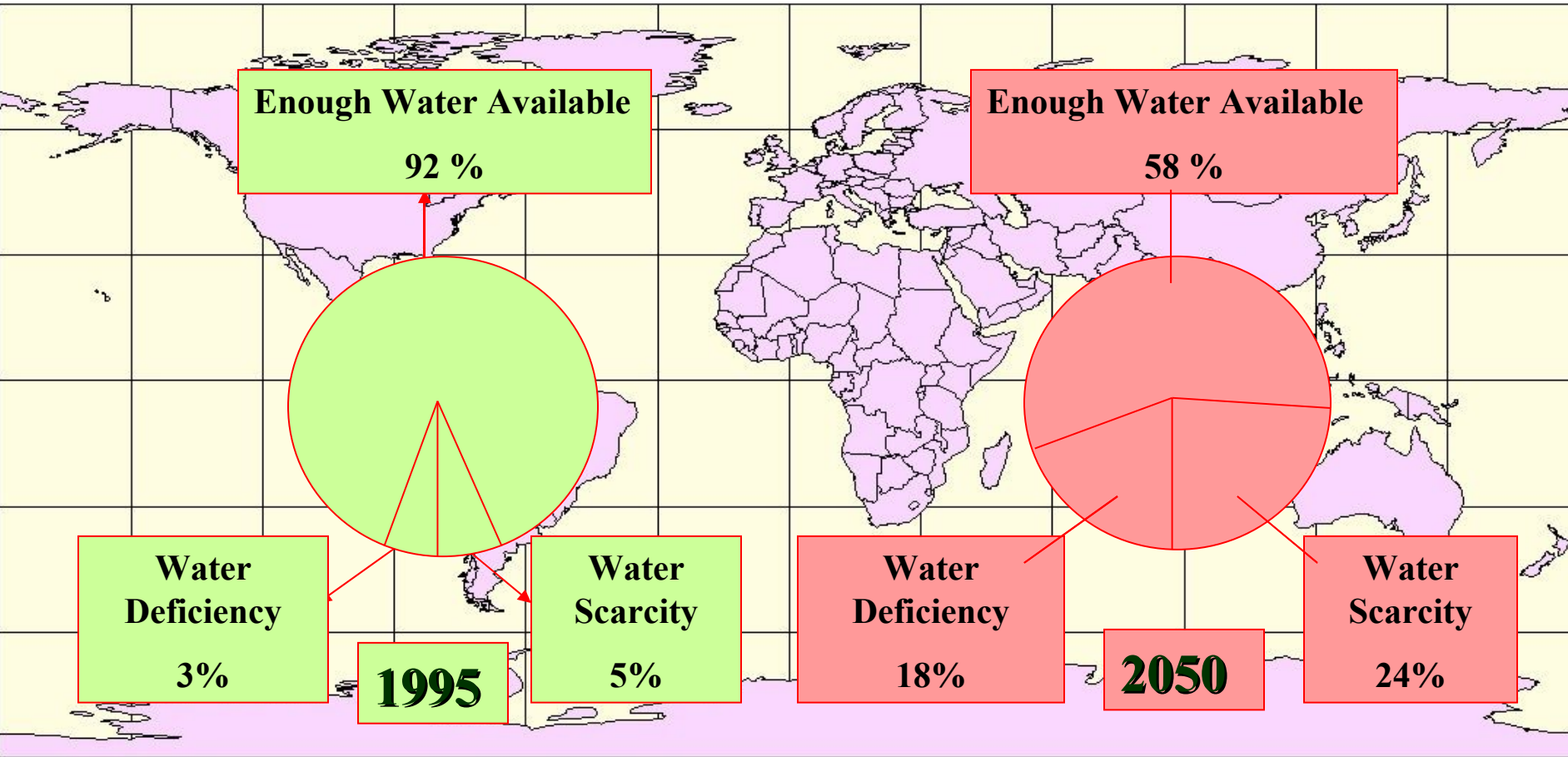
**Water Scarcity**  
5%

**1995**

**Water Deficiency**  
18%

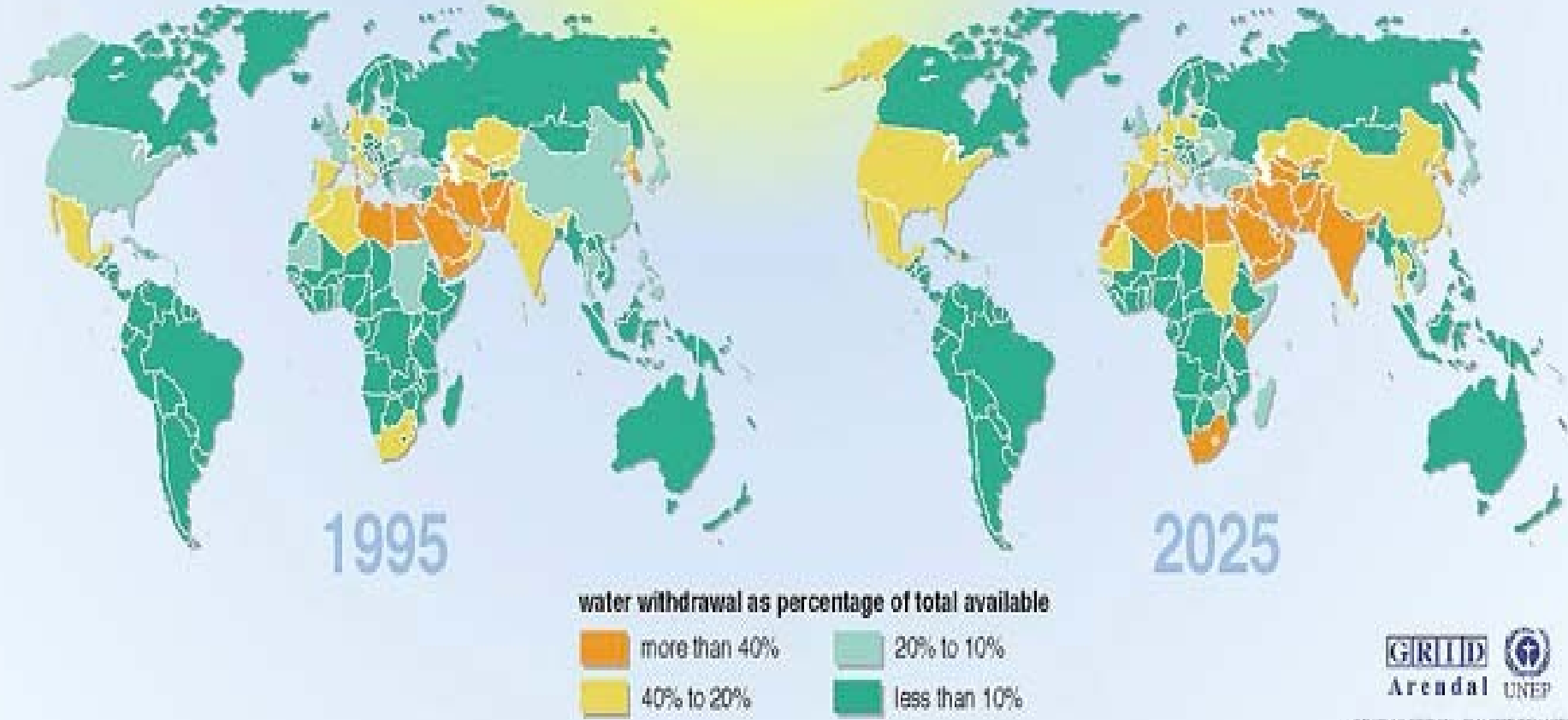
**Water Scarcity**  
24%

**2050**



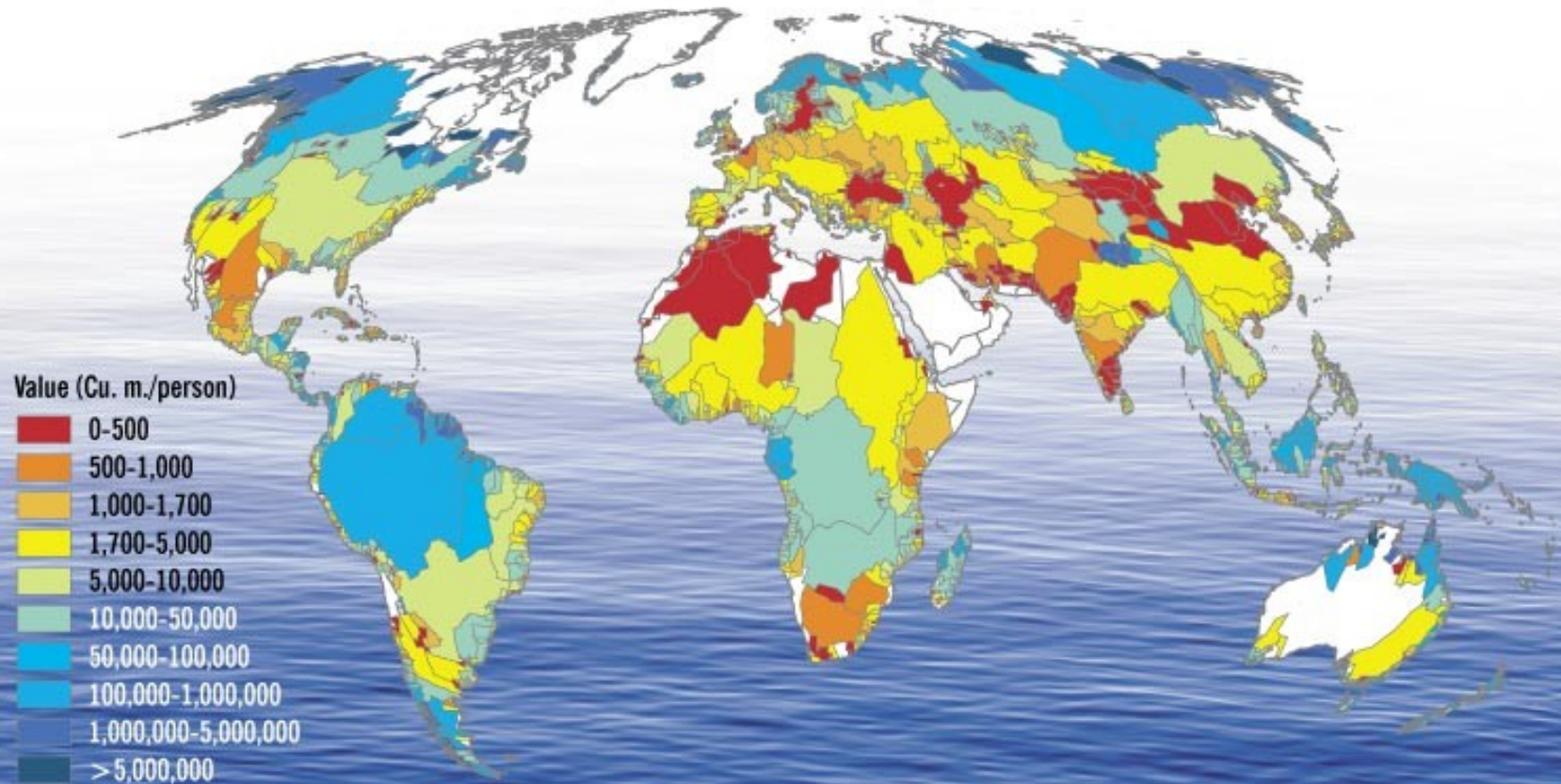
# Water Stress will Increase Independent of Climate Change

## Freshwater stress



Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

# Cubic Meters of Water per Person by Basin



Source: Transboundary Freshwater Dispute Database, 2001,  
<http://www.grdc.sr.unh.edu>



# « VIRTUAL » WATER



75 liters of water

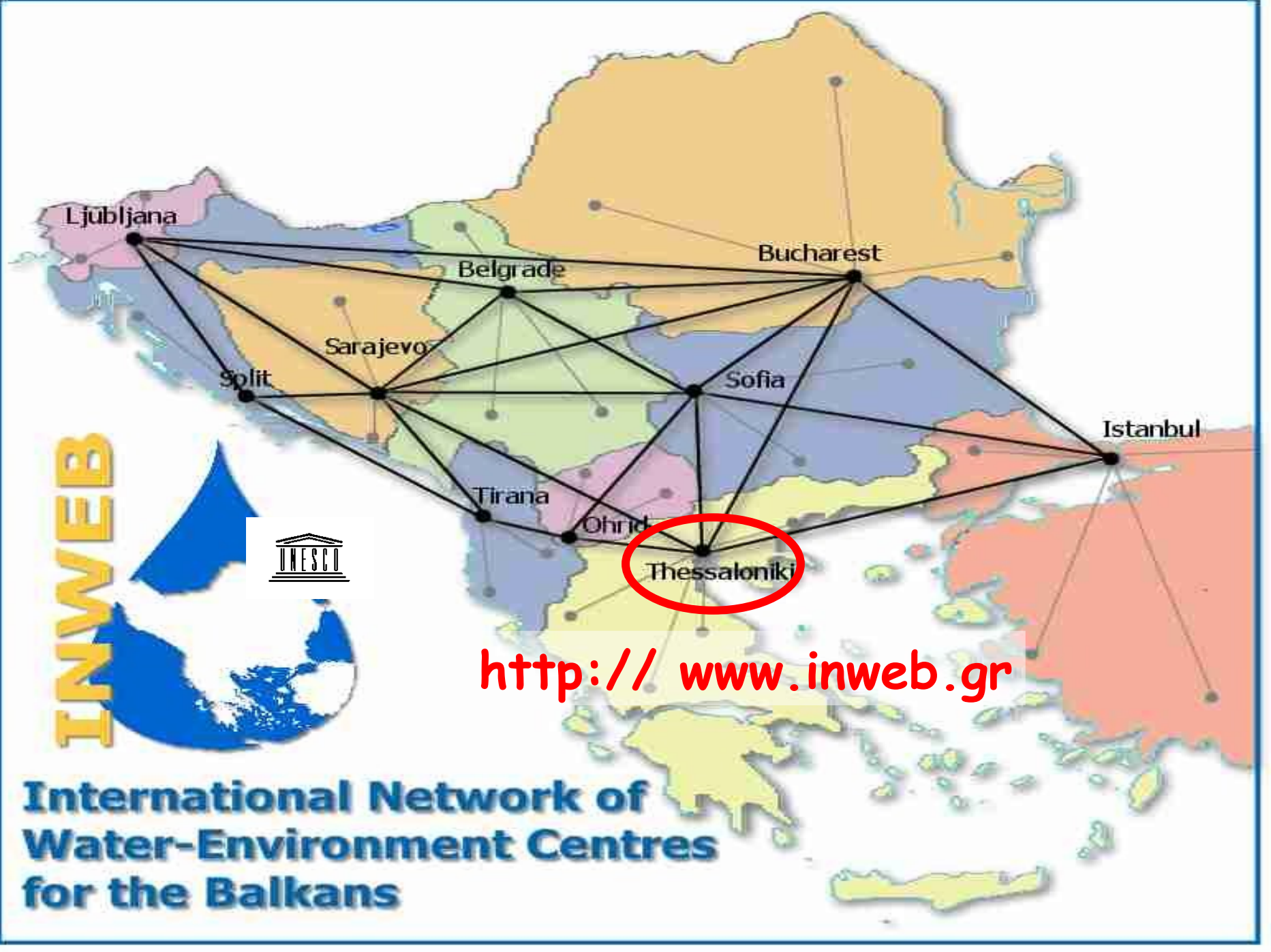


150 liters of water



15.000 liters of water /Kg





**INWEB**



**International Network of  
Water-Environment Centres  
for the Balkans**

[http:// www.inweb.gr](http://www.inweb.gr)



# THE SITUATION IN S-E EUROPE









Dinaric karst

Carpatho-Balkan

Eastern Balkan

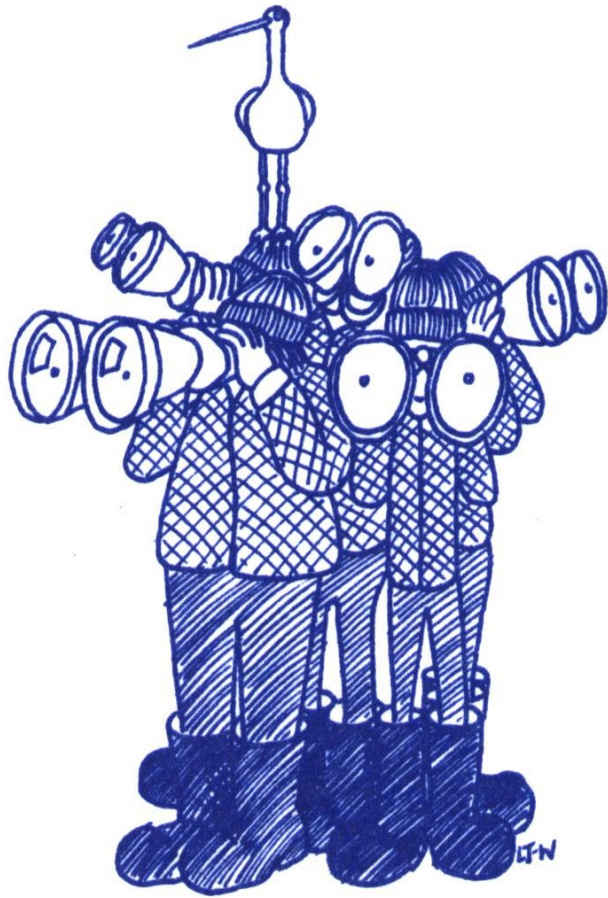
South Balkan

Hellenic









Us

Them



Us

Them



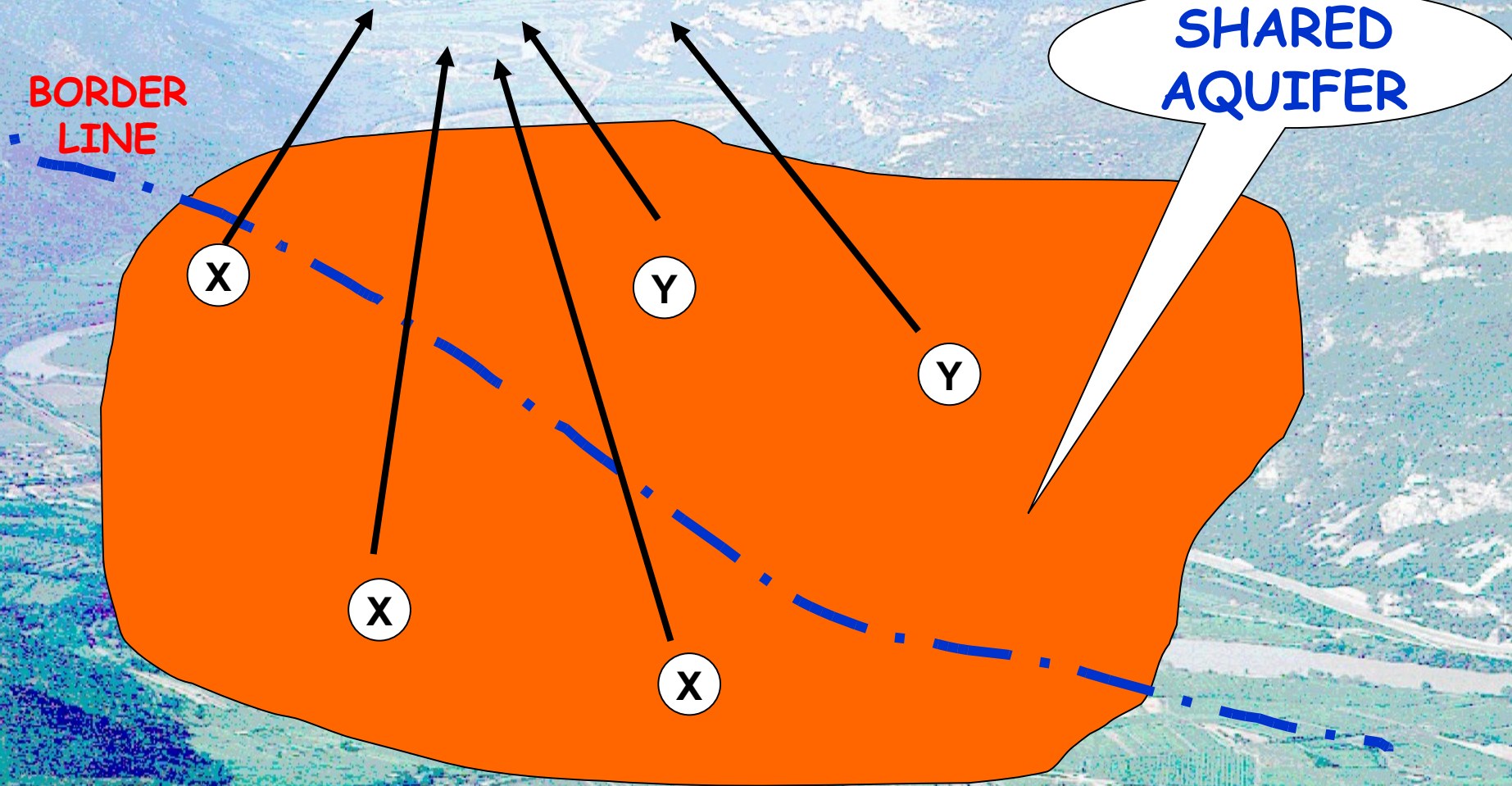


# MONITORING OF SHARED AQUIFER RESOURCES

MONITORING STATIONS

BORDER  
LINE

SHARED  
AQUIFER





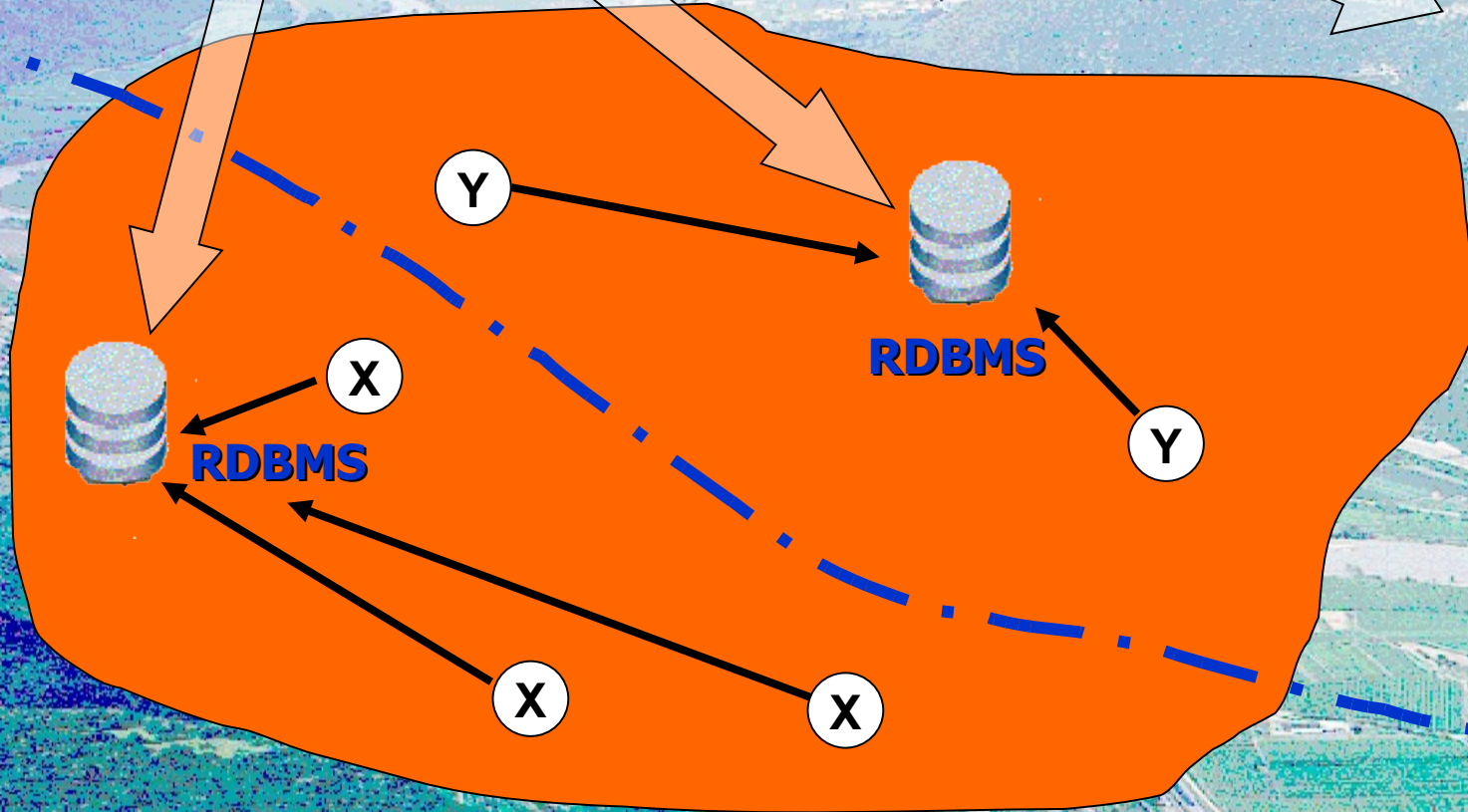
**SERVER**



**Internet**  
+



**CLIENTS**



Y

**RDBMS**

Y

X

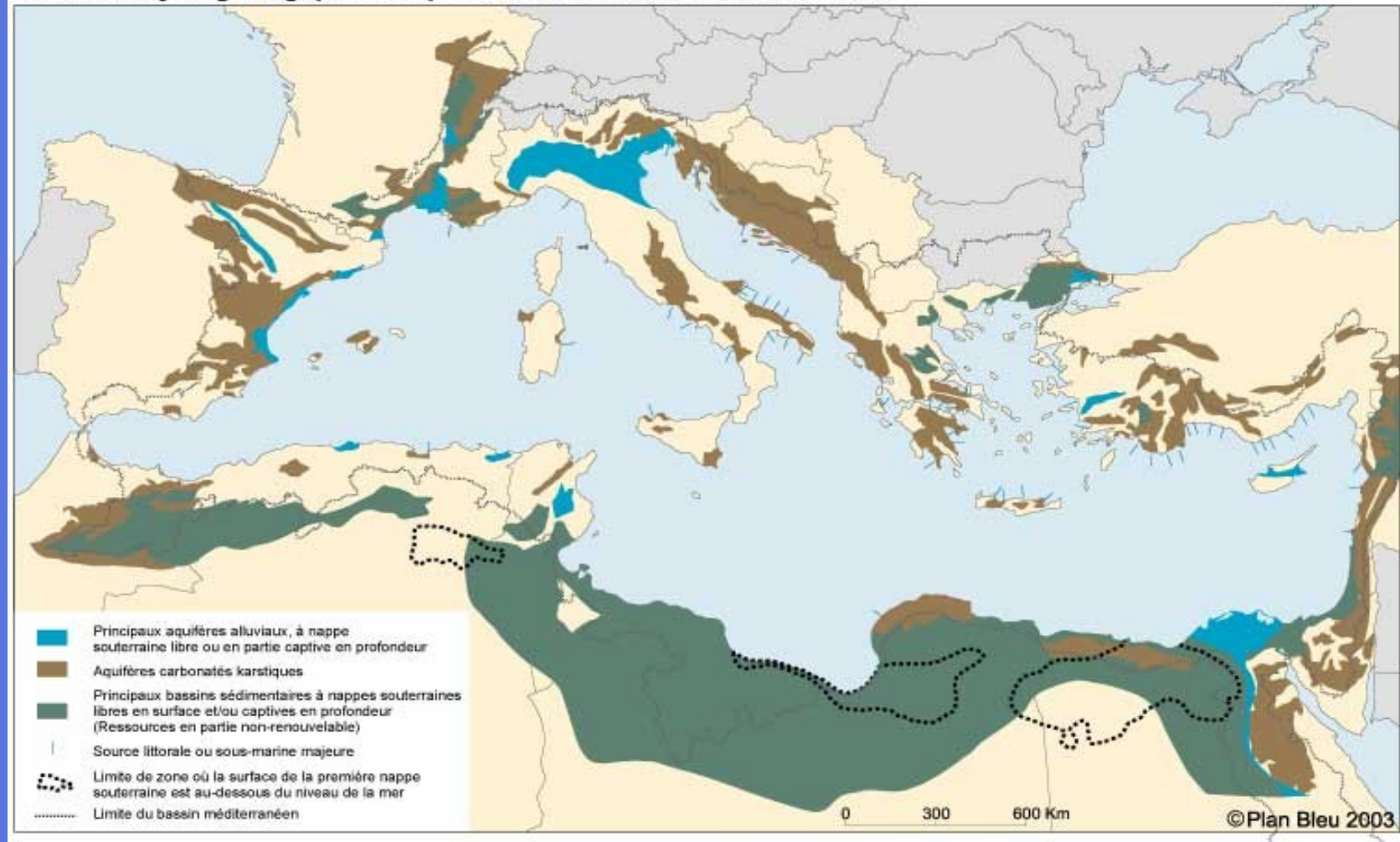
**RDBMS**

X

X



## Structures hydrogéologiques et aquifères dans le bassin méditerranéen



### Hydrogeological structures and aquifers in the Mediterranean basin

The eastern coast of the Adriatic Sea and also the Levantine sub-basin are characterized by the karst hydrogeology with high infiltration and vulnerability, limited surface runoff with submarine groundwater discharge from karstic aquifers and springs.



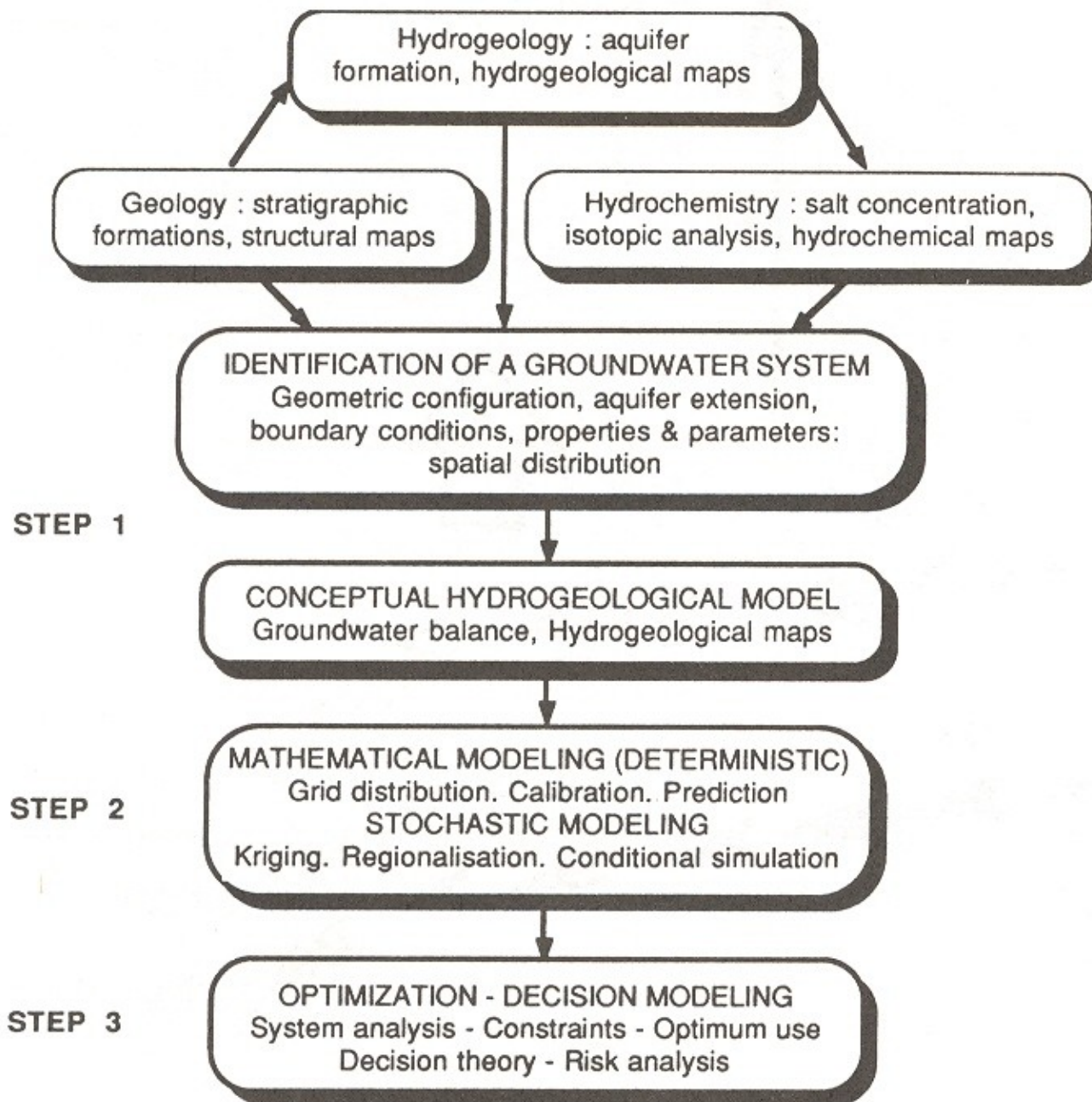


Δ: Έκλεμνίμαϊ ασβεστολιθικά μερίκια  
 ως τας οποίας διακρίνονται εστι-  
 ταμίμα: υδροπεδωματίμα: ζώναι  
 ύψους ύδατος.

ΑΝΑΛΥΣΙΣ ΤΩΝ ΚΥΡΙΩΤΕΡΩΝ  
ΑΣΒΕΣΤΟΛΙΘΙΝΩΝ ΠΕΡΙΣ ΤΗ ΧΡΑΣΙ

0 50 100 κ.









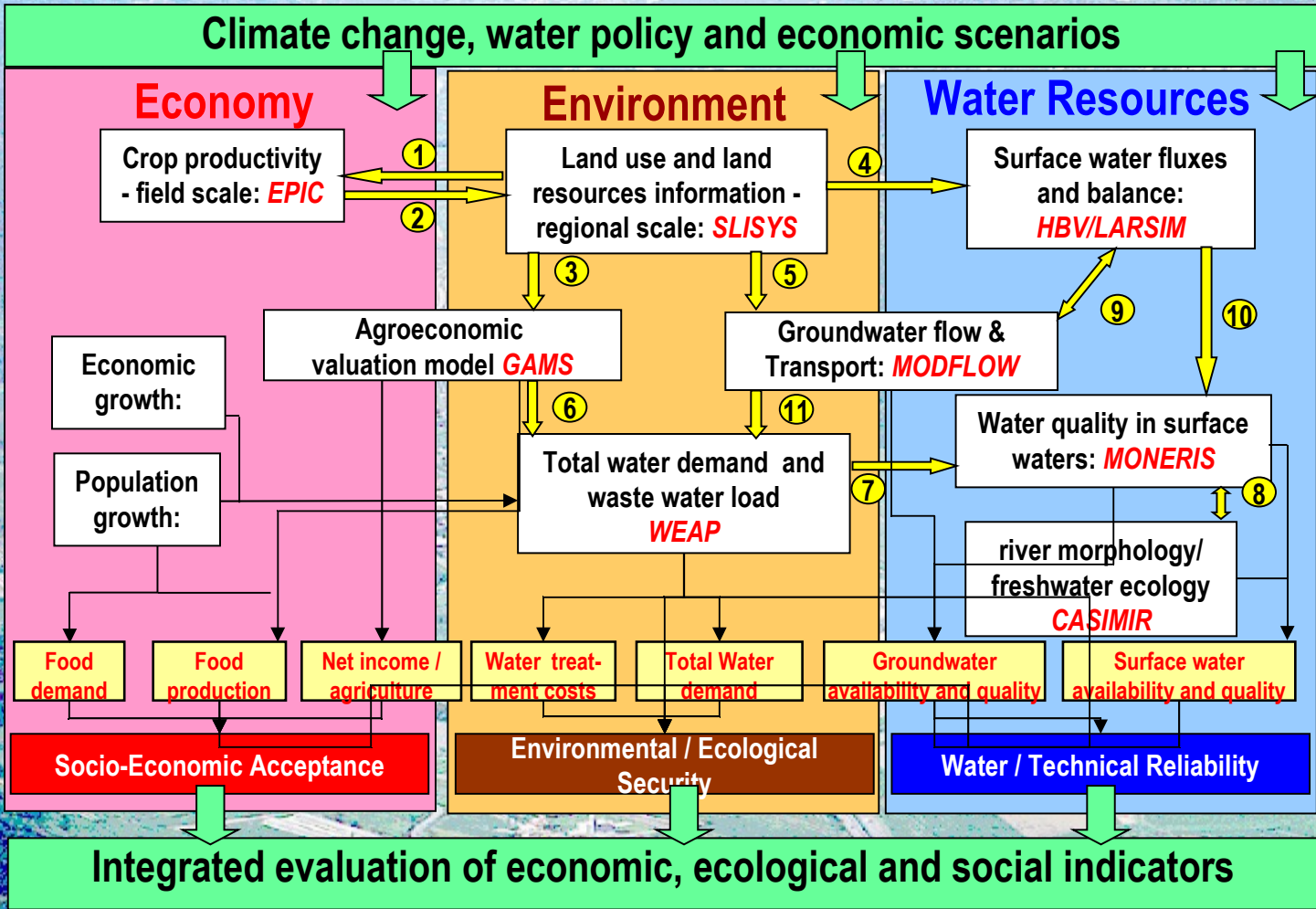
**Societal  
Systems  
Models**

**Physical  
Systems  
Models**

**The duality of systems modeling  
of a real world problem**



# SUBMODELS FOR IWWM

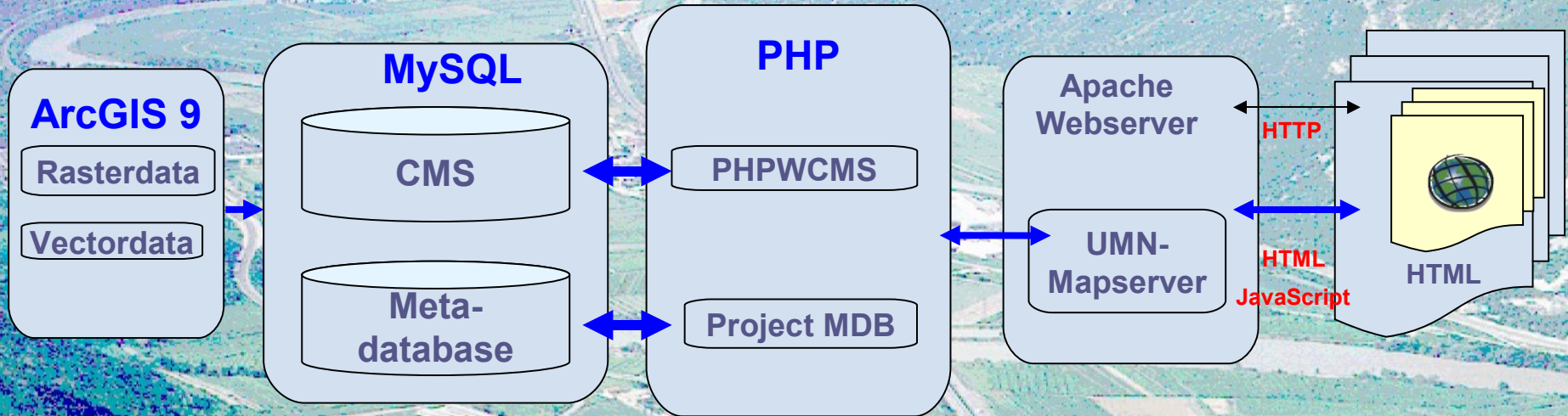




# IMPORTANCE OF RESEARCH AND TECHNOLOGY

## DATABASES, MODELING, SCENARIA, ALTERNATIVE REMEDIATION PRACTICES, INFORMATION NETWORKS

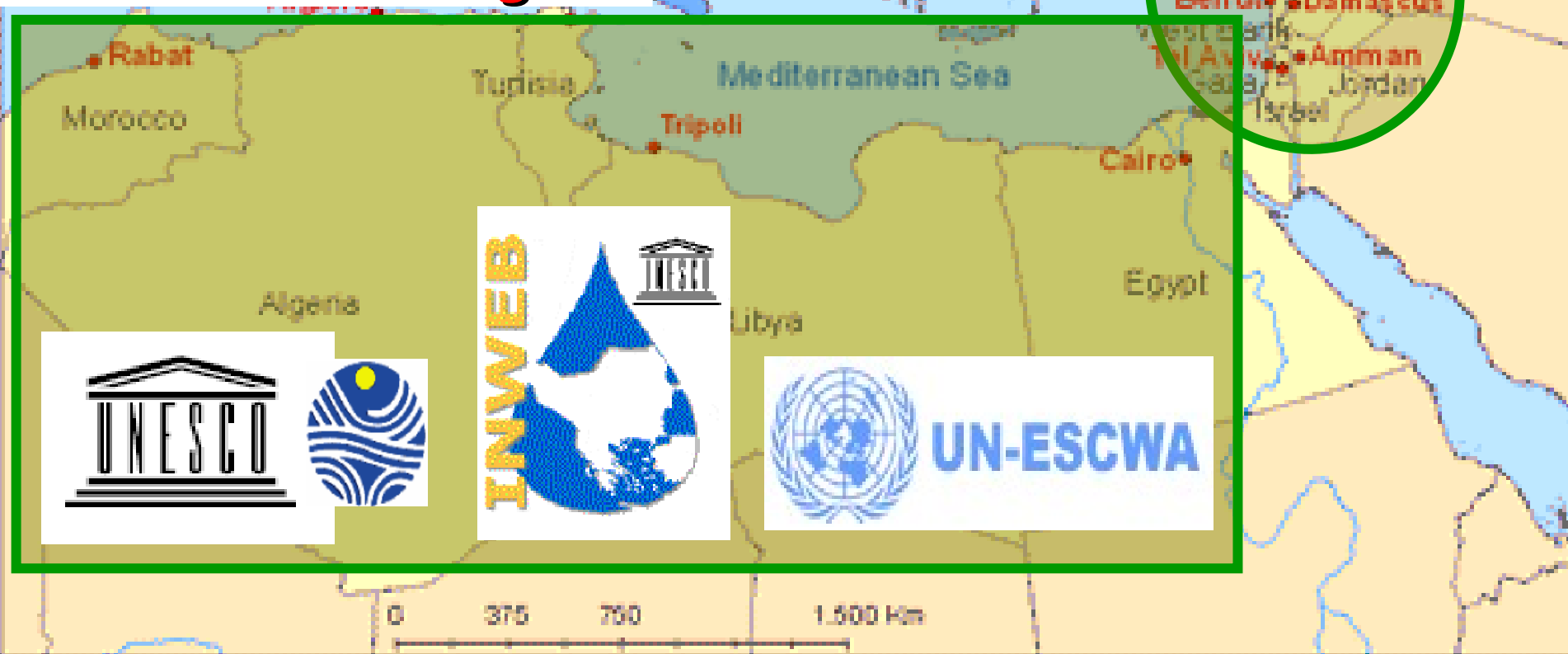
**GIS-DATA**      **DATABASE**      **APPLICATIONS**      **SERVER**      **CLIENTS**  
Browser





**UNESCO-INWEB  
shared waters  
in the Balkans (SEE)**

**shared aquifers  
database  
in the MEDA region**

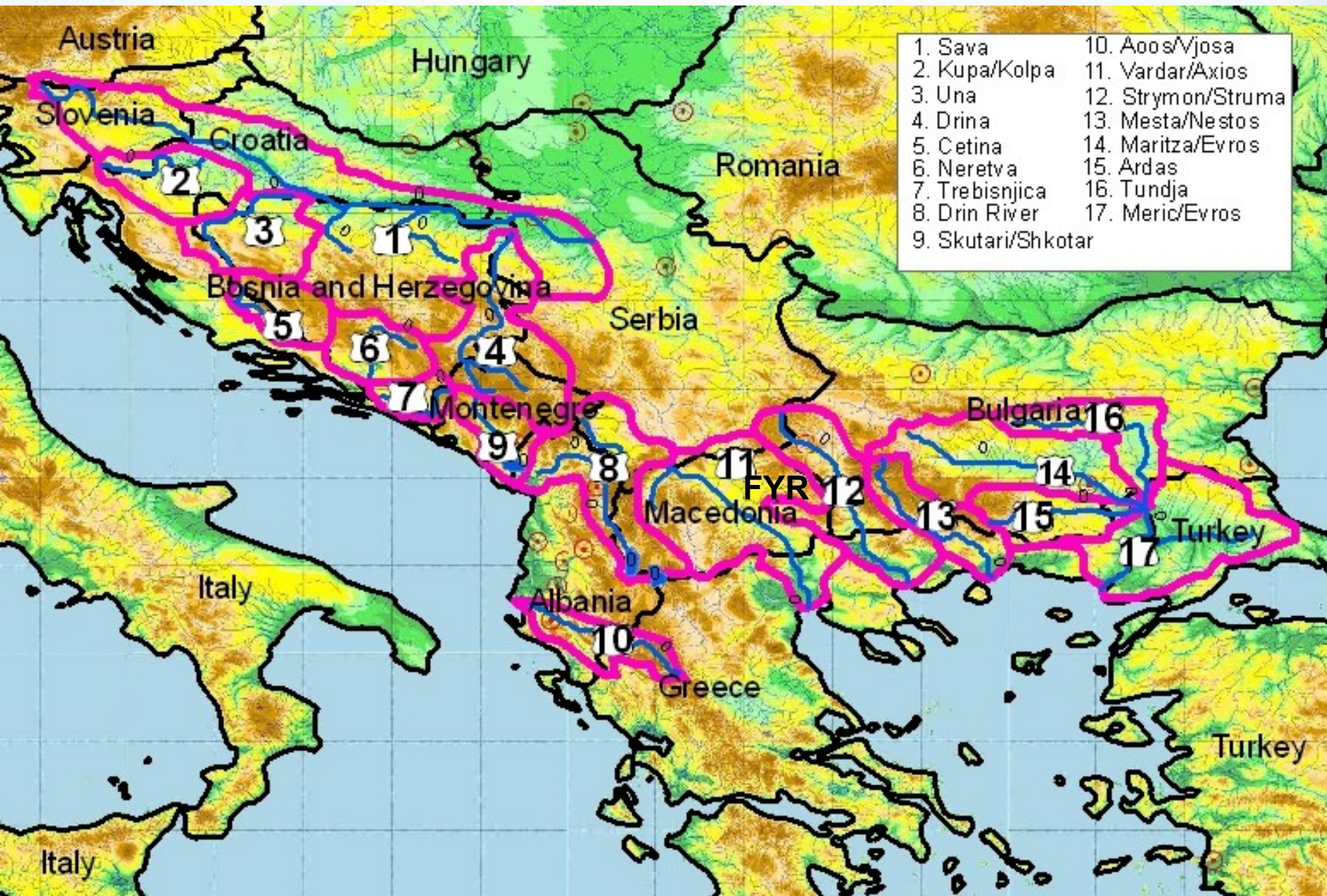




# ***INWEB, Thessaloniki, Greece***







- |                    |                    |
|--------------------|--------------------|
| 1. Sava            | 10. Aaos/Vjosa     |
| 2. Kupa/Kolpa      | 11. Vardar/Axios   |
| 3. Una             | 12. Strymon/Struma |
| 4. Drina           | 13. Mesta/Nestos   |
| 5. Cetina          | 14. Maritza/Evros  |
| 6. Neretva         | 15. Ardas          |
| 7. Trebisnjica     | 16. Tundja         |
| 8. Drin River      | 17. Meric/Evros    |
| 9. Skutari/Shkotar |                    |

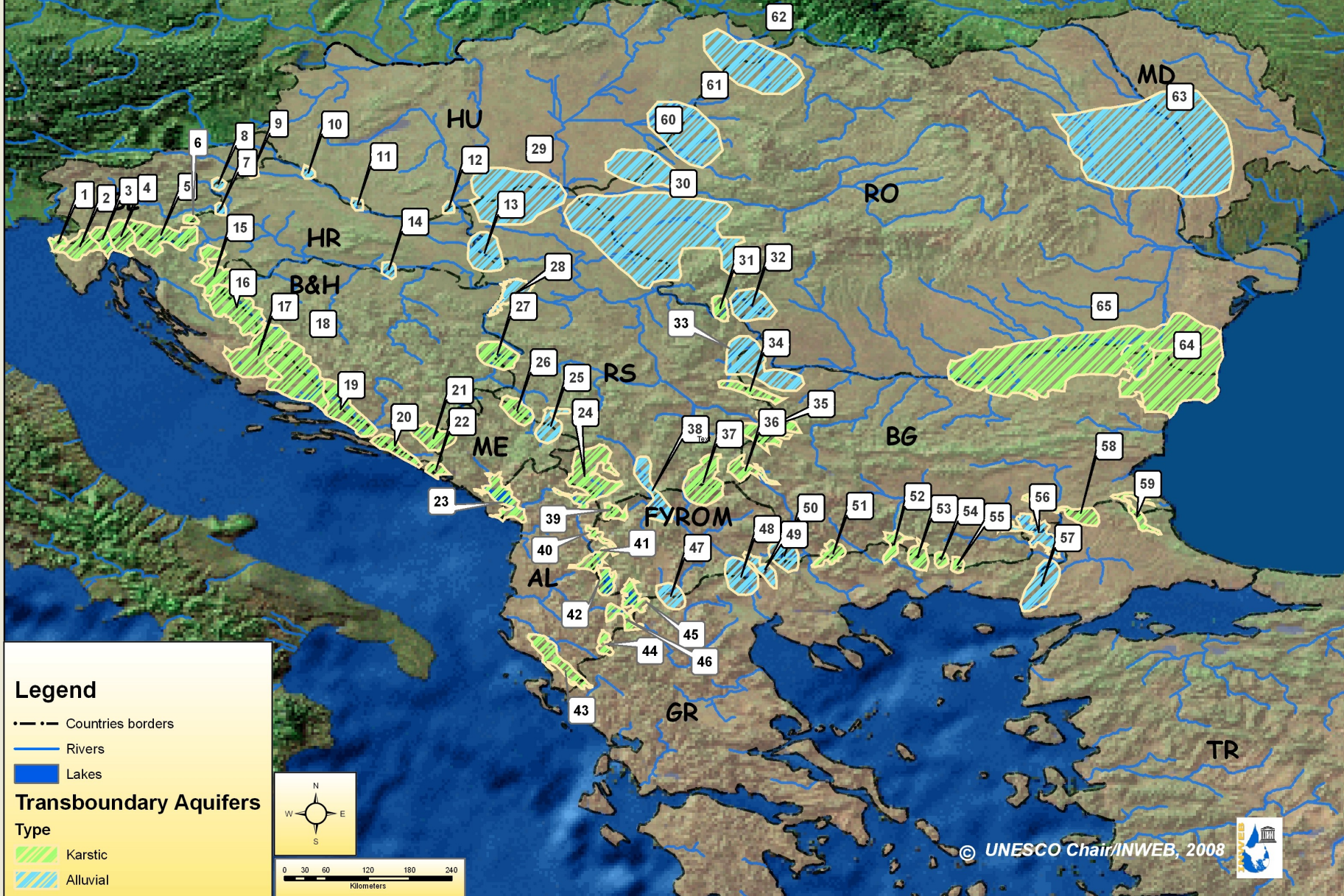


# Sub-Danubian Transboundary River & Lake Basins in the Balkans





# Transboundary Aquifers in South Eastern Europe (SEE)



## Legend

- Countries borders
- Rivers
- Lakes

## Transboundary Aquifers

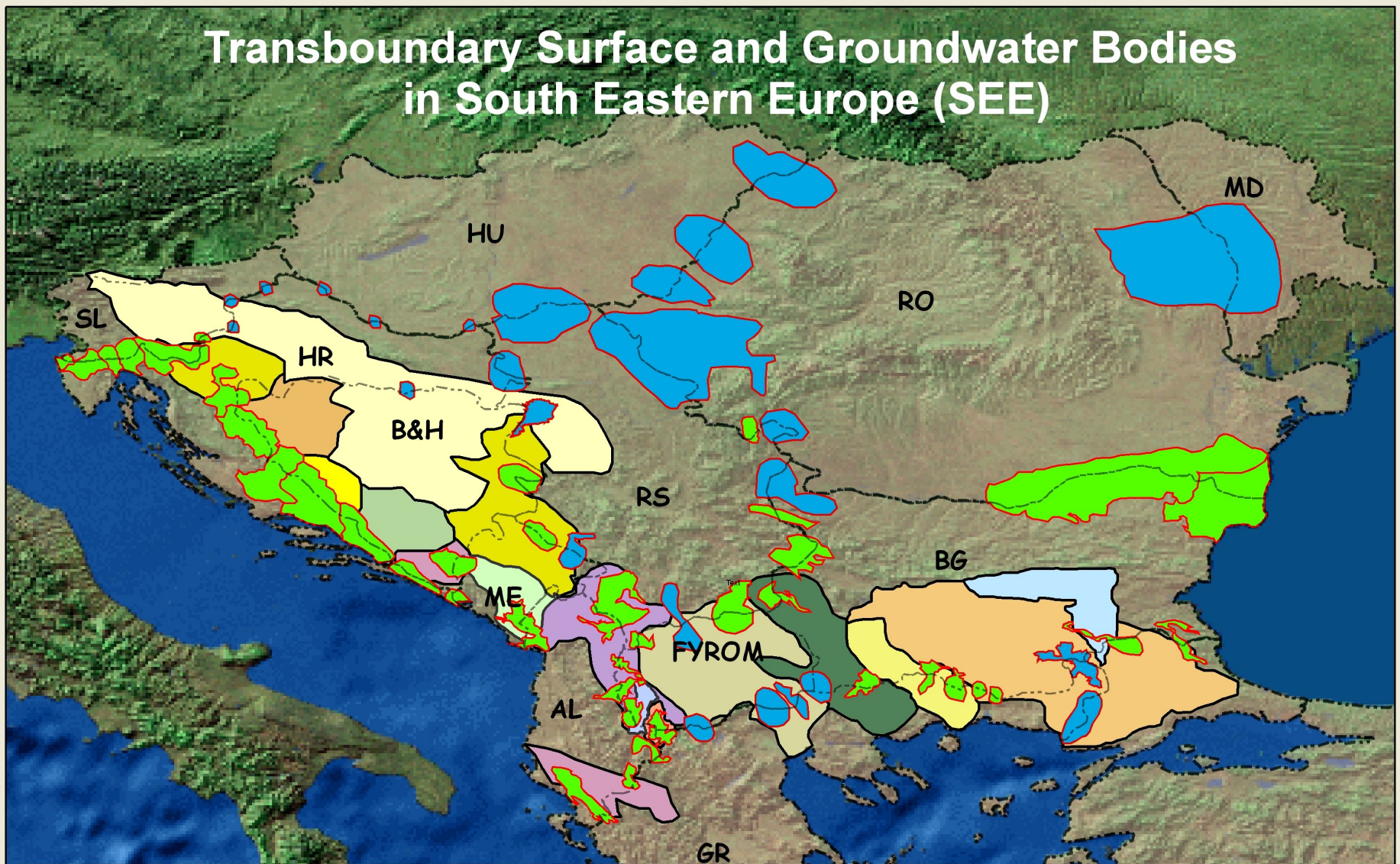
### Type

- Karstic
- Alluvial





# Transboundary Surface and Groundwater Bodies in South Eastern Europe (SEE)



## Legend

--- Countries borders

### Transboundary Aquifers

#### Type

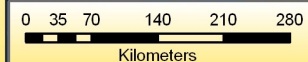
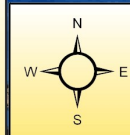
- Karstic
- Alluvial

### Transbandoury Lakes

- Lake Dojran/Doirani
- Lake Ohrid
- Lake Prespa
- Lake Skadar/Shkodra
- Cetina
- Drin
- Drina
- Kupa/Kolpa
- Lake Skadar/Shkodra

### Transbandoury River Basins

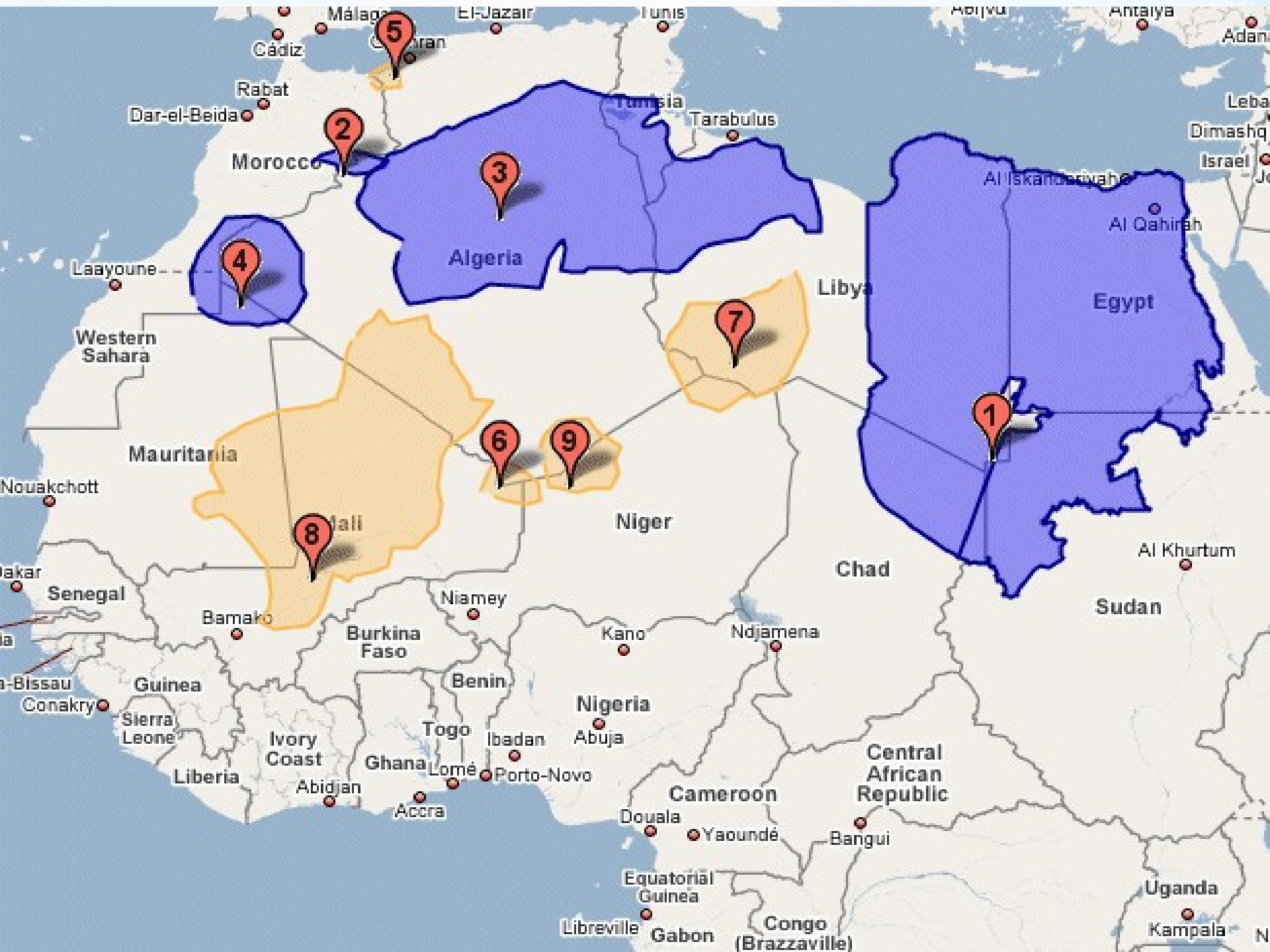
- Maritza/Evros/Ergene
- Mesta/Nestos
- Neretva
- Sava
- Struma/Strymon
- Trebisnjica
- Tundja/Tunka
- Una
- Vardar/Axios
- Vjosa/Aoos



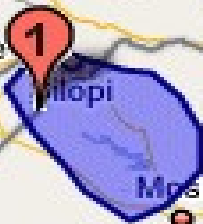
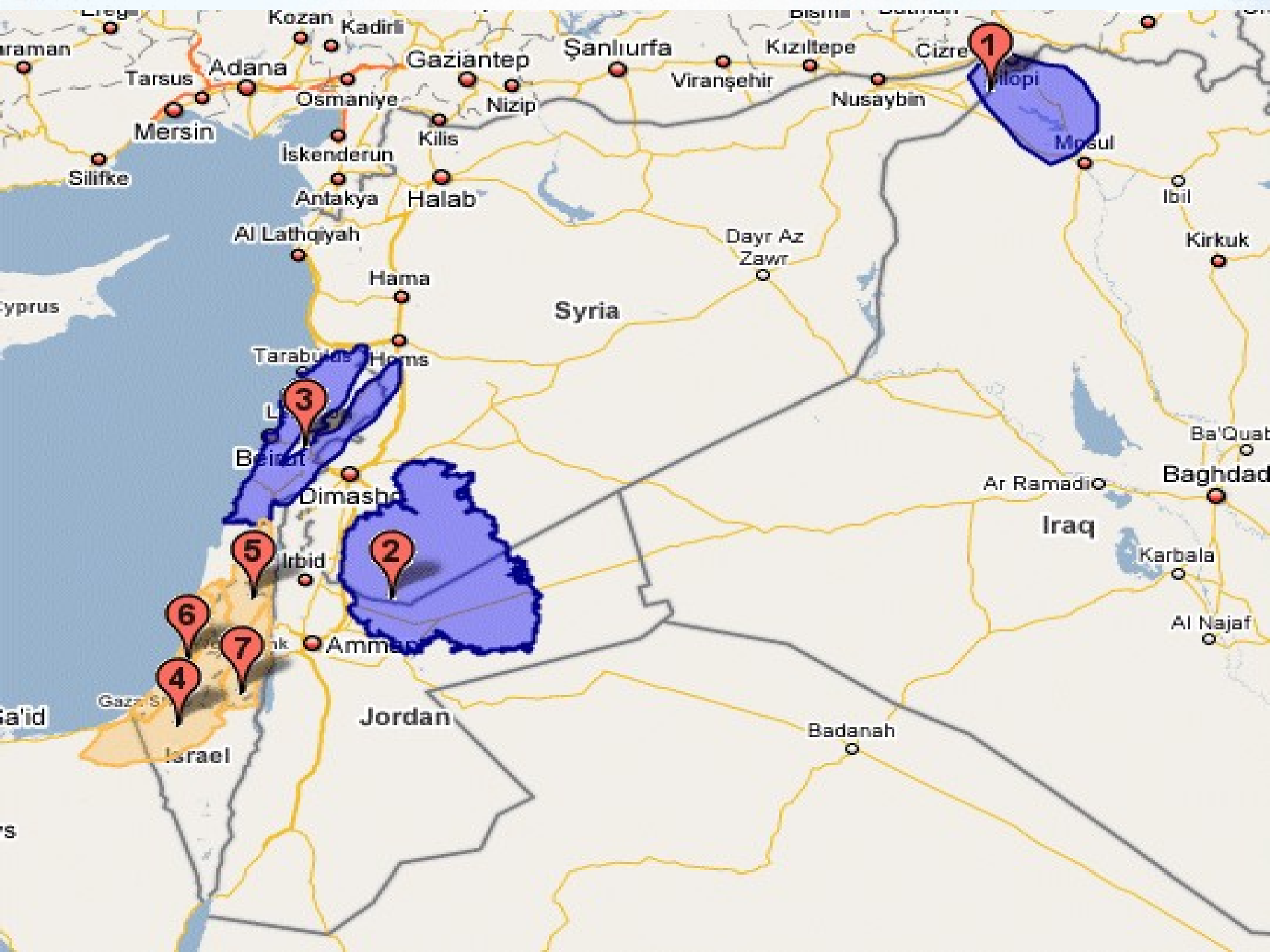
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**NEW!**

The deadline for the submission of abstracts has been extended to 15th June 2008.

**NEW!**

IV International Symposium on Transboundary Waters Management.

Thessaloniki, Greece

15<sup>th</sup> - 18<sup>th</sup> October 2008

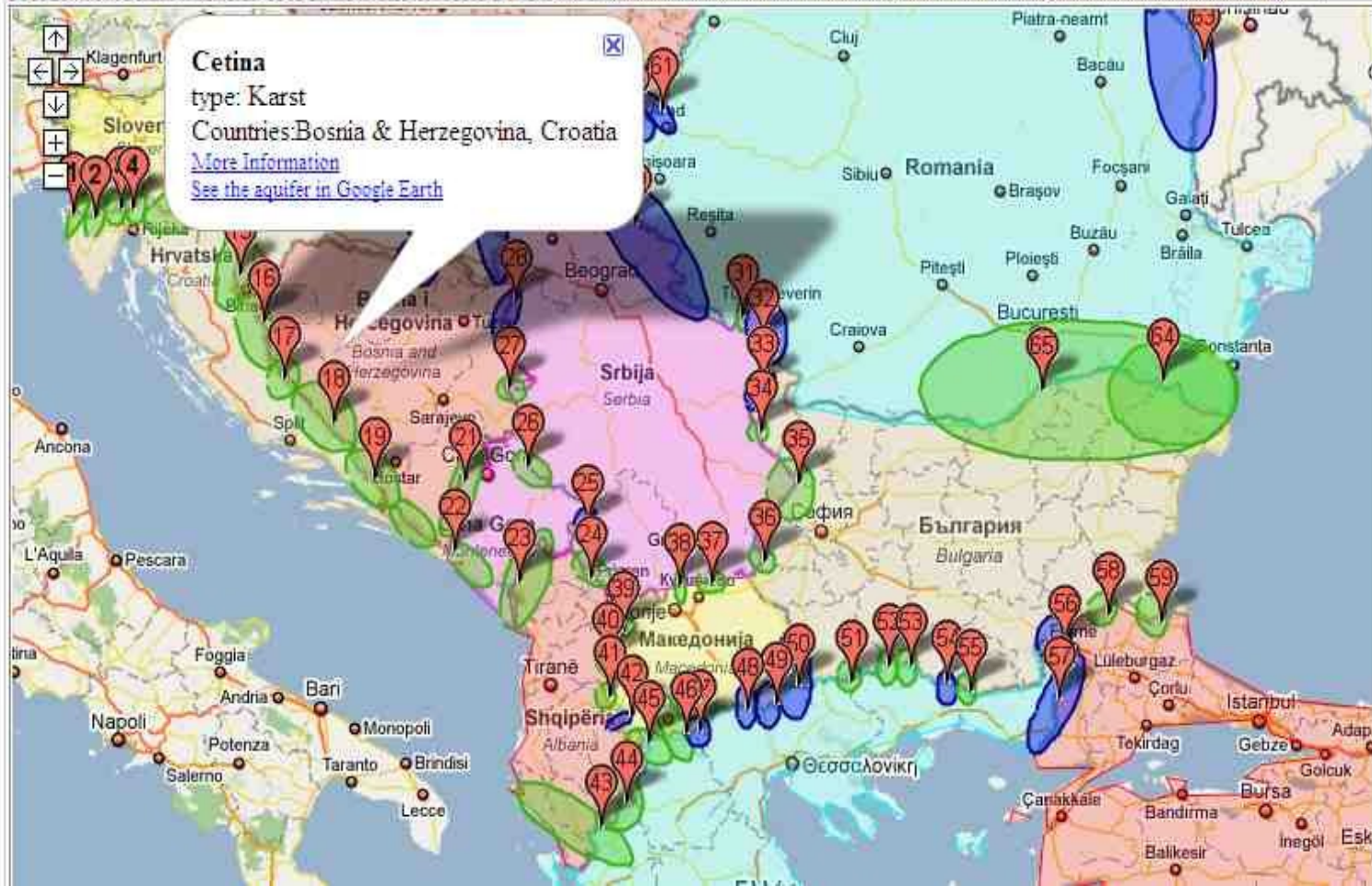


Take a virtual tour in Google Earth

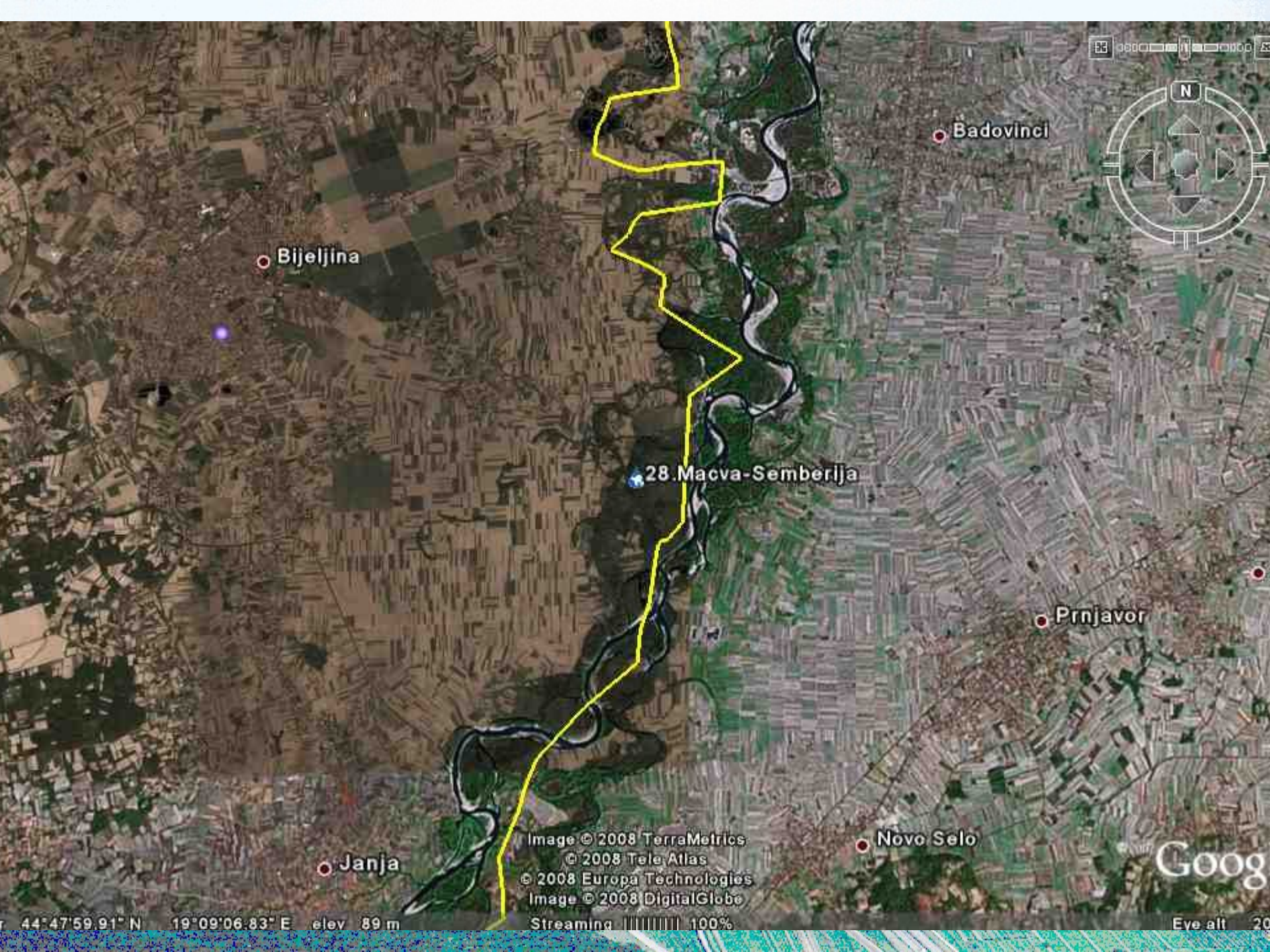
See the list of Aquifers

Select aquifer from the dropdown list or click on the map.

18 - Cetina (Bosnia & Herzegovina / Croatia)







0 500 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000



Badovinci

Bijeljina

28. Macva-Semberija

Prnjavor

Novo Selo

Janja

Image © 2008 TerraMetrics  
© 2008 Tele Atlas  
© 2008 Europa Technologies  
Image © 2008 DigitalGlobe  
Streaming 100%

Google

44°47'59.91" N 19°09'06.83" E elev 89 m

Elev alt 20

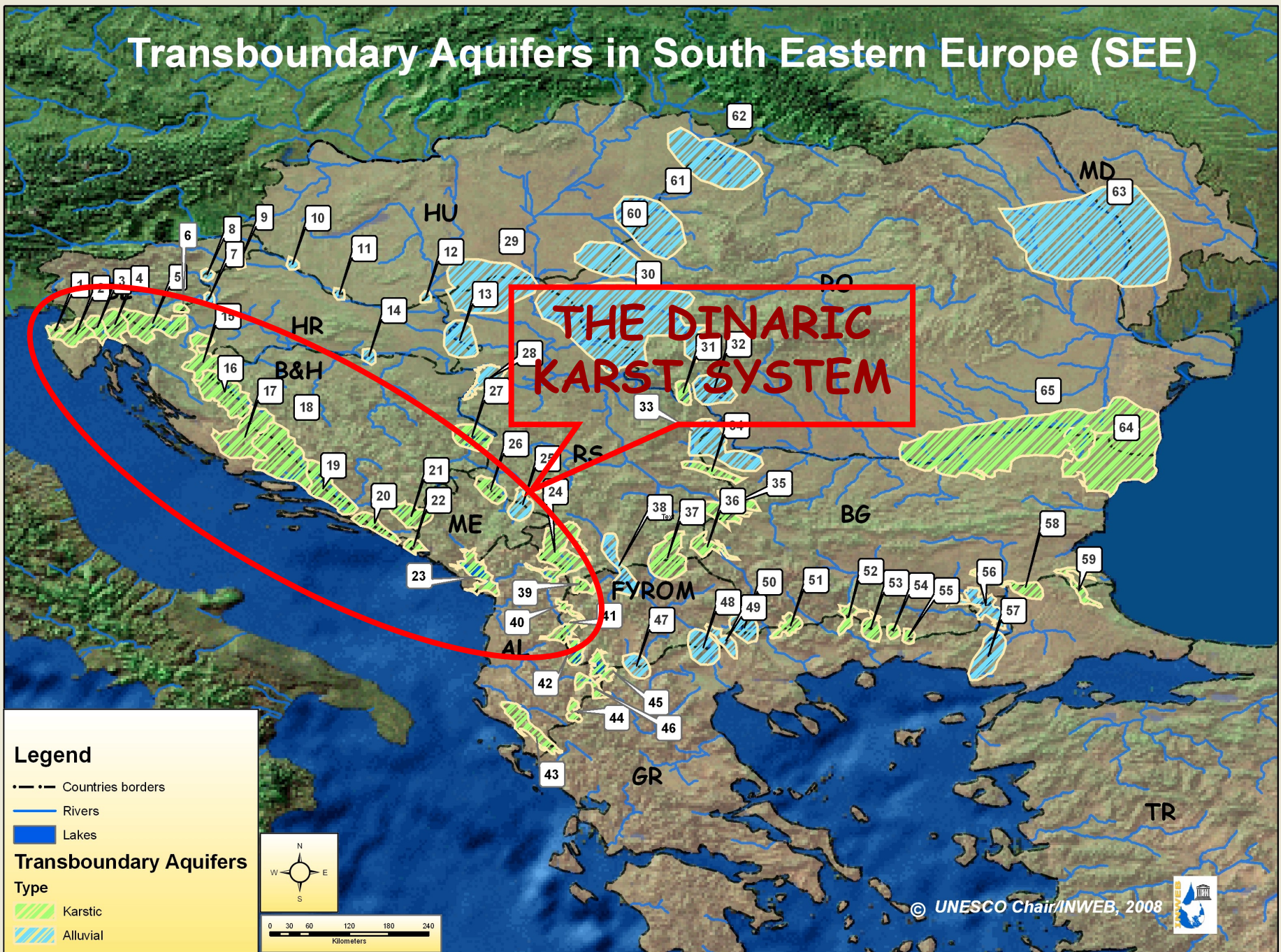


(Source: FAO/AQUASTAT2005  
 (National sources compiled by the Plan Bleu  
 (Including non-renewable source extractions  
 (Egypt: of which 4.8 are infiltrations from Nile irrigations (secondary  
 resources)  
 (Israel: of which 0.38 are external (from Cis-Jordan, mountain aquifer)

Country	Renewable internal groundwater recharge Annual averages in km <sup>3</sup> /yr		Portion (%) of total internal renewable water resources		Total current groundwater abstractions (in 2000 or close year) in km <sup>3</sup> /yr	
	Entire country ( <sup>1</sup> )	Part of Mediterranean Basin ( <sup>2</sup> )	Entire country ( <sup>1</sup> )	Part of Mediterranean Basin ( <sup>2</sup> )	Entire country ( <sup>1</sup> )	Part of Mediterranean Basin ( <sup>2</sup> )
<b>Spain</b>	29.9	10.44	27	37.3	6	3.27
<b>Italy</b>	43.0	43.0	24	23.6	10.4	10.4
<b>Malta</b>	0.033	0.033	87	~100	0.032	0.032
<b>Croatia</b>	11.0	9.0	29	50	0.2	~0.1
<b>FYR of</b>	1.0	1.0	18	18.5	0.2	0.2
<b>Albania</b>	6.2	6.2	23	23	0.6	0.6
<b>Greece</b>	10.3	10.3	18	17.8	3.56	3.56
<b>Cyprus</b>	0.41	0.41	53	35.9	0.166	0.166
<b>Turkey</b>	69.0	20.0	30	30.3	63	5.0
<b>Lebanon</b>	3.2	3.1	67	64.6	0.4	0.4
<b>Israel</b>	1.07 <sup>(5)</sup>	0.83 <sup>(5)</sup>	67	71.4	1.05	~0.8
<b>Egypt</b>	6.1 <sup>(4)</sup>	~6.0 <sup>(4)</sup>	72	62.5	7.01	6.1
<b>Libya</b>	0.5	0.5	83	85.7	4.08	1.8
<b>Tunisia</b>	1.45	1.15	35	~31.1	1.88	1.63
<b>Algeria</b>	1.6	1.33	14	11.1	2.6	1.6
<b>Morocco</b>	5.77	1.0	28	~20	3.71	0.2



# Transboundary Aquifers in South Eastern Europe (SEE)







- ① DALMATIA
- ② WEST BOSNIA
- ③ WEST HERZEGOVINA
- ④ EAST HERZEGOVINA
- ⑤ MONTENEGRO







# UNESCO-INWEB

## *Main Findings / Main Needs*

- ▶ No priority in the political agenda
- ▶ Transboundary legal agreements on joint water management are still not fully operative, insufficiently implemented or completely missing
  - ▶ Local stakeholders are still showing no or very low awareness about environmental issues and impacts of bad water management
- ▶ The water management policy is presently in an intensive reform process (WFD!), with different progress in the Balkan countries (e.g. lack of institutional capacities and of political interest)



A serene landscape photograph capturing a sunset over a large body of water. The sun is positioned low on the horizon, creating a bright, golden glow that reflects across the water's surface. In the foreground, several tall, green reeds stand in the shallow water. To the right, a small wooden boat is partially visible, with a person sitting inside, their back to the camera. The background features a range of low mountains under a clear sky. The overall mood is peaceful and contemplative.

*Ευχαριστώ !*