

Water resources management and GIS (part 1)

Use of GIS for the management of environmental information. Open-source GIS tools and online data sources. Creation of water related maps.

By

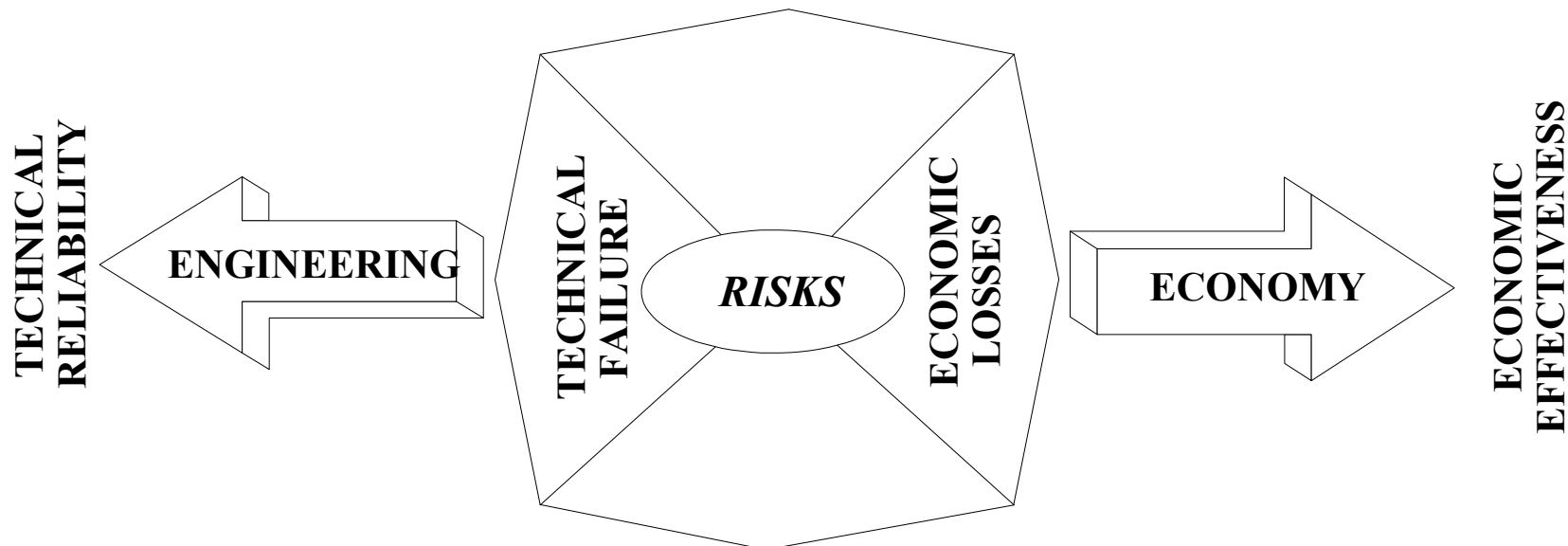
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Thursday, 9/12/2021

Water Resources Management

- Until the end of the 20th century Water Resources Management was, almost exclusively, oriented to hydrotechnical works focusing on the technical reliability and economic efficiency of projects covering water demands and securing human's life and wealth.



Water Resources Management

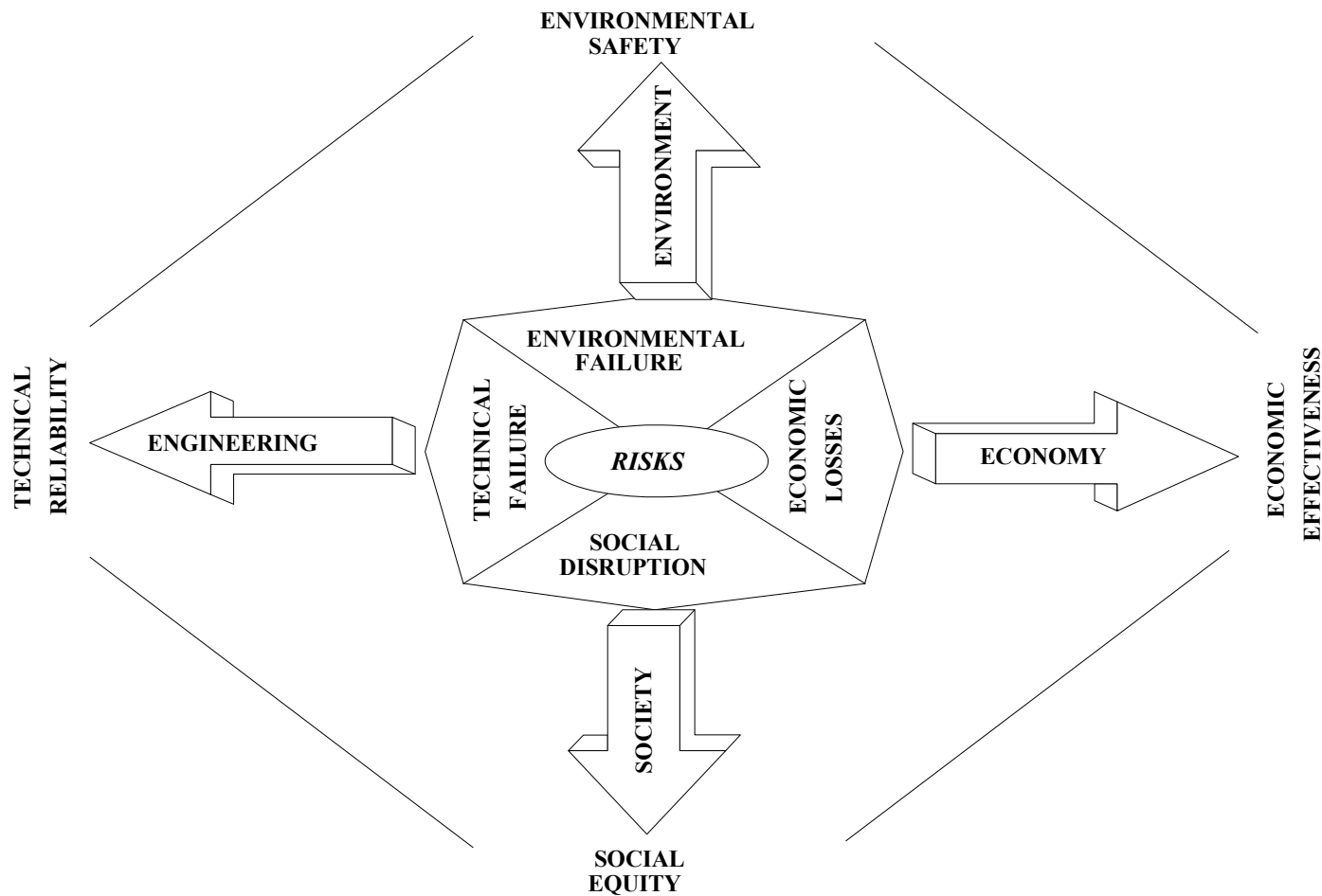
- ❑ The transition from this dipole development scheme to the current one, where environmental protection and social prosperity forms part of the development equation, emerged with the sustainable development concept (year 1987).

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

United Nations World Commission on Environment and Development report “Our Common Future”, commonly called the Brundtland Report

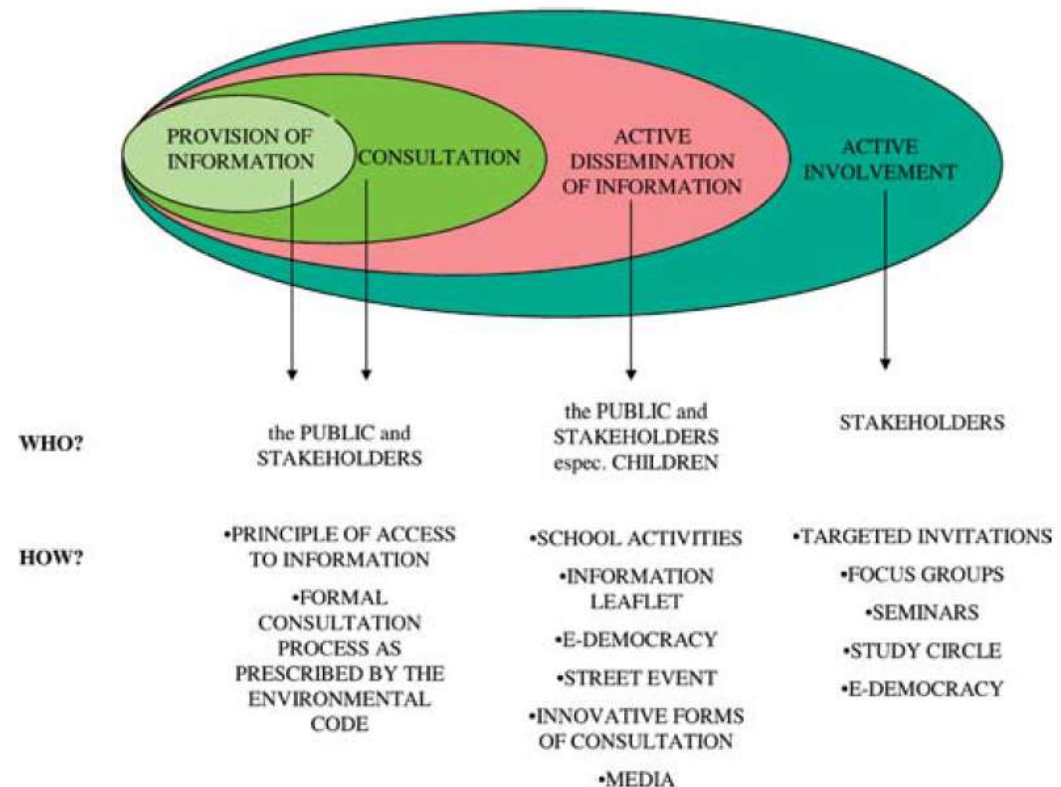
United Nations’ Millennium Declaration identified principles and treaties on sustainable development, **including economic development, social development and environmental protection.**

Water Resources Management



Water Resources Management

- One of the latest advancements is attributed to public participation on water management decision making processes, also known as stakeholders' participation, which plays an important role to the water management contemporary era.



Figure's source: Jonsson A. Public participation in water resources management: stakeholder voices on degree, scale, potential, and methods in future water management. *Ambio*. 2005 Nov;34(7):495-500. PMID: 16435737.

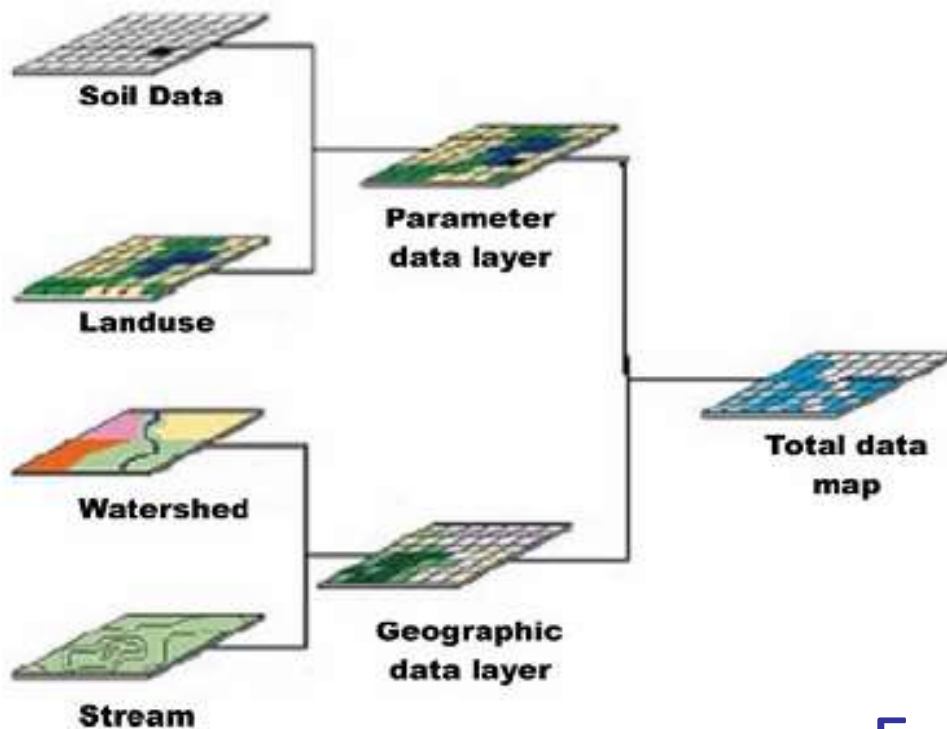
Geographic Information Systems

- Geographic Information Systems -GIS is a modern technology, which is developing rapidly in conjunction with the science of Geoinformatics, which is the sector of information technology that deals with the processing and analysis of geographically reported data.

- GIS is defined as “the equipment, the software, the data, the methods and the human resources for the import, processing, storage and presentation of data – that have spatial information”



Geographic Information Systems



1. Maps overlying and creation of unique outputs
2. DTM Processing and basin properties

Examples:

Soil data maps + Land Use maps → Curve Number (CN)

DTM → flow direction, flow accumulation, slopes...

Use of GIS for the creation of geodatabases

- **Database** is a collection of information organized in such a way that a computer program can quickly select desired pieces of data.
 - **Geodatabase** is the common data storage and management framework for ArcGIS. It combines "geo" (spatial data) with "database" (data repository) to create a central data repository for spatial data storage and management.
 - The serving of georeferenced data that are stored in geodatabases over the Internet is based on the technology known as **Web Map Service (WMS)**.
-

Commercial GIS products



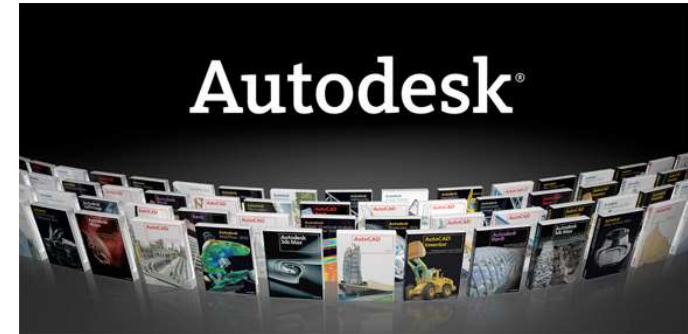
esri

ArcGIS



Bentley[®]
Sustaining Infrastructure

GeoWebPublisher



Autodesk's Map 3D and Civil 3D products



LizardTech's Express Server

Freeware, open source (OS) (GIS)

Οι 3 κύριες κατηγορίες των open source GIS (in terms of programming languages) είναι:

- “C” languages,
- Java, and
- .NET



GRASS GIS



Q GIS



OpenEV



SharpMap

Geospatial Application Framework for the CLR



SAGA

System for Automated Geoscientific Analyses



MapWindow GIS



Potlach

Commercial WebGIS products



esri

ArcGIS Server



Autodesk's Map 3D and Civil 3D products



The Earth to Business Company ERDAS Apollo



Bentley[®]
Sustaining Infrastructure

GeoWebPublisher



LizardTech's Express Server

Freeware, open source WebGIS products



<kml

```
xmlns="http://earth.google.com/kml/2.2">
<Document id="general_map.png">
  <name>general_map.png</name>
  <Snippet></Snippet>
```



```
<?xml version="1.0"?>
```

```
<ARCXML version="1.0">
```

```
<RESPONSE>
```

```
<ERROR machine="IMSEmu WINNT;
Apache/2.2.10 (Win32); PHP 5.2.6 cgi-fcgi"
processid="0" threadid="">
```

```
XMLParser: Fatal parsing error:
```

```
'Undefined variable: post'
```

```
</ERROR>
```

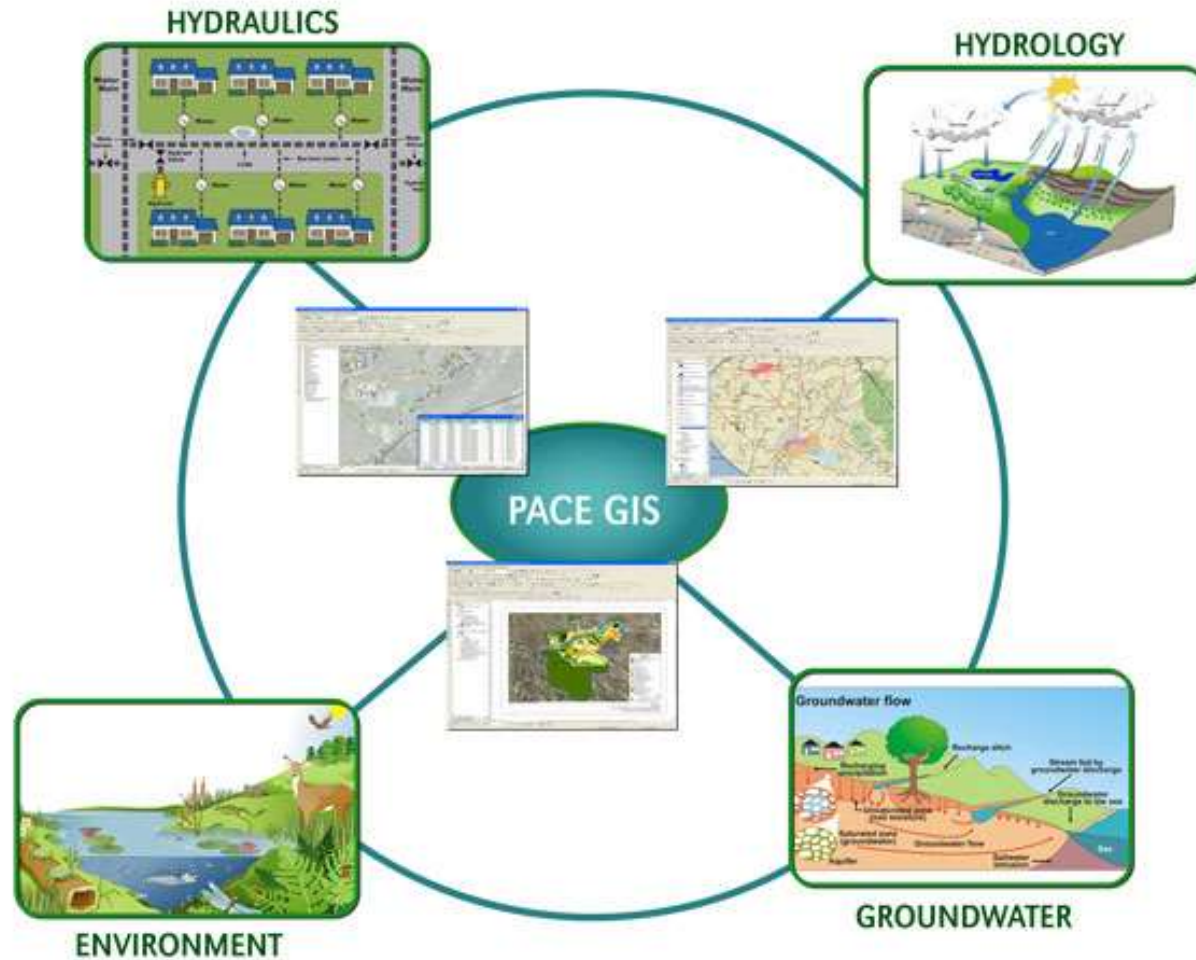
```
</RESPONSE>
```

```
</ARCXML>
```

```
.....
</kml>
```



GIS on water resources



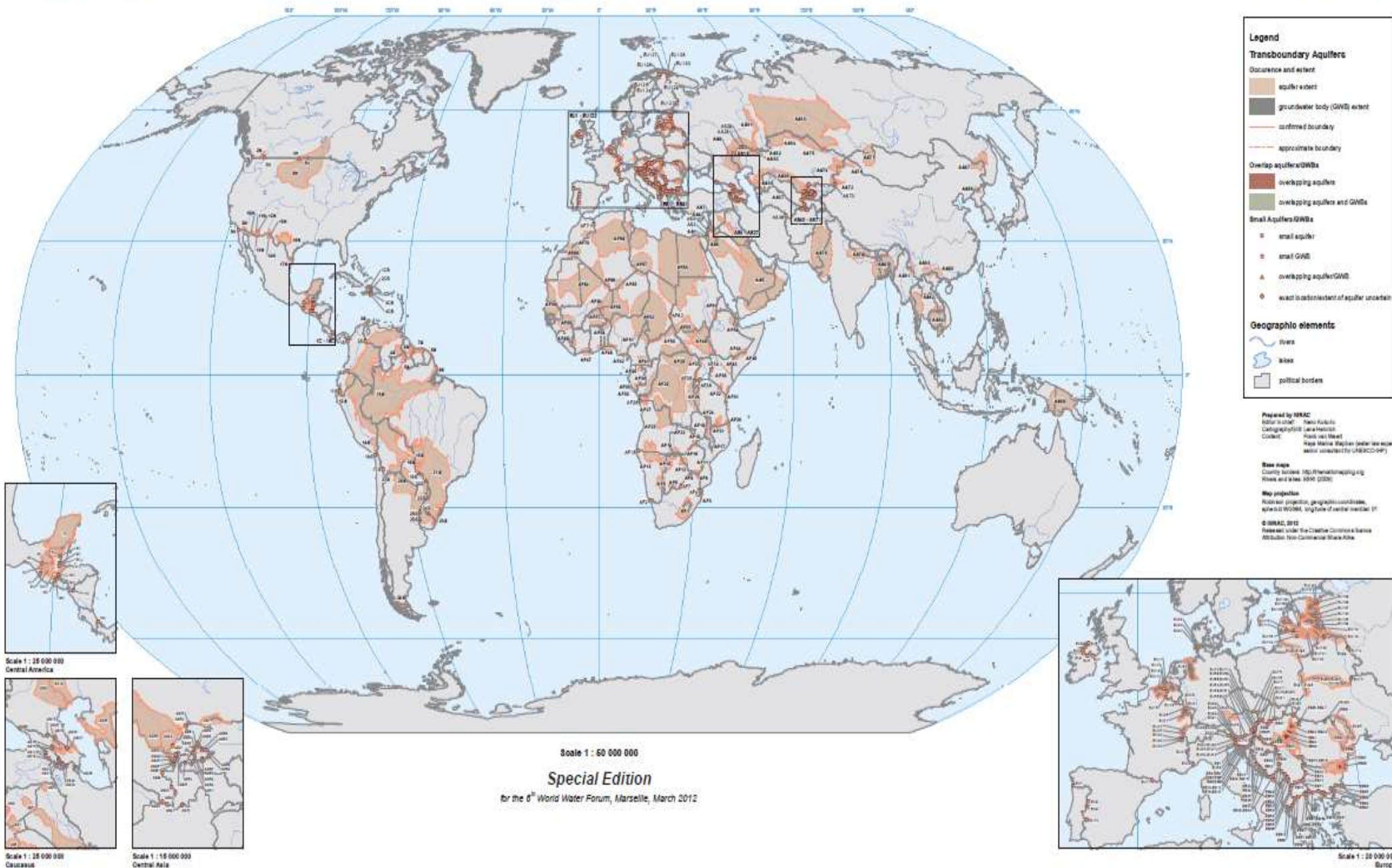
Transboundary River & Lake Basins



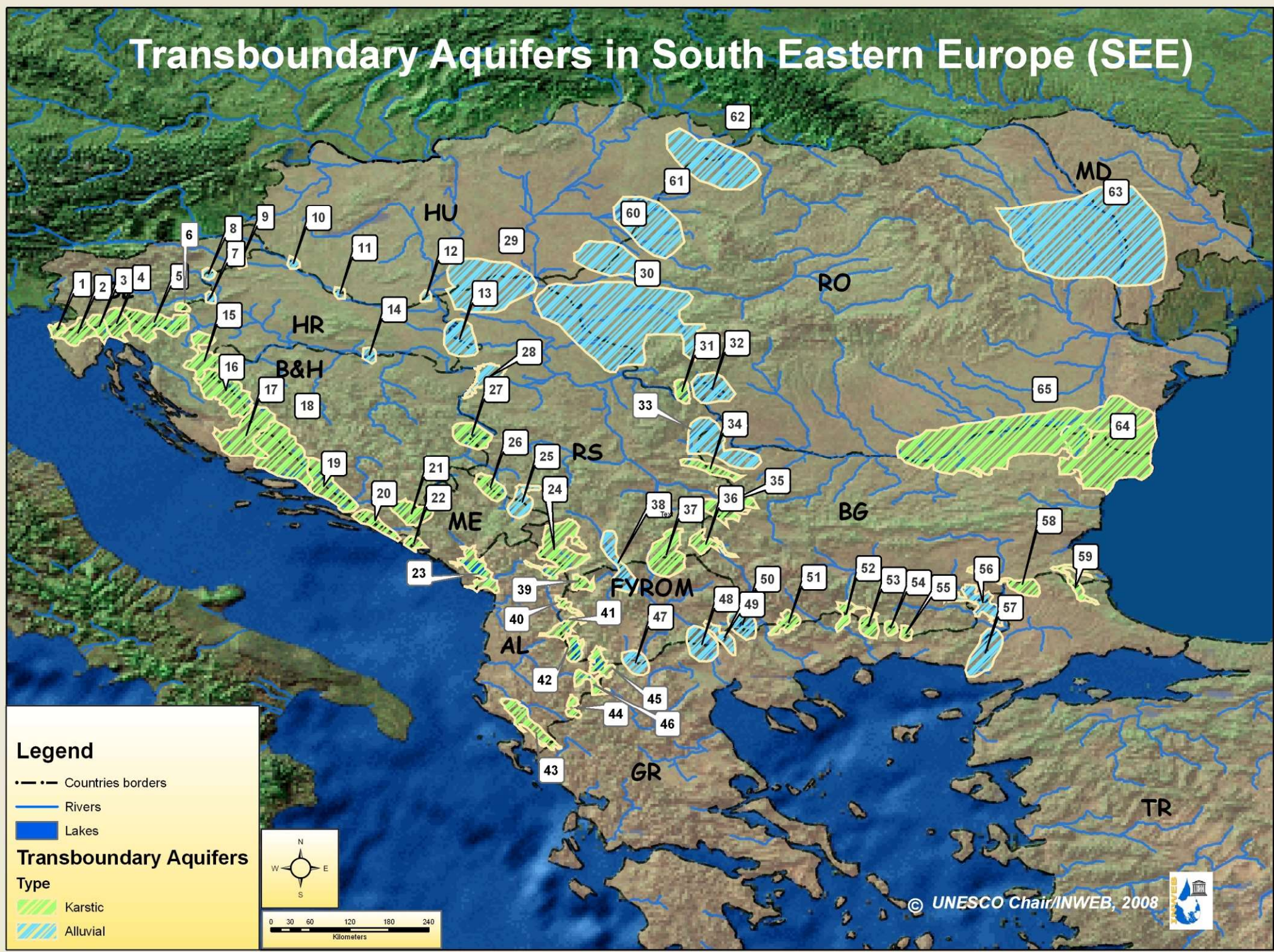
- Cover 45% of the land surface of the Earth;
- Affect 40% of the world's population;
- Account for approximately 60% of global river flow;
- Cross the political boundaries of 148 countries

Transboundary Aquifers of the World

- Update 2012 -



Transboundary Aquifers in South Eastern Europe (SEE)



Legend

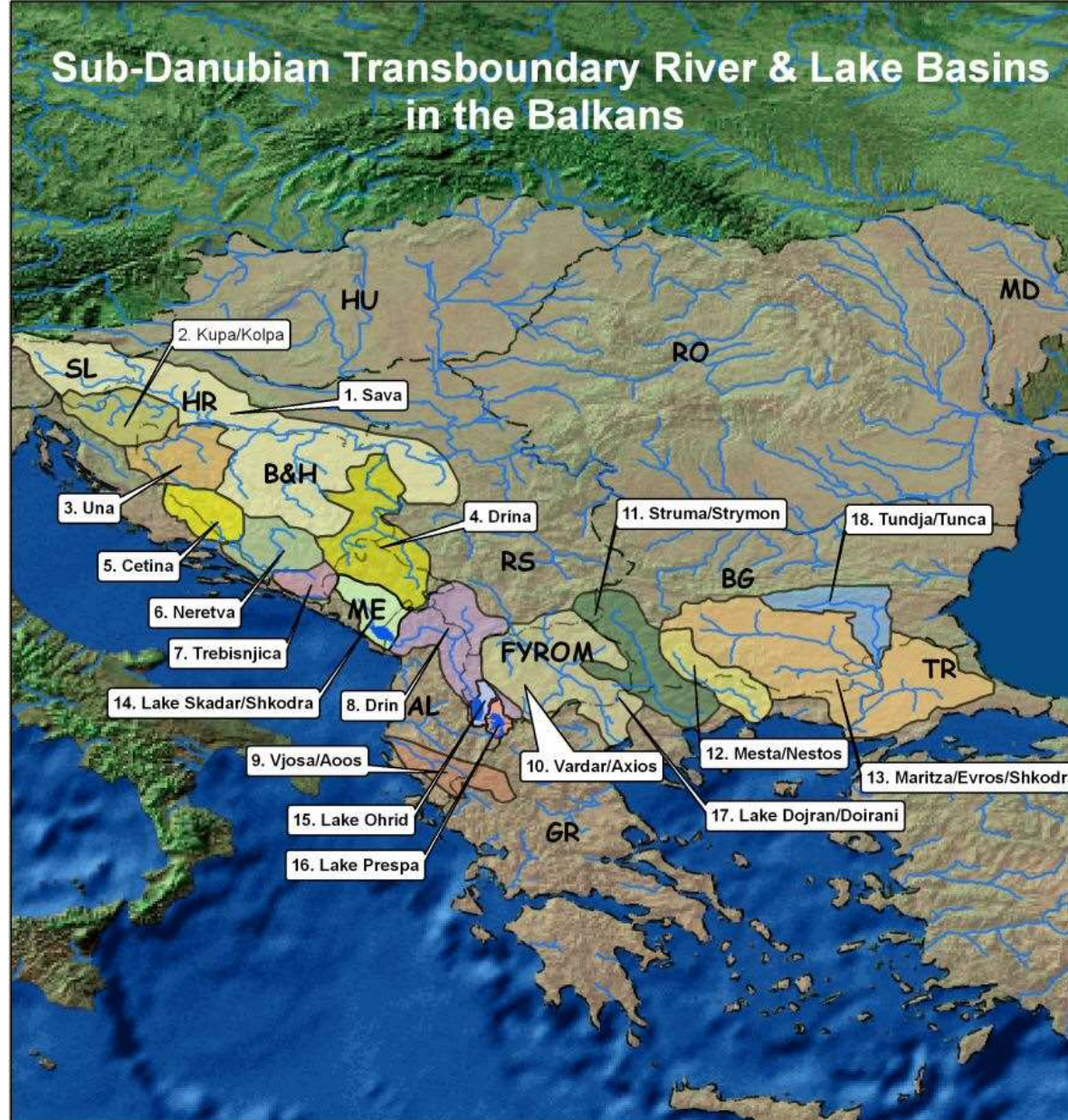
- Countries borders
- Rivers
- Lakes

Transboundary Aquifers

- Type
- Karstic
 - Alluvial



Sub-Danubian Transboundary River & Lake Basins in the Balkans



Legend

- Country Borders
- Rivers
- Lakes

Transboundary River Basins

- Cetina
- Drin
- Drina
- Kupa/Kolpa
- Maritza/Evros/Ergene
- Mesta/Nestos
- Neretva
- Sava
- Struma/Strymon
- Trebisnjica
- Tundja/Tunca
- Una
- Vardar/Axios
- Vjosa/Aoos

Transboundary Lakes

- Lake Dojran/Doirani
- Lake Ohrid
- Lake Prespa
- Lake Skadar/Shkodra

0 40 80 160 240 320
Kilometers

1. **Google maps and Google earth**
2. **[Global Groundwater Information System](#)**
3. **[Water Framework Directive implementation in Greece](#)**
4. **[Windy](#) (meteorological projections)**
5. **[Traffic in Thessaloniki](#)**
6. **[Marine traffic](#)**
7. **[Airplanes traffic](#)**

QGIS is a user-friendly Open-Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open-Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities.

<https://qgis.org/en/site/forusers/index.html>

- Download <https://qgis.org/en/site/forusers/download.html>
- User's manual https://docs.qgis.org/3.22/en/docs/user_manual/
- Training manual https://docs.qgis.org/3.22/en/docs/training_manual/

Proposed steps for creating a map:

1. **Get or create the required spatial information**
2. **Analyze the data**
3. **Creation of map**

For this exercise we will need

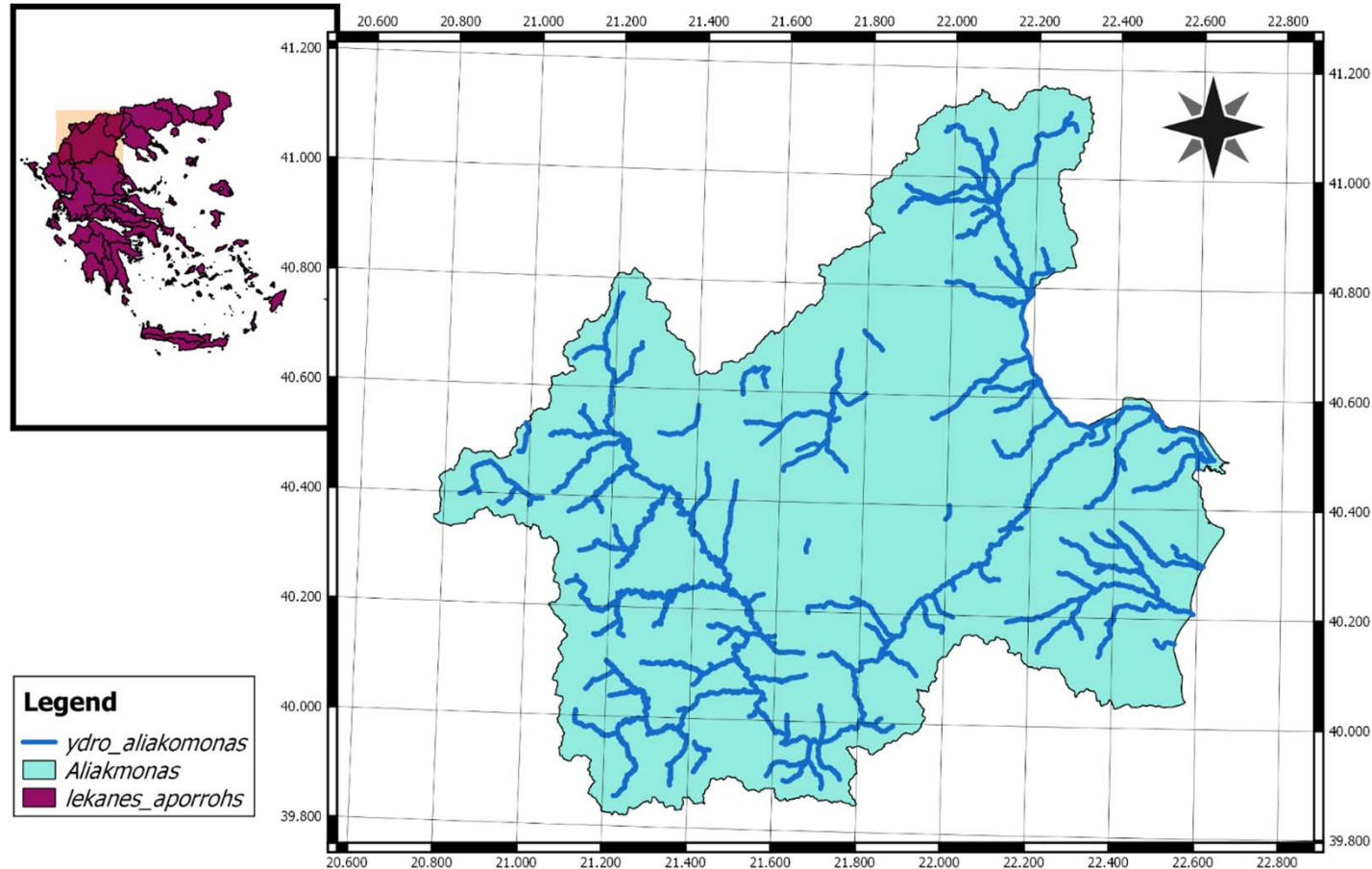
- **Countries boundaries**
- **Water Districts**
- **Basins of Greece**
- **Monitoring stations of Greece**
- **Rivers and Lakes**
- **Protected areas**

At the European Union scale, there are 2 main data sources that include data for the water resources:

- **[WISE - Water Information System for Europe is the European information gateway to water issues](#)**
- **[European Environment Information and Observation Network](#)**

WISE: We will retrieve data for this exercise such as:

- **Water Districts**
- **Basins of Greece**
- **Monitoring stations of Greece**
- **Rivers and Lakes**



Λεκάνη απορροής Αλιάκμονα και κύριο υδρογραφικό δίκτυο

Thank you for your attention!
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