

Water management adaptation to climate change: Romanian experience

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Adaptation to climate change requires.....

- **Science based knowledge**
- **Resilient development policies**
- **Behavioral change**
- **Appropriate institutions and regulatory mechanisms**
- **Adequate economic resources and instruments**
- **Regional & international cooperation**

Effects of water scarcity and droughts

- Threatened water supplies for human agglomerations and industries
- Reduced water availability for agriculture
- Reduced hydropower production (more use of coal and gas power)
- Disturbance of inland navigation
- Increased risk of algal blooms
- Changes in salt-loads in streams (both increases and decreases possible)
- Impact on river flora and fauna

Main factors

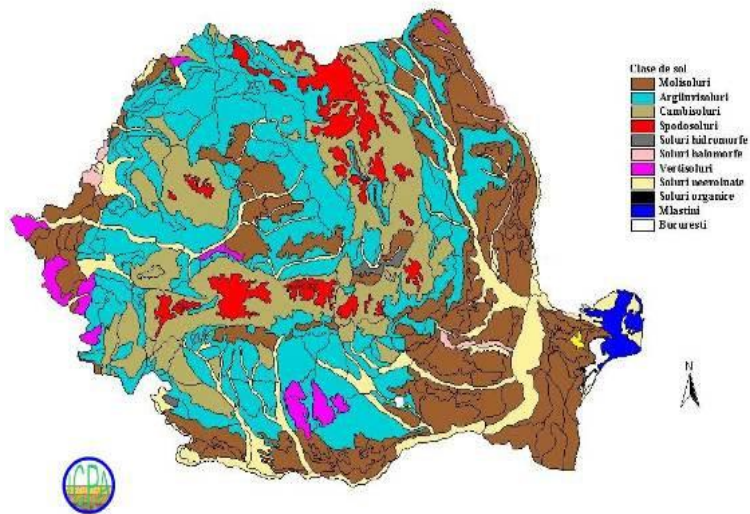
- Geomorphology
- Soils
- River network
- Climate
- Vegetation
- Human impact

Geomorphology

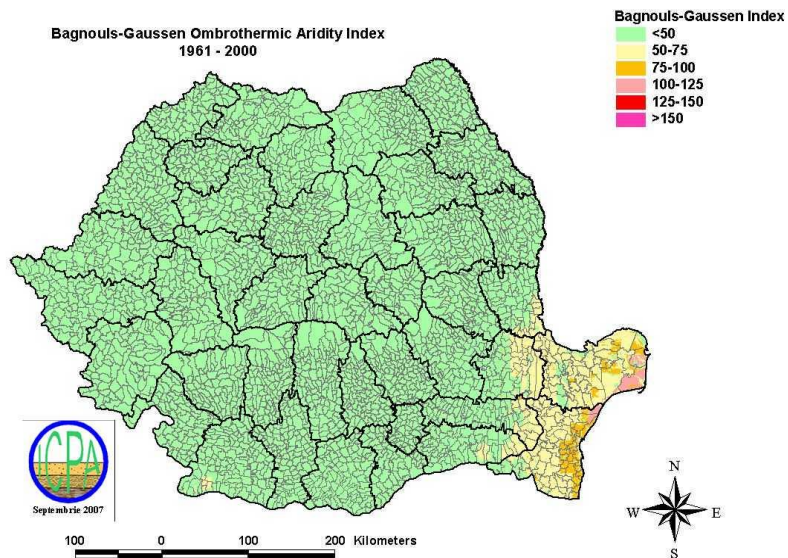
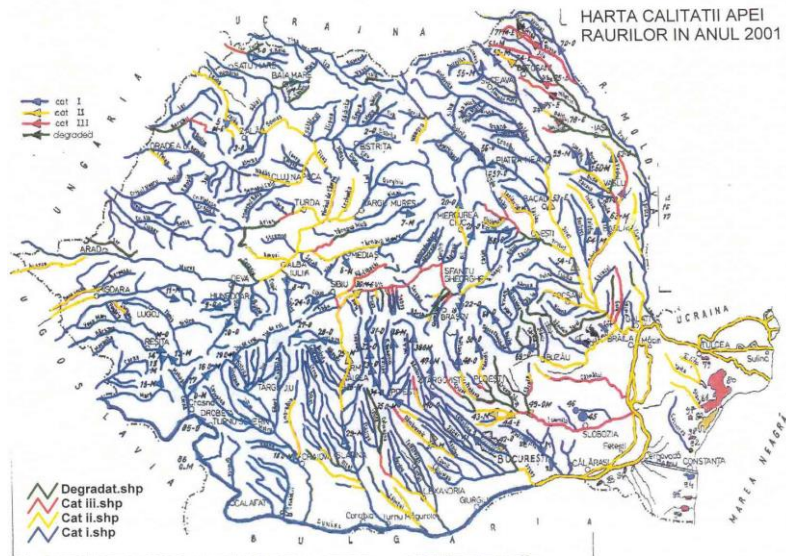


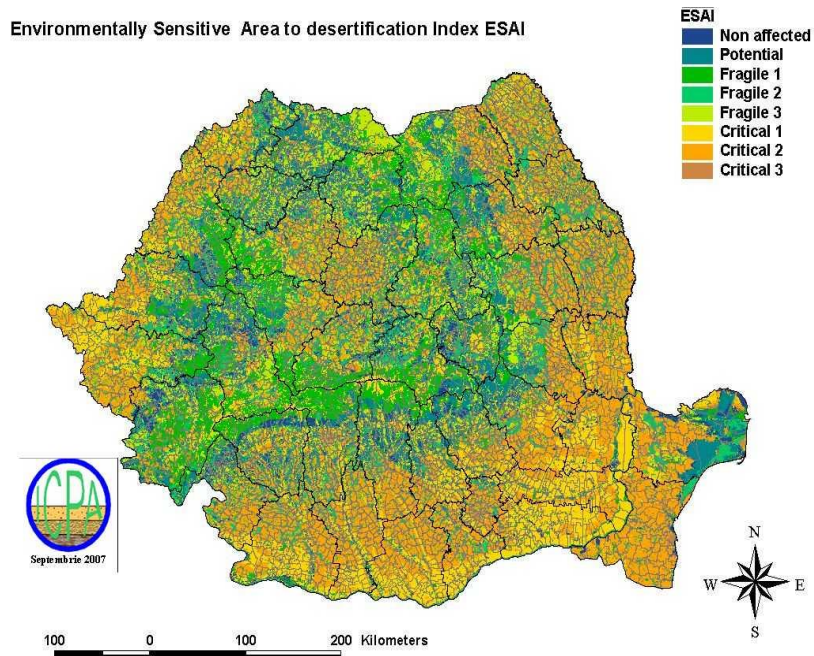
- Carpathians make a barrier and separate a continental oceanic climate in West by continental climate in East

Soils of Romania



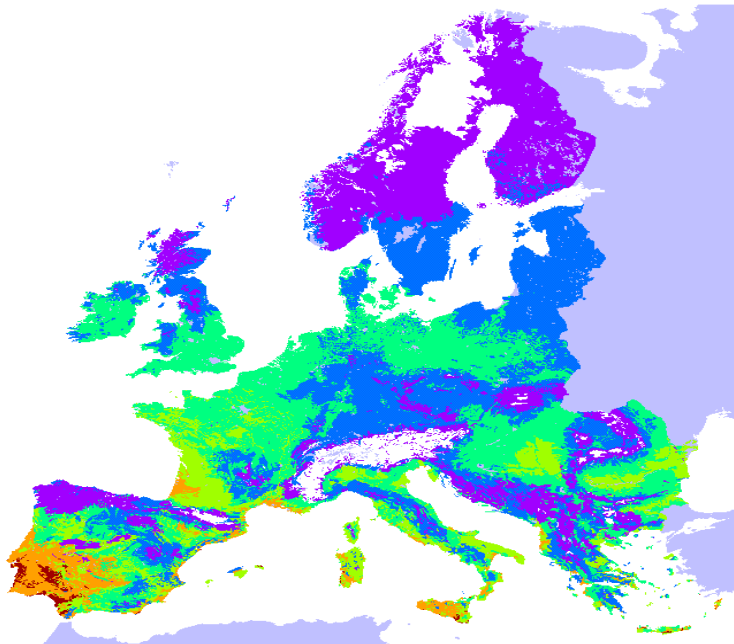
Complex hydrographic network





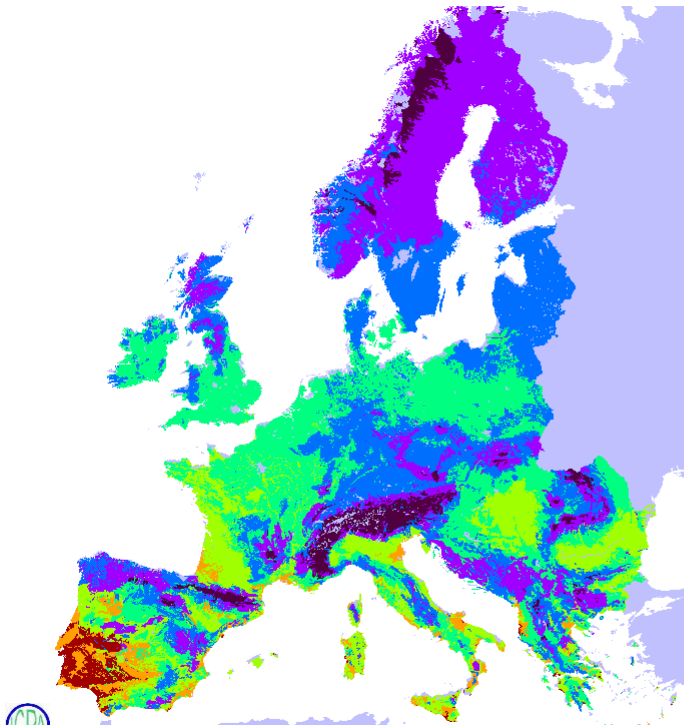
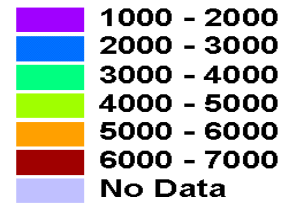
Scenarios concerning water scarcity and drought in Romania

- Increase in average temperature (0.5-1.5 °C on medium term and 2.0-5.0 °C)
- Prolonged droughts in south and south eastern part of the country
- Reduction of the water inflow by 20%



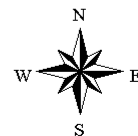
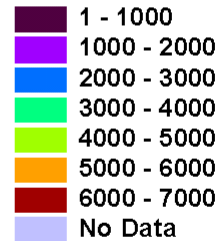
Sum T > 0 All year

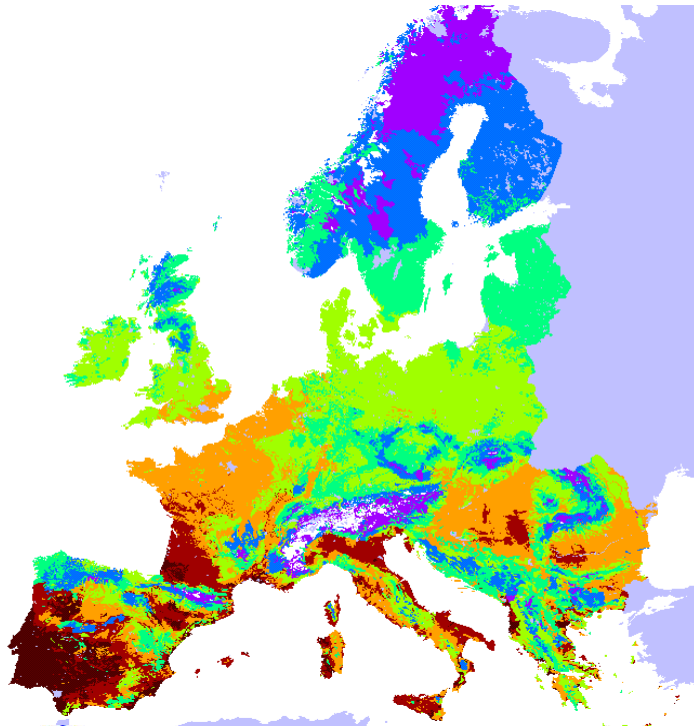
Meteo 1990.shp
0 - 1000



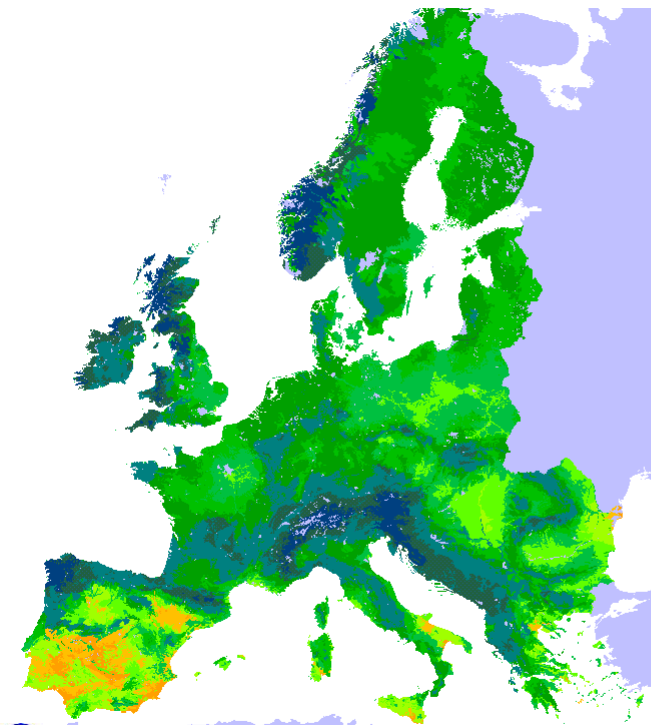
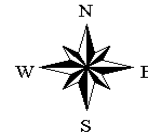
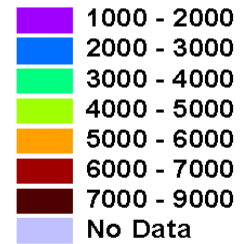
Sum T > 0 All year

Meteo 2015 h2.shp



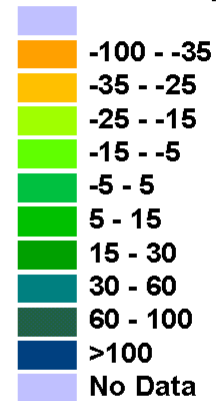


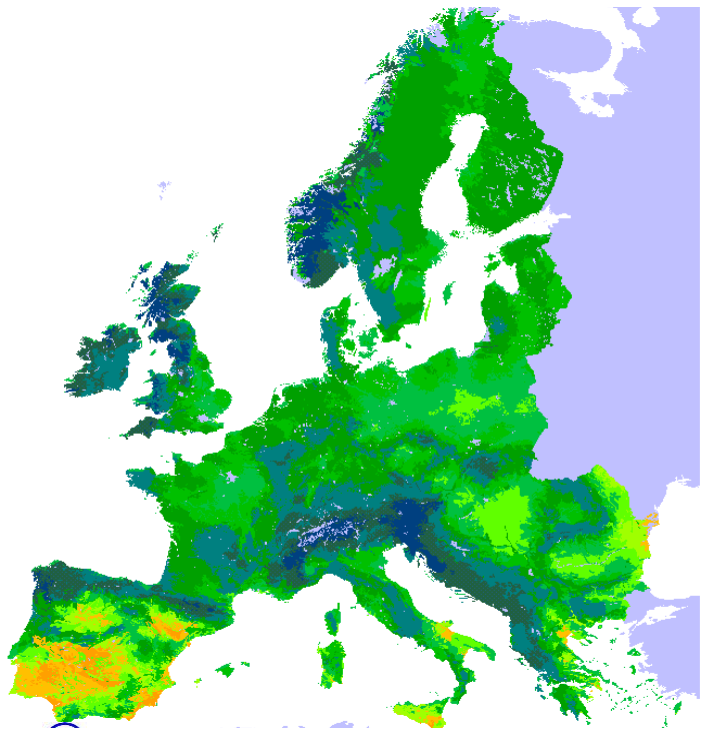
Meteo 2085 h2.shp
0 - 1000



**Average yearly rain excedent
Soil drainage included**

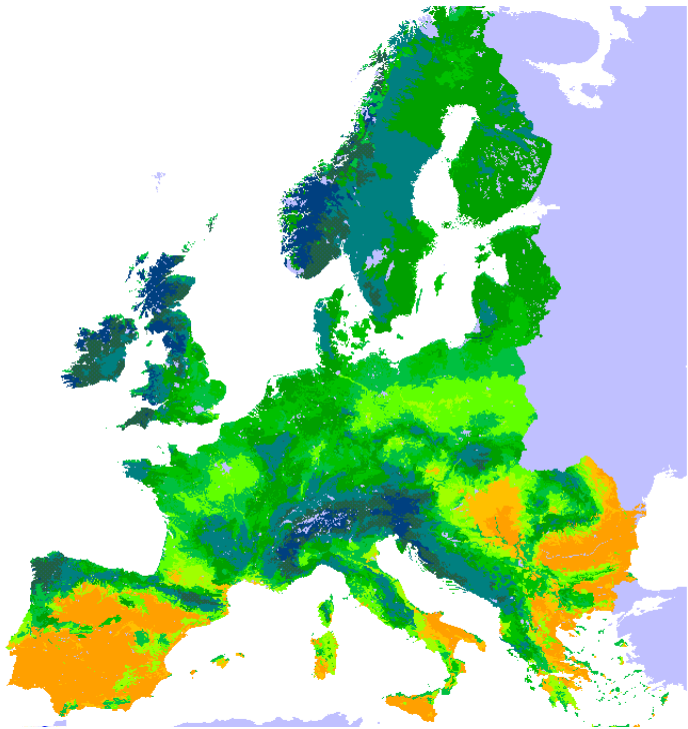
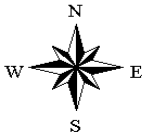
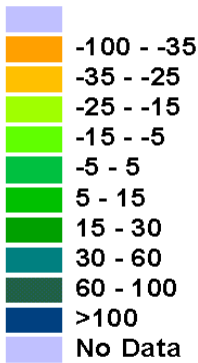
Meteo 1990.shp





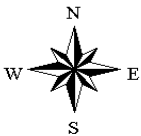
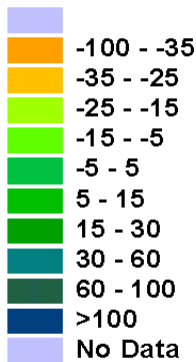
Average Yearly Rain Excedent
Soil Drainage included

Meteo 2015 h2.shp



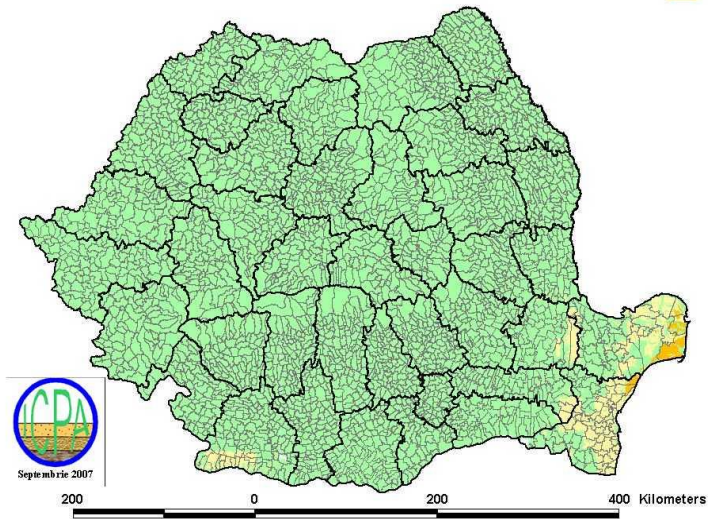
Average Yearly Rain Excedent
Soil Drainage included

Meteo 2085 h2.shp



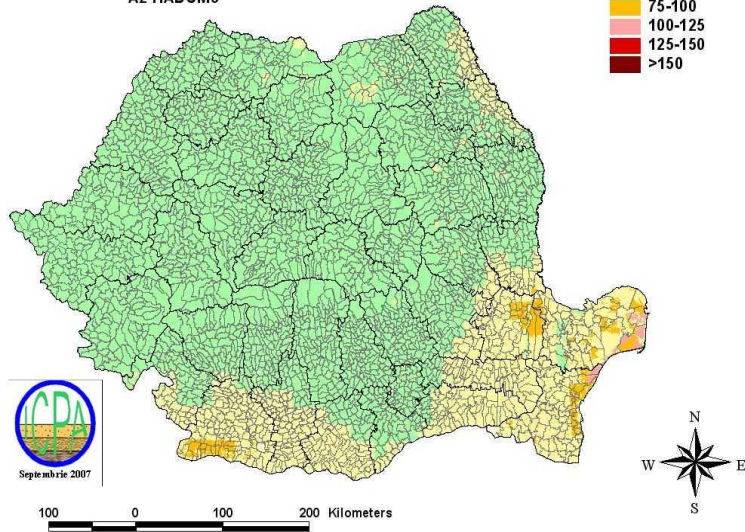
Bagnouls-Gausson Ombrothermic Aridity Index
2010-2020
A2 HADCM3

Bagnouls-Gausson Index
<50
50-75
75-100



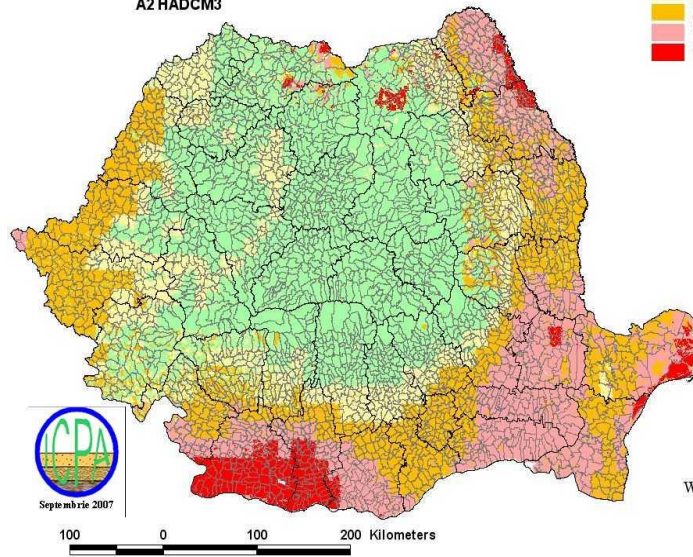
Bagnouls-Gausson Ombrothermic Aridity Index
2041-2050
A2 HADCM3

Bagnouls_Gausson Index
<50
50-75
75-100
100-125
125-150
>150

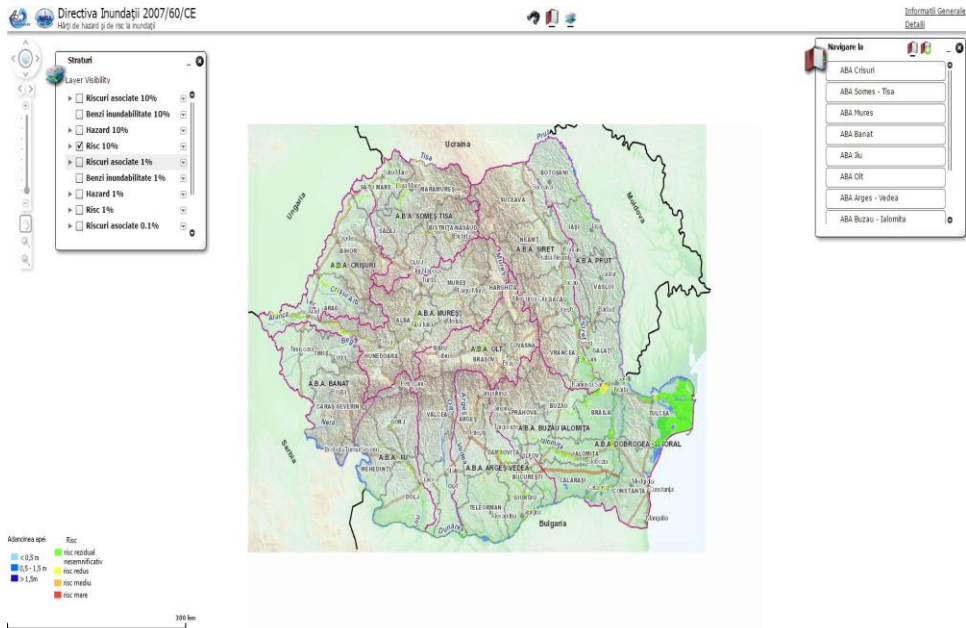


Bagnouls-Gausson Ombrothermic Aridity Index
2071-2080
A2 HADCM3

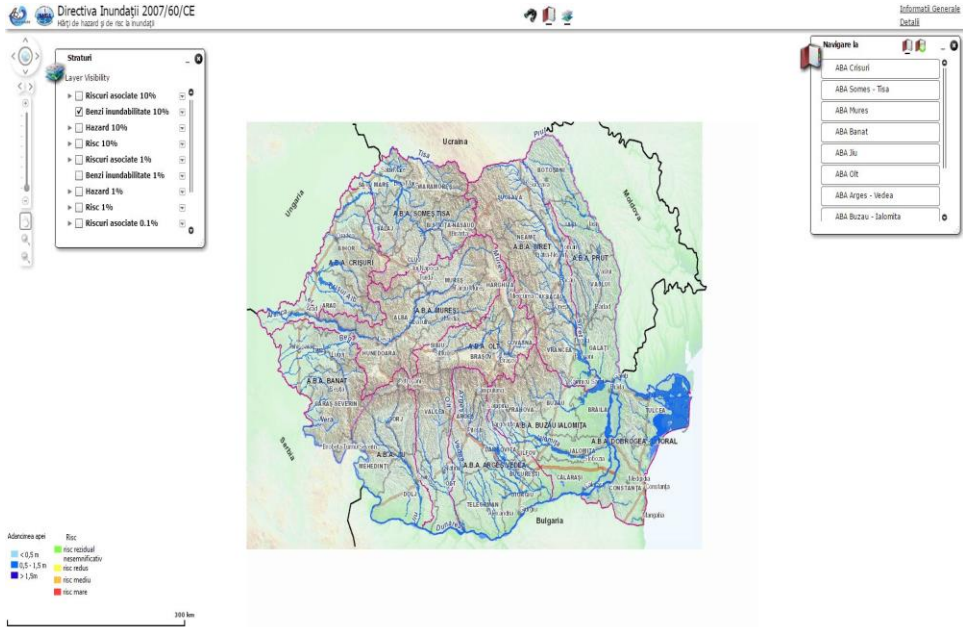
Bagnouls-Gausson Index



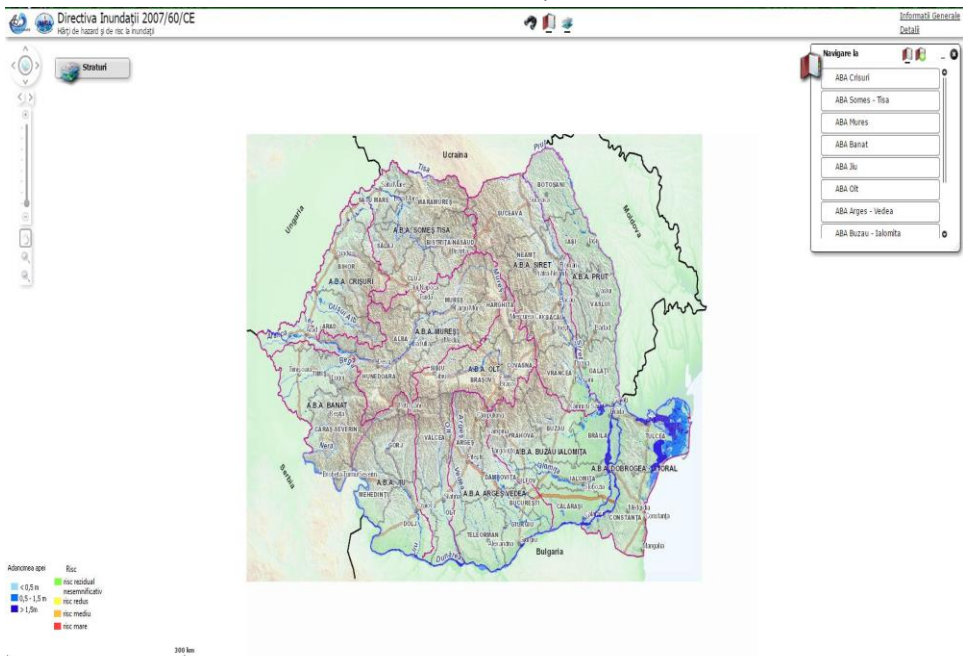
Flood Risk Map



Flood areas



Hazard Map



Action Plan for Water Scarcity and Drought

- Strengthening institutional framework
- Improving legislative framework
- Developing a long term strategy
- Increase research and development activities
- Establishing and implement adaptation measures

Strengthening institutional framework

- Improving cooperation between main institutions involved in drought management
 - Ministry of Agriculture and Rural Development (National Administration for Land Reclamation, National Institute for Soil Science)
 - Ministry of Environment, Water and Forest (National Administration "Romanian Waters", National Forest Administration National Administration for Meteorology)
- Improving consultancy capacity in rural area

Implementation of long term strategy concerning flood risk management

- Improve the institutional capacity
- Increase public awareness
- Develop and implement “no regret measures”
- Promote insurance for covering the risk
- Upgrade existing infrastructure (events occurring in 100 years)
- Improve the forecast capacity
- Training and involvement of the local communities

Developing a long term strategy for droughts and water scarcity

- to reduce vulnerability of the local communities and natural ecosystems
- to reduce effects on social and economic activities
- to provide a sustainable framework for further development
- to increase public awareness and public involvement

Increase research and development activities

- Improve the knowledge of drought and land degradation phenomena
- Extend the capacity for meteorological and hydrological forecast
- Development of the water saving technologies
- Improving knowledge on water resources (groundwater)
- Improving knowledge related to flash floods
- Further research for climate change effects

Establishment and implementation of the adaptation measures

Non- structural measures

- Creation of a water saving culture/new technologies
- Better forecast of water regime
- Use of economic instruments/right price on water
- Improve land use planning
- Optimization of the water management
- Re-use of water

Establishment and implementation of the adaptation measures

- Afforestation
- Extensions and rehabilitation of the water supply networks
- Modernization of the irrigation systems
- Rehabilitation of the wetland areas
- Developing new water sources (wells)
- Improving waste water treatment

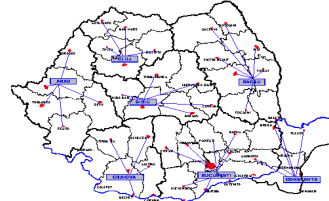
Measure implementation

Few examples

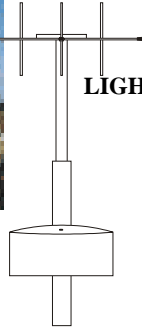
SIMIN: AUTOMATICAL MEASURE POINTS



**WEATHER
AUTOMATICAL
STATIONS (60)**

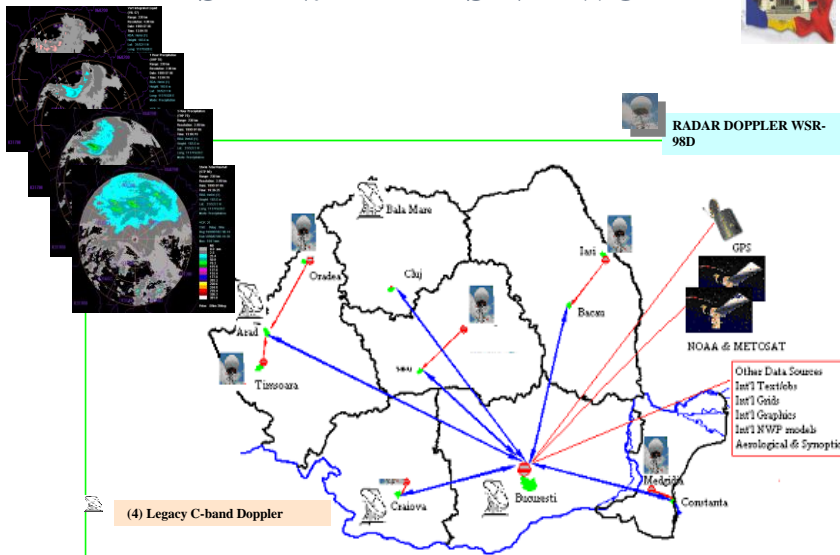


**LIGHTNING DETECTORS
NETWORK (8 Sensors)**



**Hydro-meteorological
river and sea buoys
(8 River, 3 Sea)**

SIMIN: RADARS NETWORK



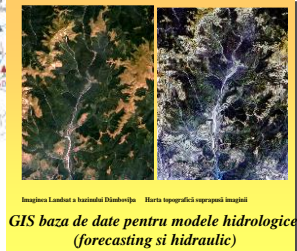
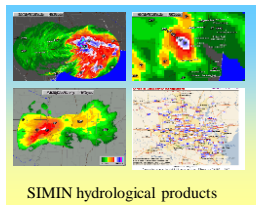
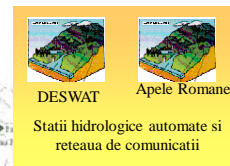
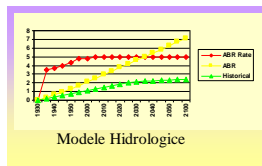
DESWAT**UPGRADE HYDROLOGICAL MONITORING STATIONS**

**UPGRADE OR REPLACE EXISTING
STRUCTURES**

581 HYDROLOGICAL STATIONS

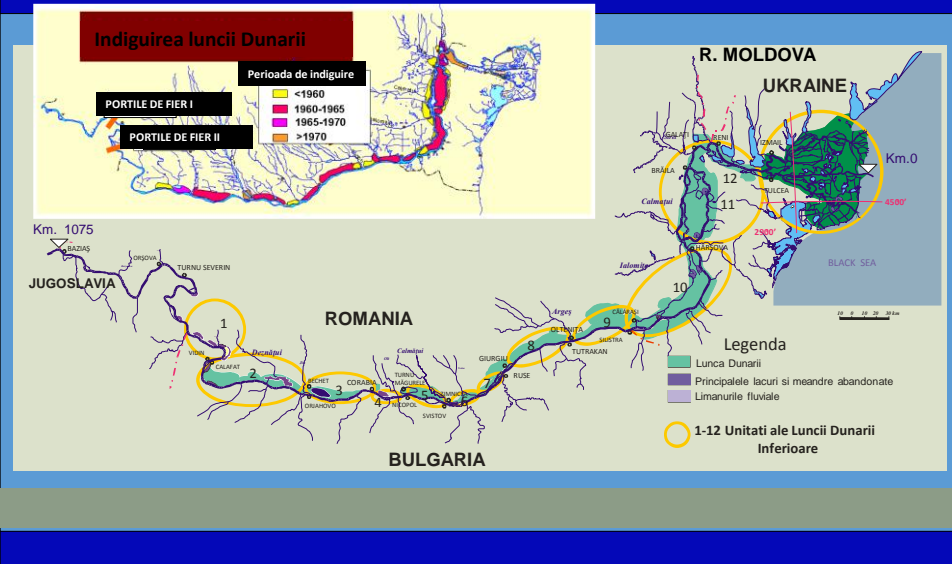
70 QUALITY STATIONS

250 RAINGAGE STATIONS



**DEVELOPING THE HYDROLOGICAL
FORECASTING SYSTEM**

Rehabilitation of the wetland areas in the Danube floodplain



Ecological rehabilitation works



Improving water circulation



Afforestation of river floodplain in 2003



Afforested area – Independenta commune, August 2003



The same area in August 2004



