Action Plan for Water Scarcity and Drought in Romania

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- **97.8 % of the Romanian surface is included in the Danube River Basin**
- **30% of the Danube River Basin belongs to Romania**

Danube is the most important theoretical water resource for Romania
Danube is very important resource from the environmental point of view mainly for the Danube Delta

Water resources of Romania (*theoretical)*

- **Inland rivers - 40 billions cm/year**
- **Danube - 85 billions cm/year**
- **Underground water -10.3 billions cm/year**

Water resources of Romania (*available)*

- **Inland rivers -14.1 billions cm/year**
- **Danube -20 billions cm/year**
- **Undergroundwater -6 billions cm/year**

Specific water resource –around 1800 cm/inhabitant/year (European average around 4000 cm/inhabitant/year

Drought and Water Scarcity in Romania-Causes

- Increase of the yearly average temperature by 0.3 ^{o}C
- Increase in number of the tropical days (>30 ^{o}C)
- Decrease of the winter days (<0 ^{o}C)
- Rapid increase in the phenomena after 2000
- Decrease of precipitation (mainly in the south of the country)
- Decrease of runoff

Impact on the water regime

- Reduced inflows to water storages
- Reduced streamflows in major catchments
- Reduced recharge of groundwater
- High frequency and duration of drying up of rivers having a catchment area less than 500 km2.

Effects of water scarcity and drougths

- 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

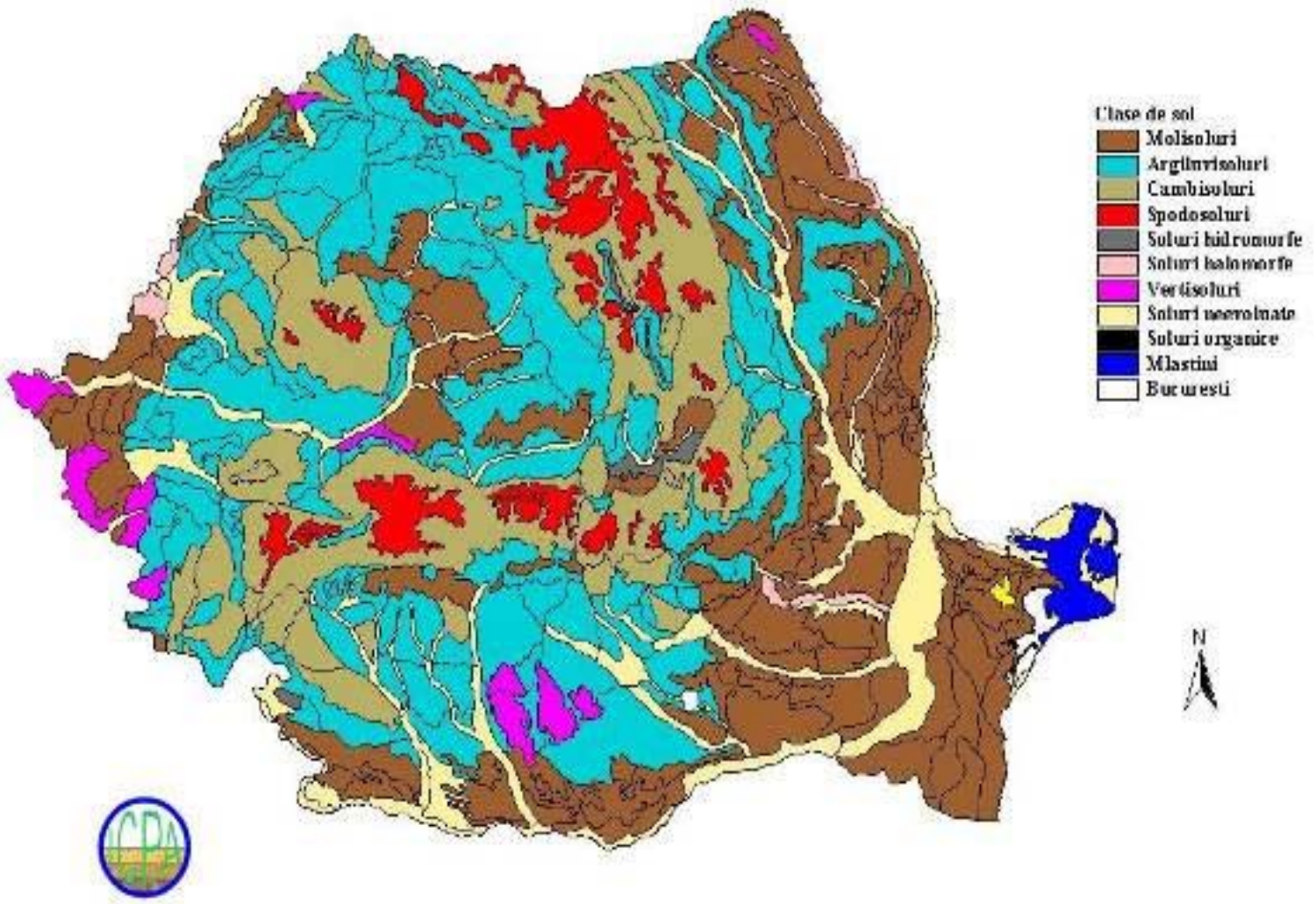
Main factors

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

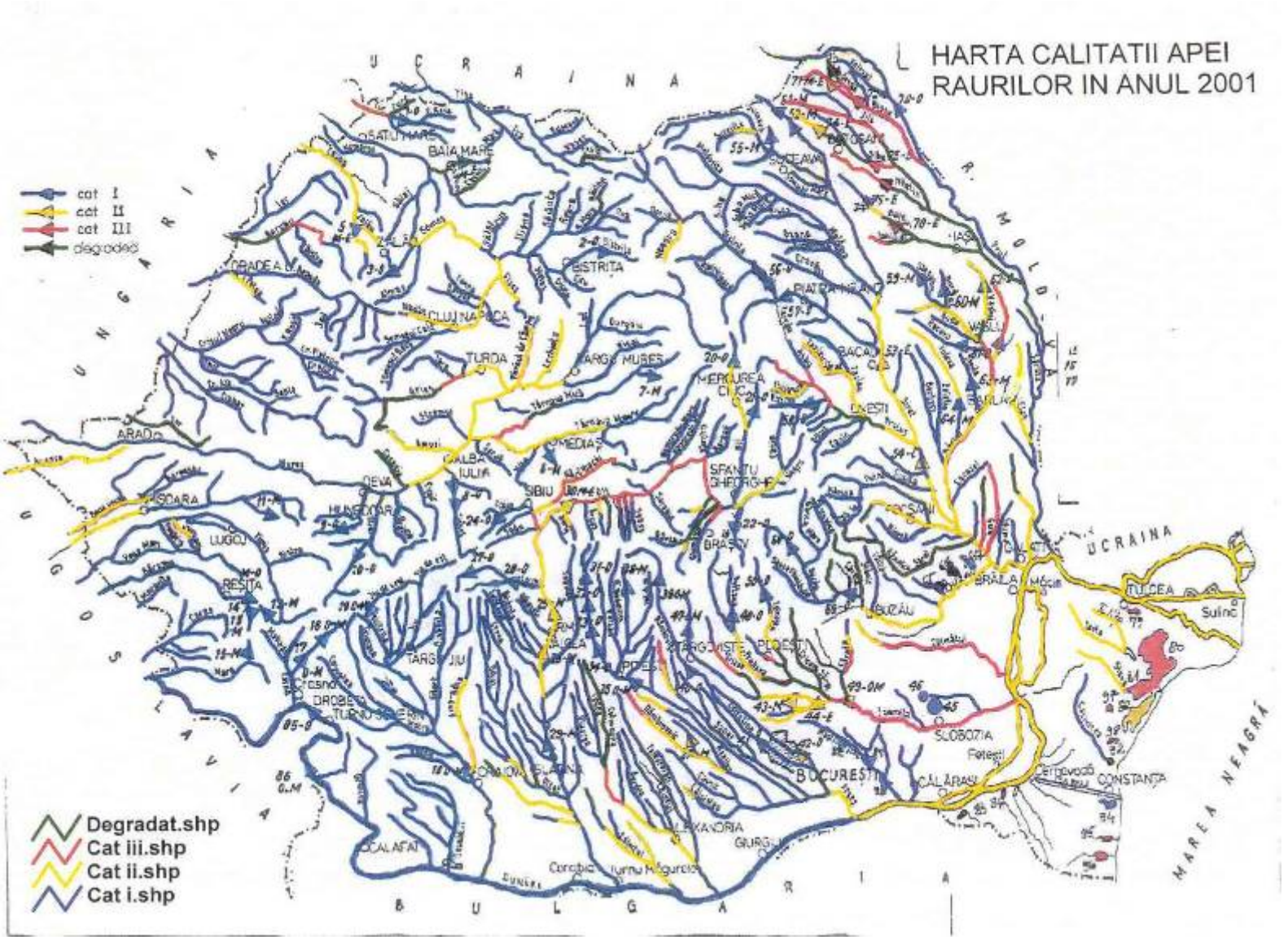
Geomorphology

- Carpathians make a barrier and separate a continental oceanic climate in west by continental climate in east

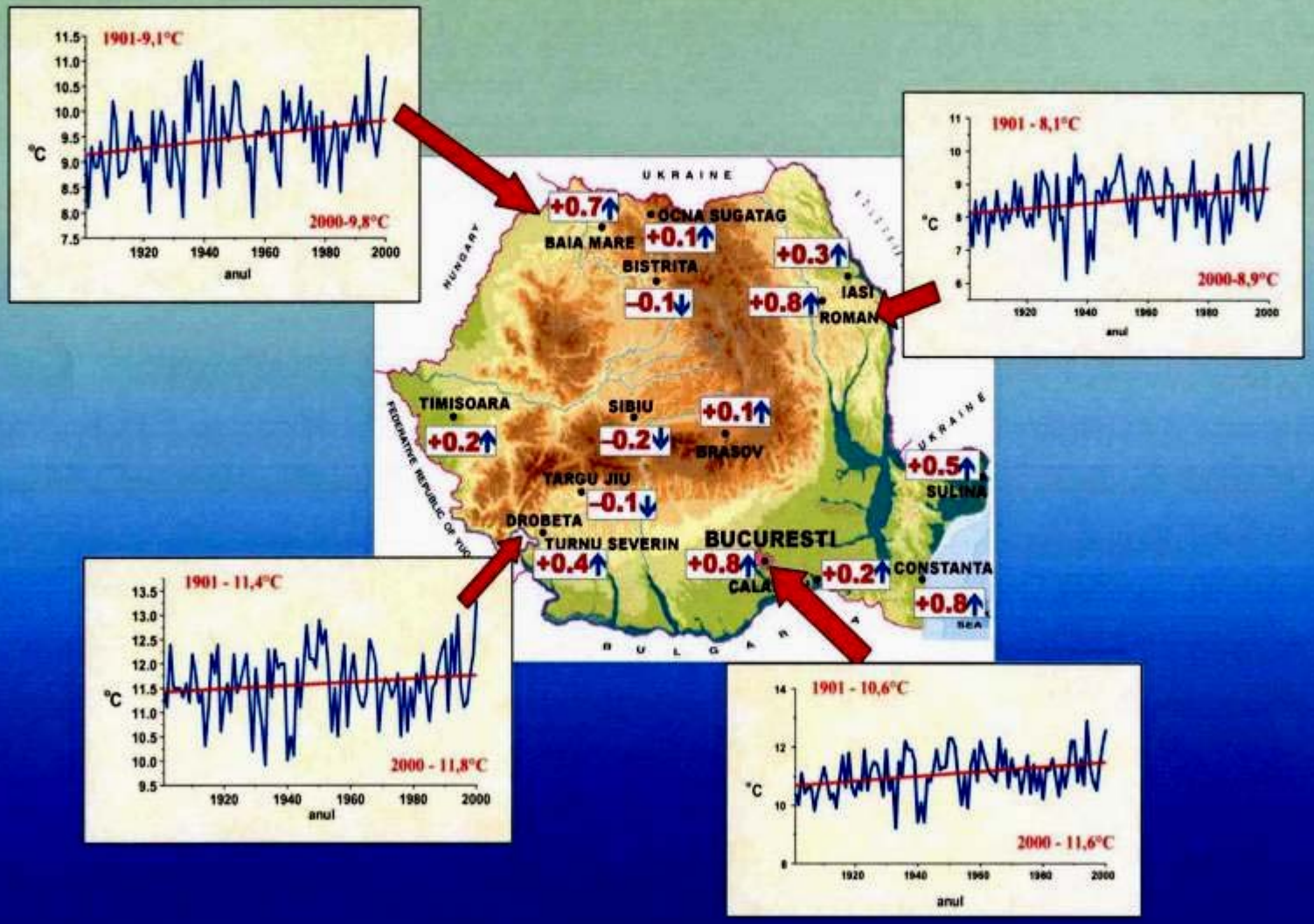
Soils of Romania



Complex hydrographic network



TEMPERATURA MEDIE ANUALA IN ROMANIA (°C/1901-2000);



Yearly average precipitation in Romania (1900-2000)

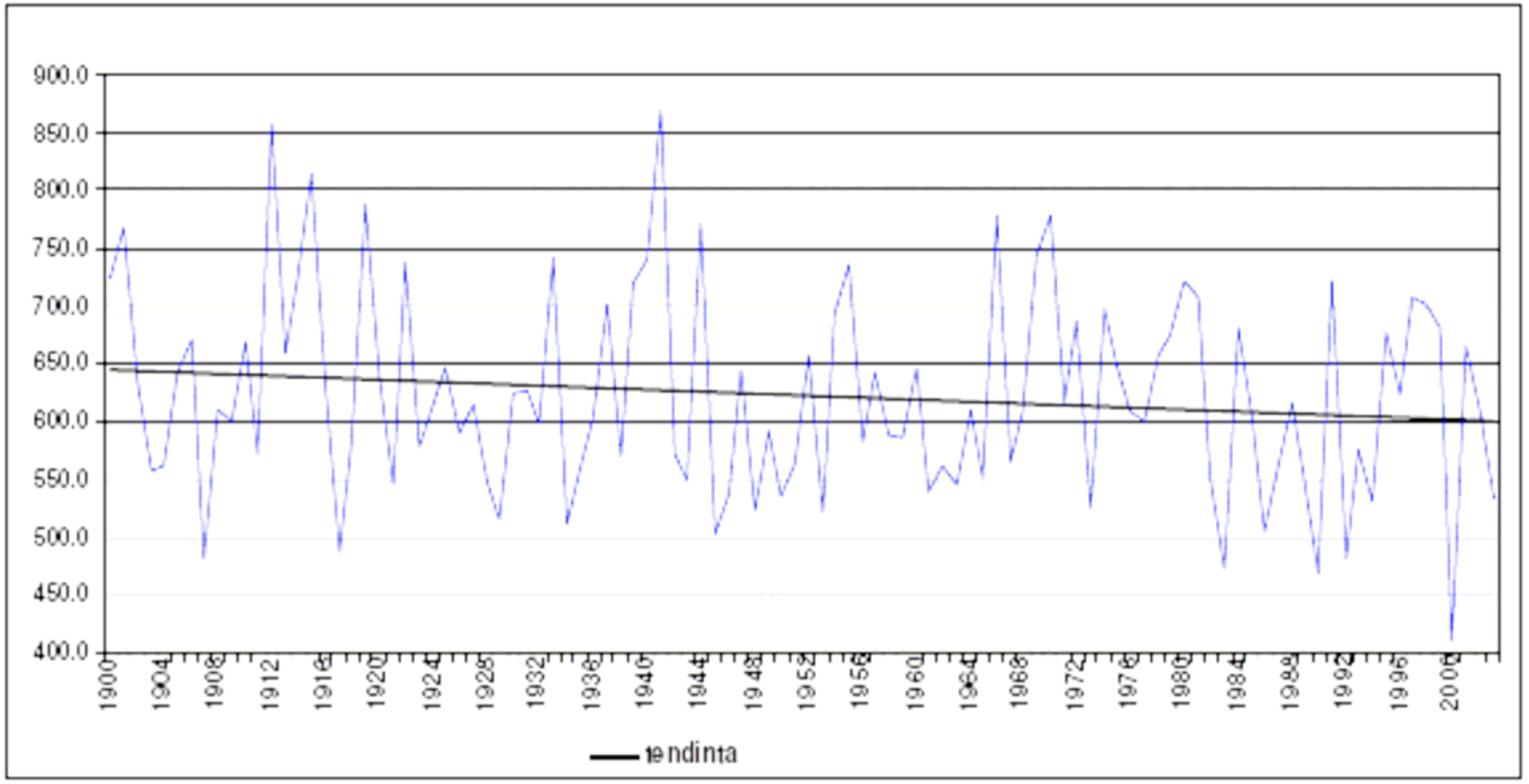
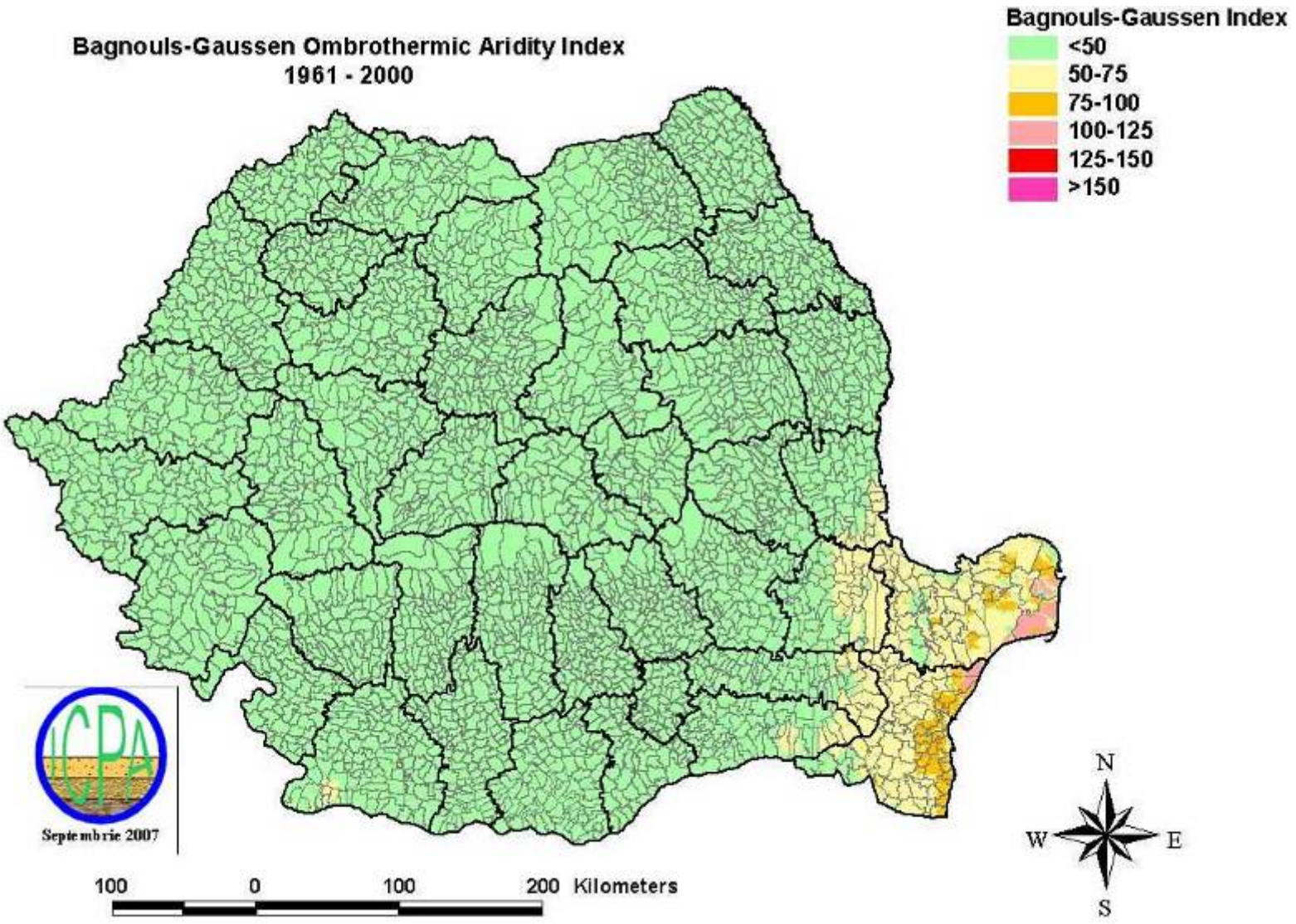
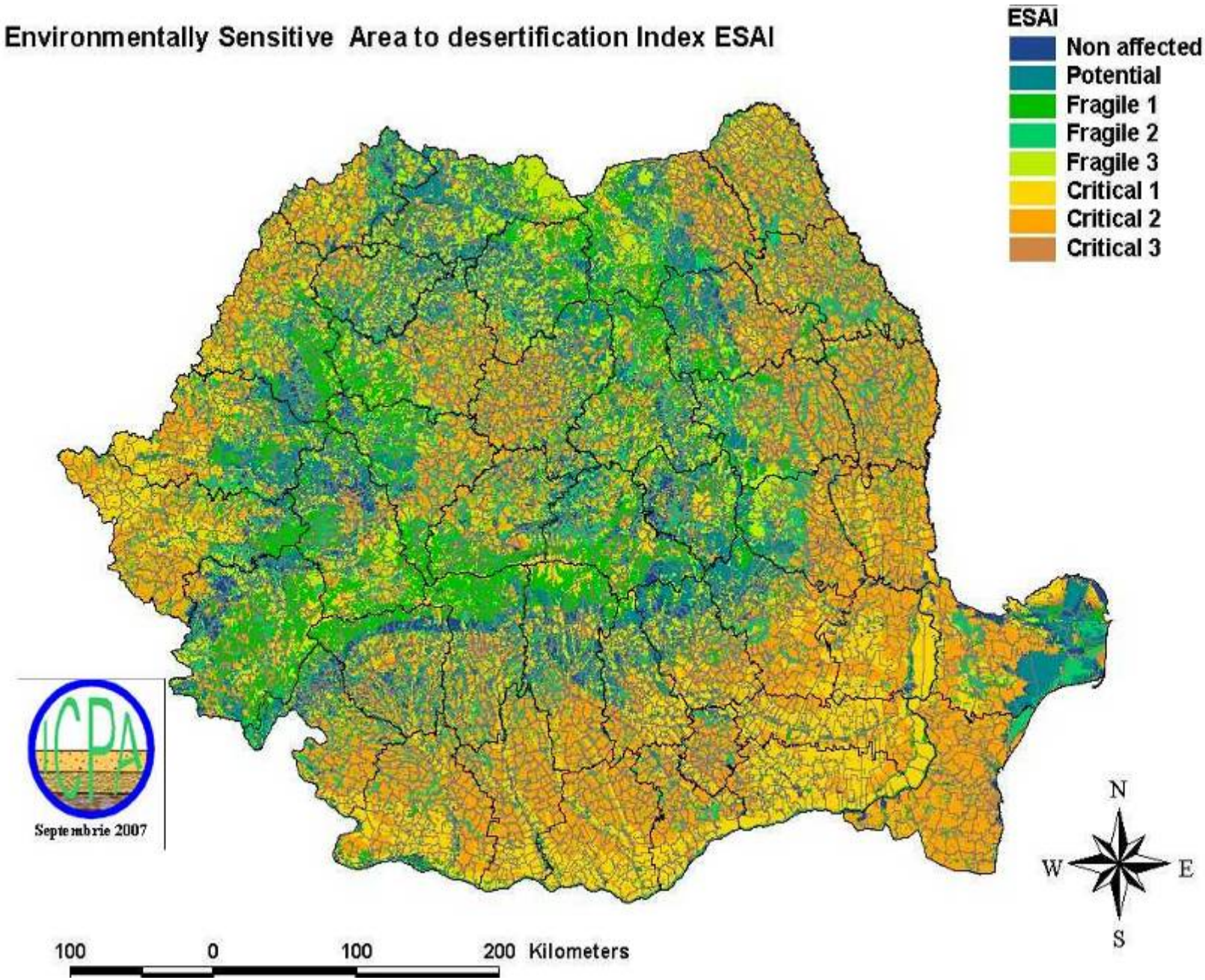


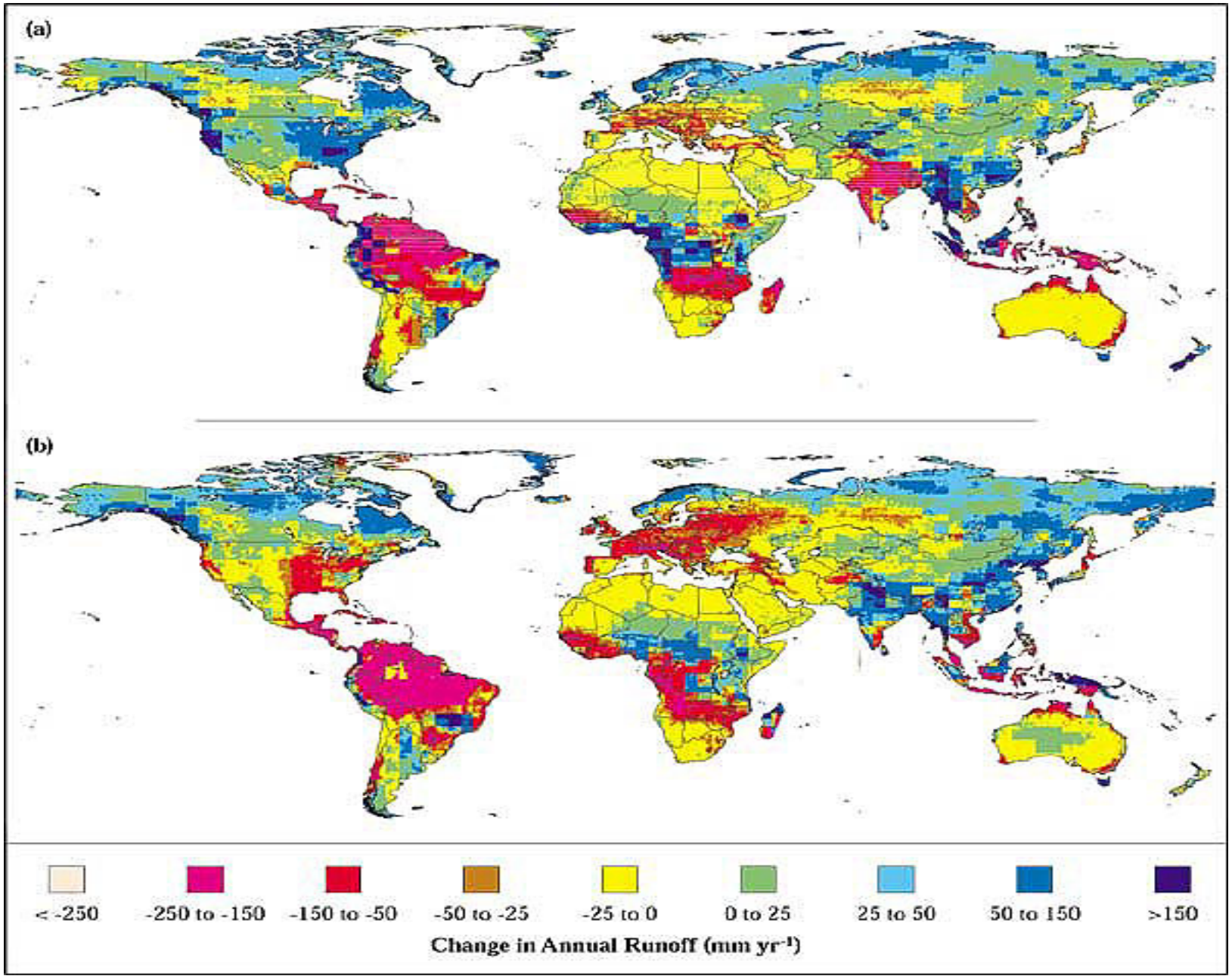
Figura 2. Cantitatea medie anuala de precipitații în România 1900-2000 (ANM, 2007)

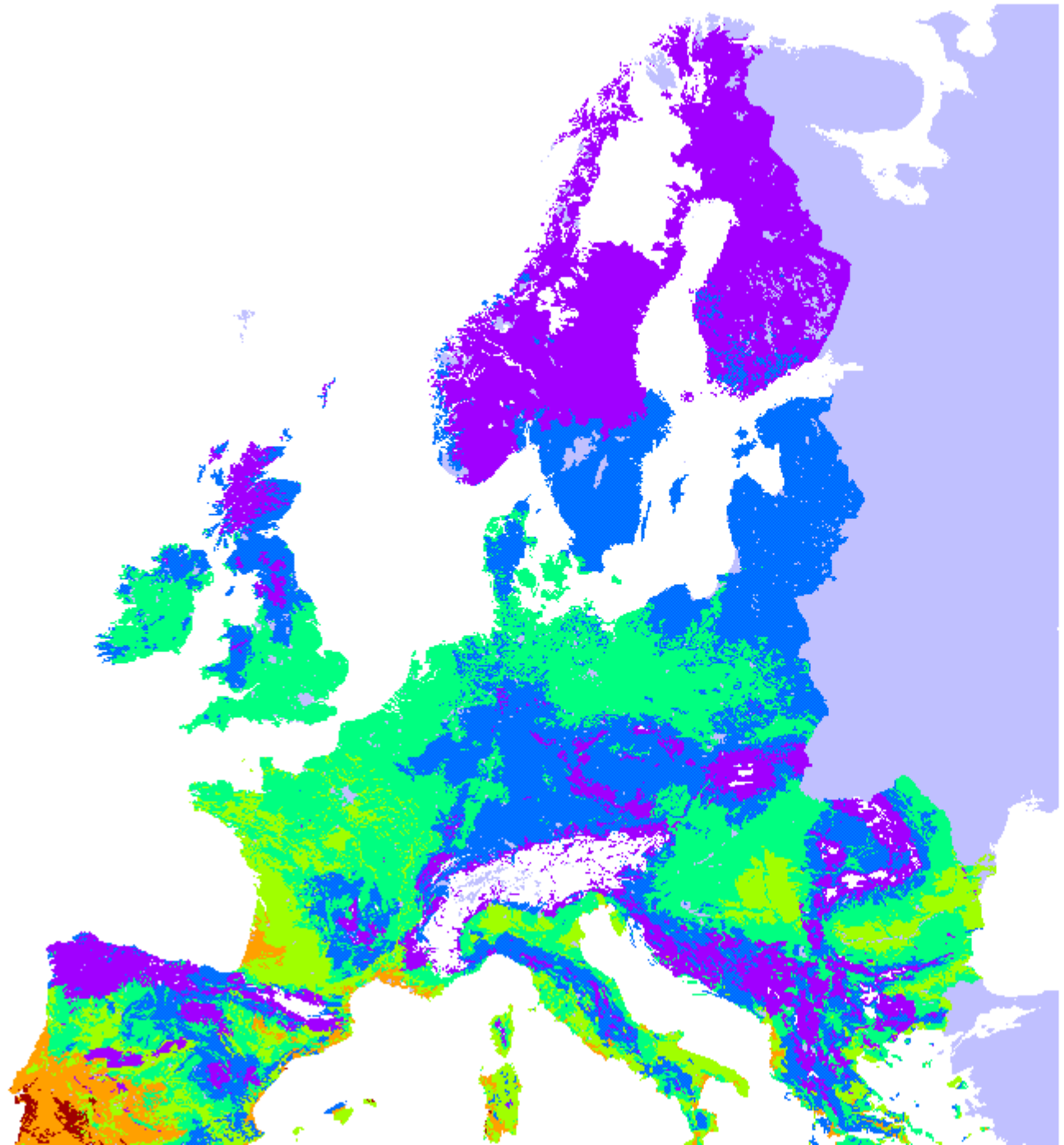

Bagnouls-Gaussen Ombrothermic Aridity Index
1961 - 2000
Bagnouls-Gaussen Index
<50
50-75
75-100
100-125
125-150
>150
ICPA
Septembrie 2007
100 0 100 200 Kilometers
N
W
E
S


Environmentally Sensitive Area to desertification Index ESAI
ESAI
Non affected
Potential
Fragile 1
Fragile 2
Fragile 3
Critical 1
Critical 2
Critical 3
ICPA
Septembrie 2007
N
W
E
S
100
0
100
200 Kilometers

Scenarios concerning water scarcity and drougth in Romania

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


(a)
(b)
< -250
-250 to -150
-150 to -50
-50 to -25
-25 to 0
0 to 25
25 to 50
50 to 150
>150
Change in Annual Runoff (mm yr-1)

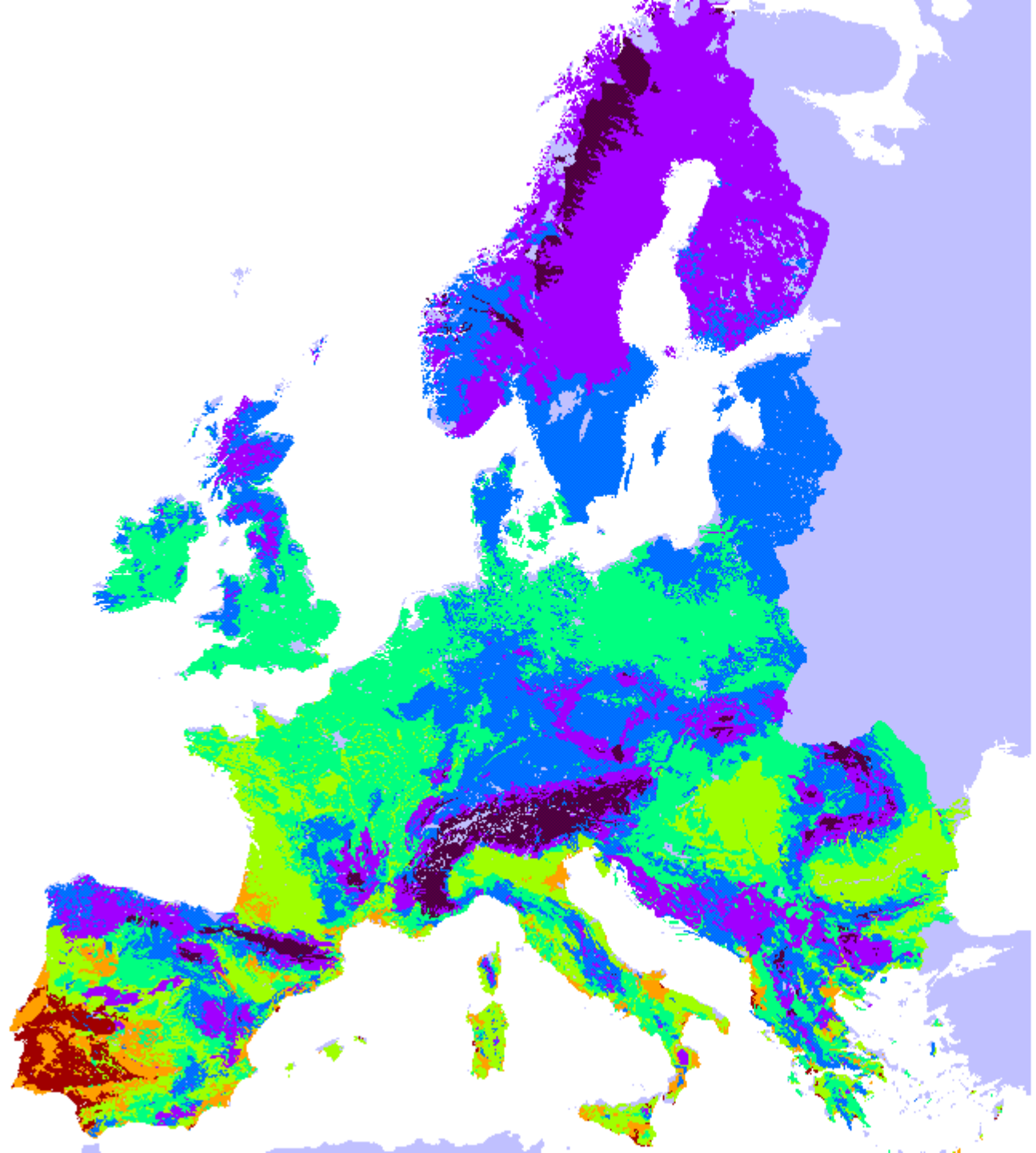


Sum T > 0
All year

Meteo 1990.shp

0 - 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
5000 - 6000
6000 - 7000
No Data

N
W
E

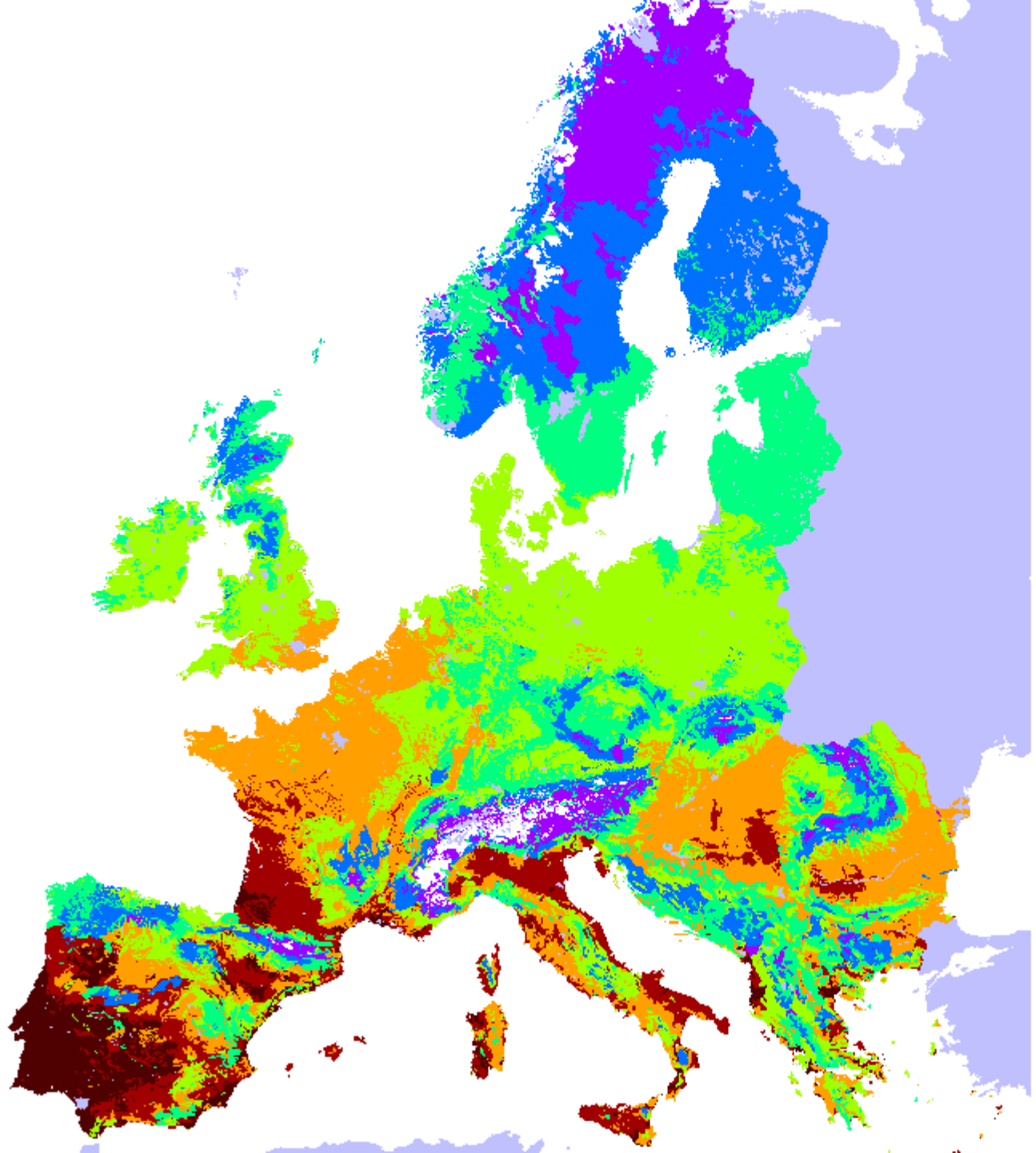


Sum T > 0
All year

Meteo 2015 h2.shp

- 1 - 1000
- 1000 - 2000
- 2000 - 3000
- 3000 - 4000
- 4000 - 5000
- 5000 - 6000
- 6000 - 7000
- No Data

N
W E
S

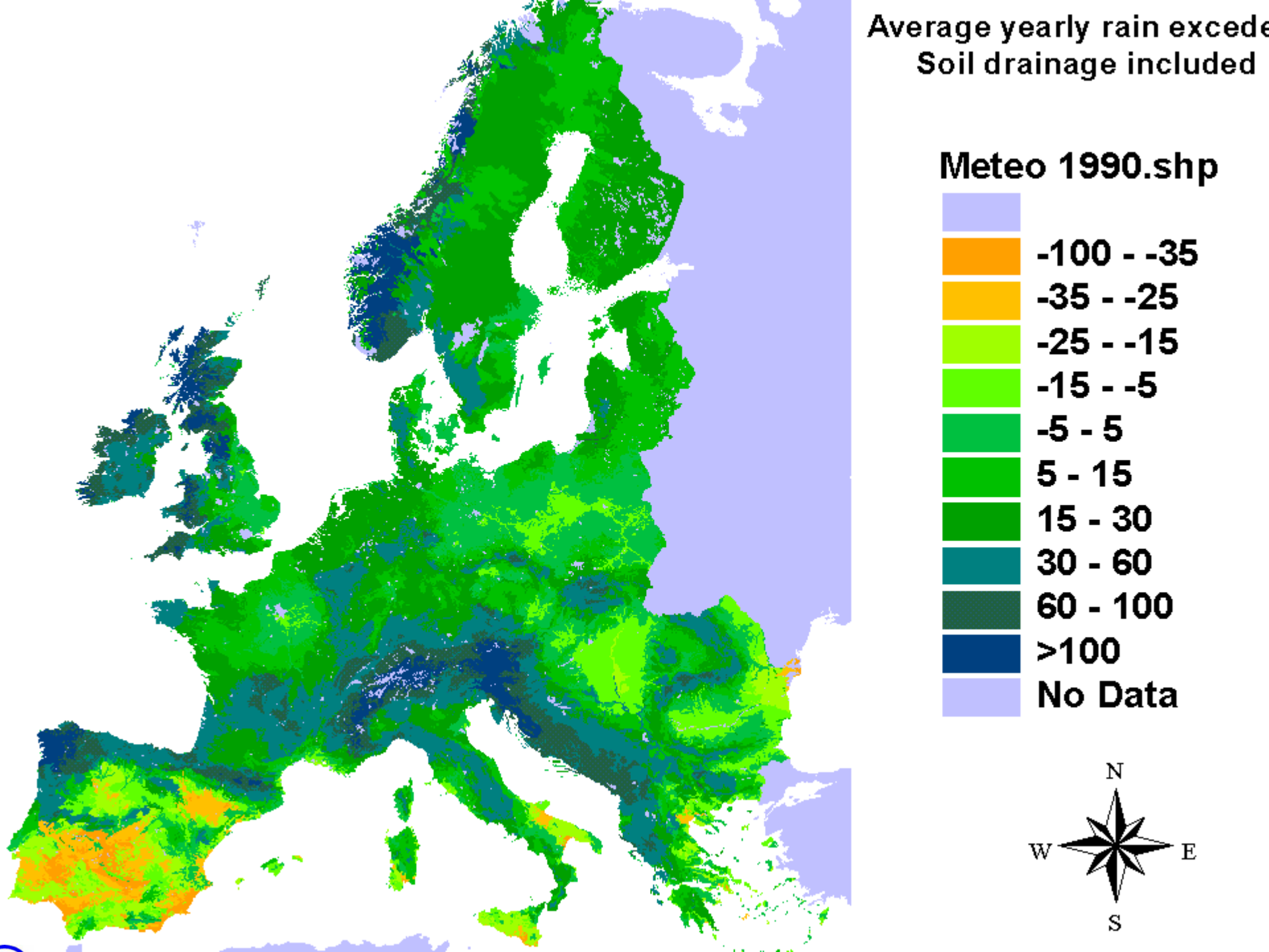


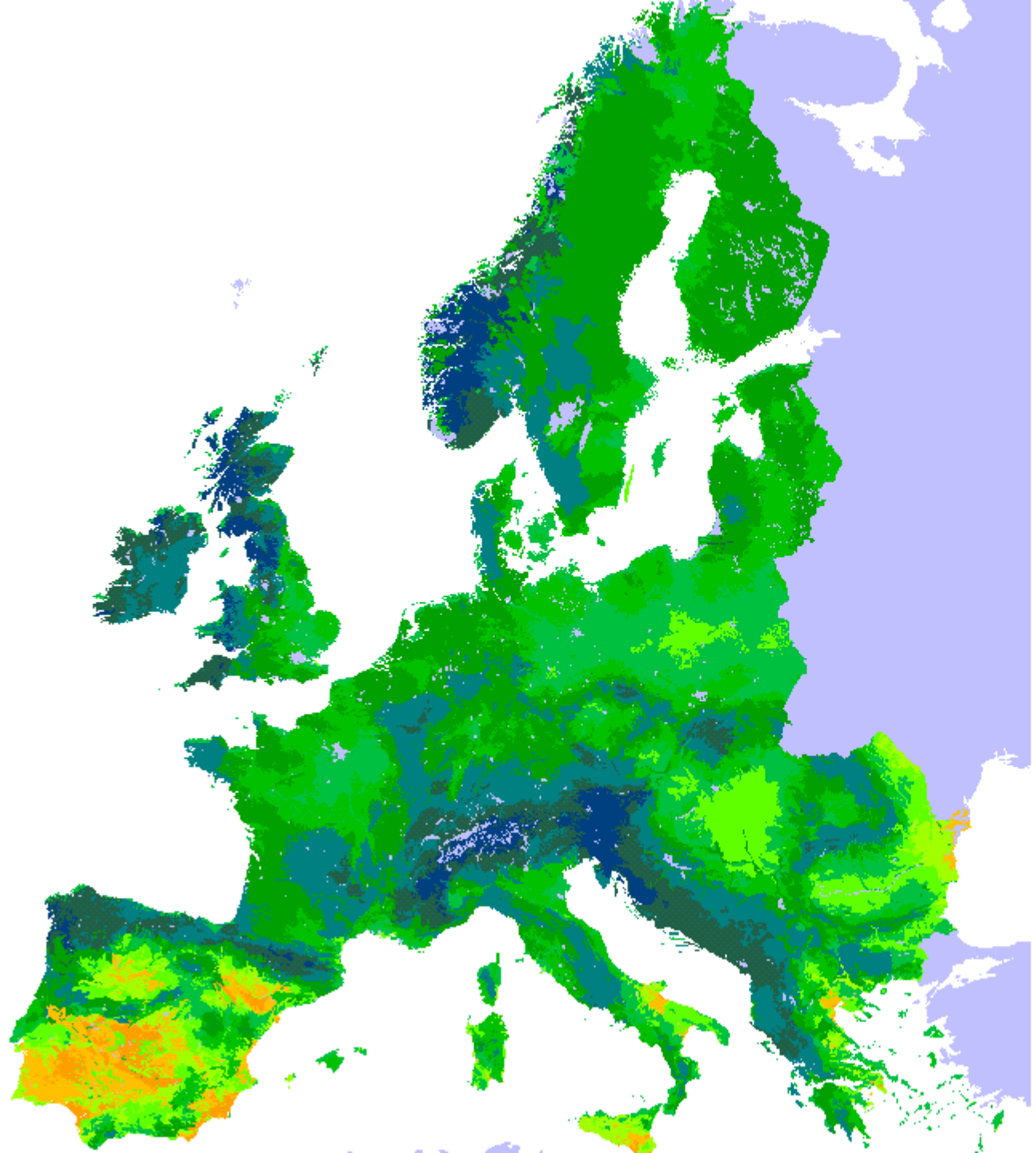
Sum T>0
All Year

Meteo 2085 h2.shp

0 - 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
5000 - 6000
6000 - 7000
7000 - 9000
No Data

N
W
E
S


Average yearly rain excede
Soil drainage included
Meteo 1990.shp
-100 - -35
-35 - -25
-25 - -15
-15 - -5
-5 - 5
5 - 15
15 - 30
30 - 60
60 - 100
>100
No Data
N
W
E
S

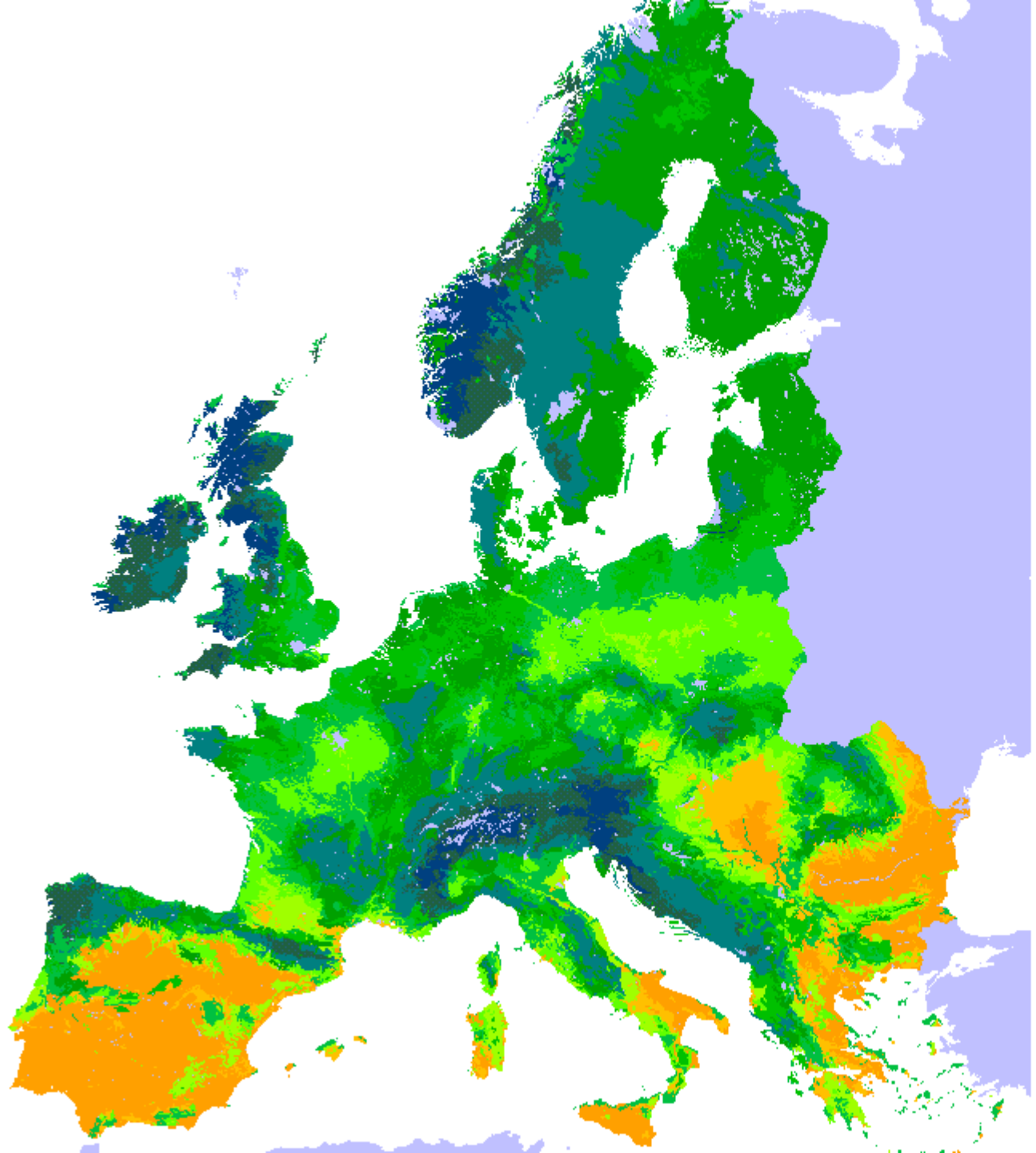


Average Yearly Rain Excedent
Soil Drainage included

Meteo 2015 h2.shp

- -100 - -35
- -35 - -25
- -25 - -15
- -15 - -5
- -5 - 5
- 5 - 15
- 15 - 30
- 30 - 60
- 60 - 100
- >100
- No Data

N
W E
S

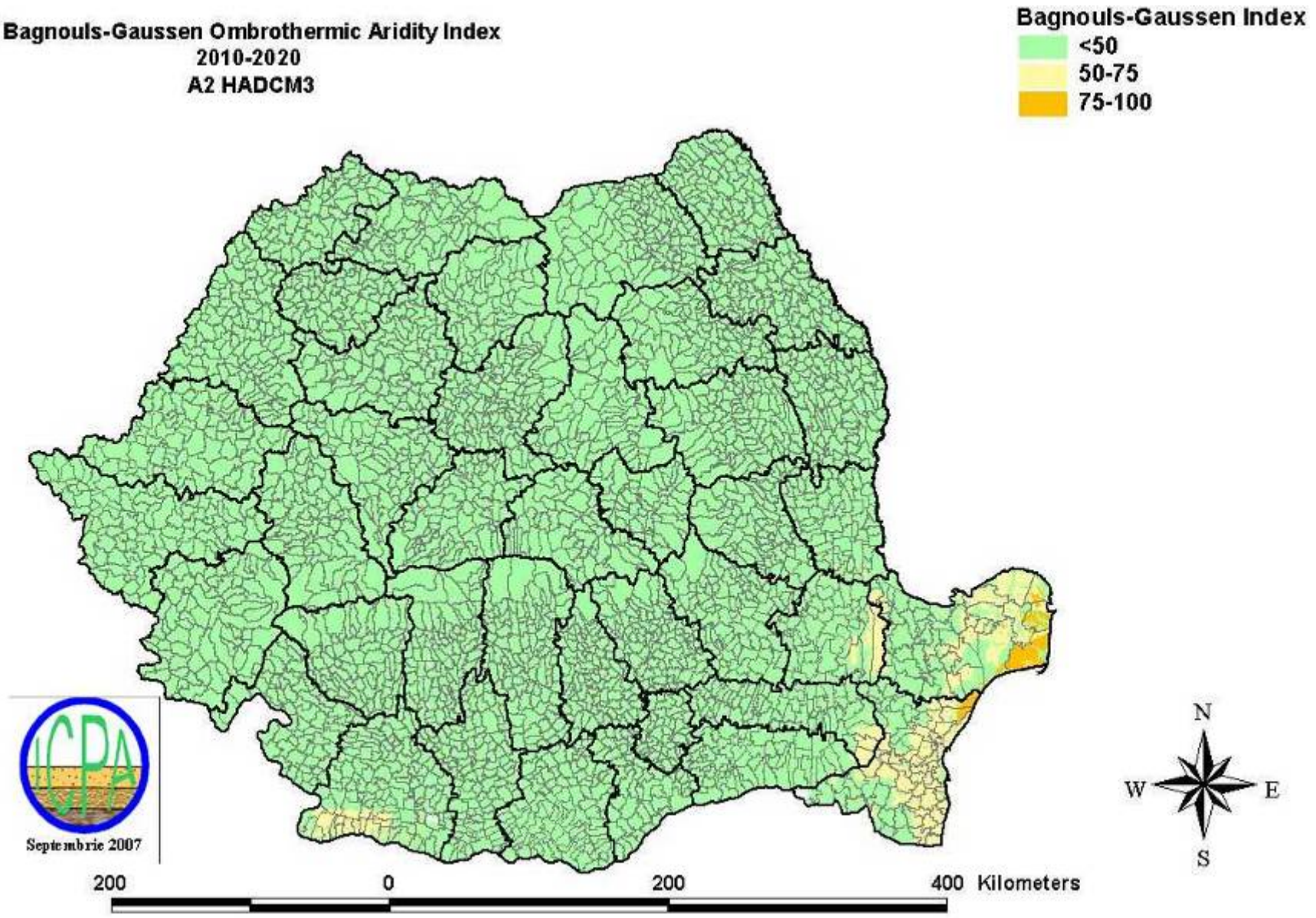


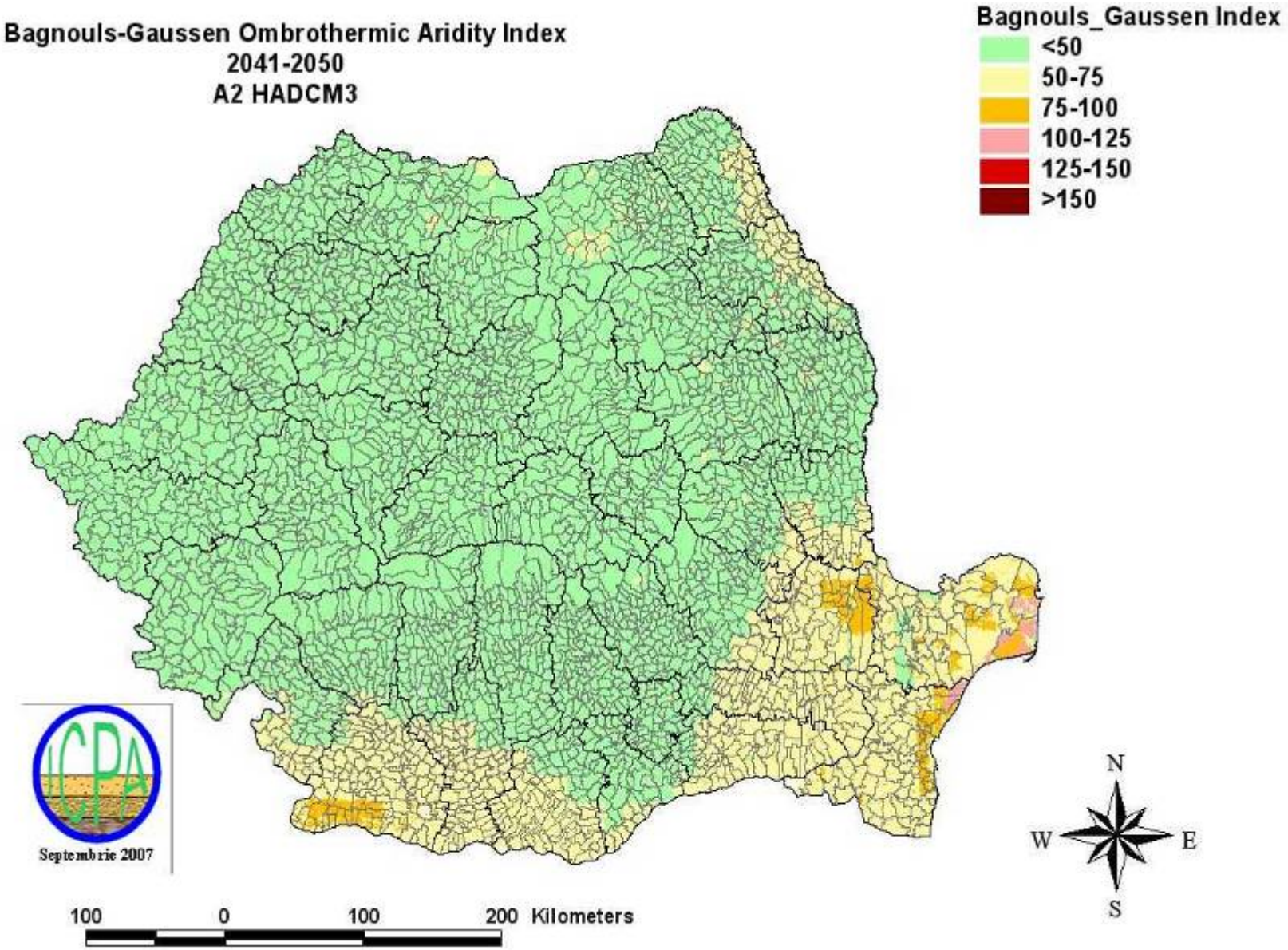
Average Yearly Rain Excedent
Soil Drainage included

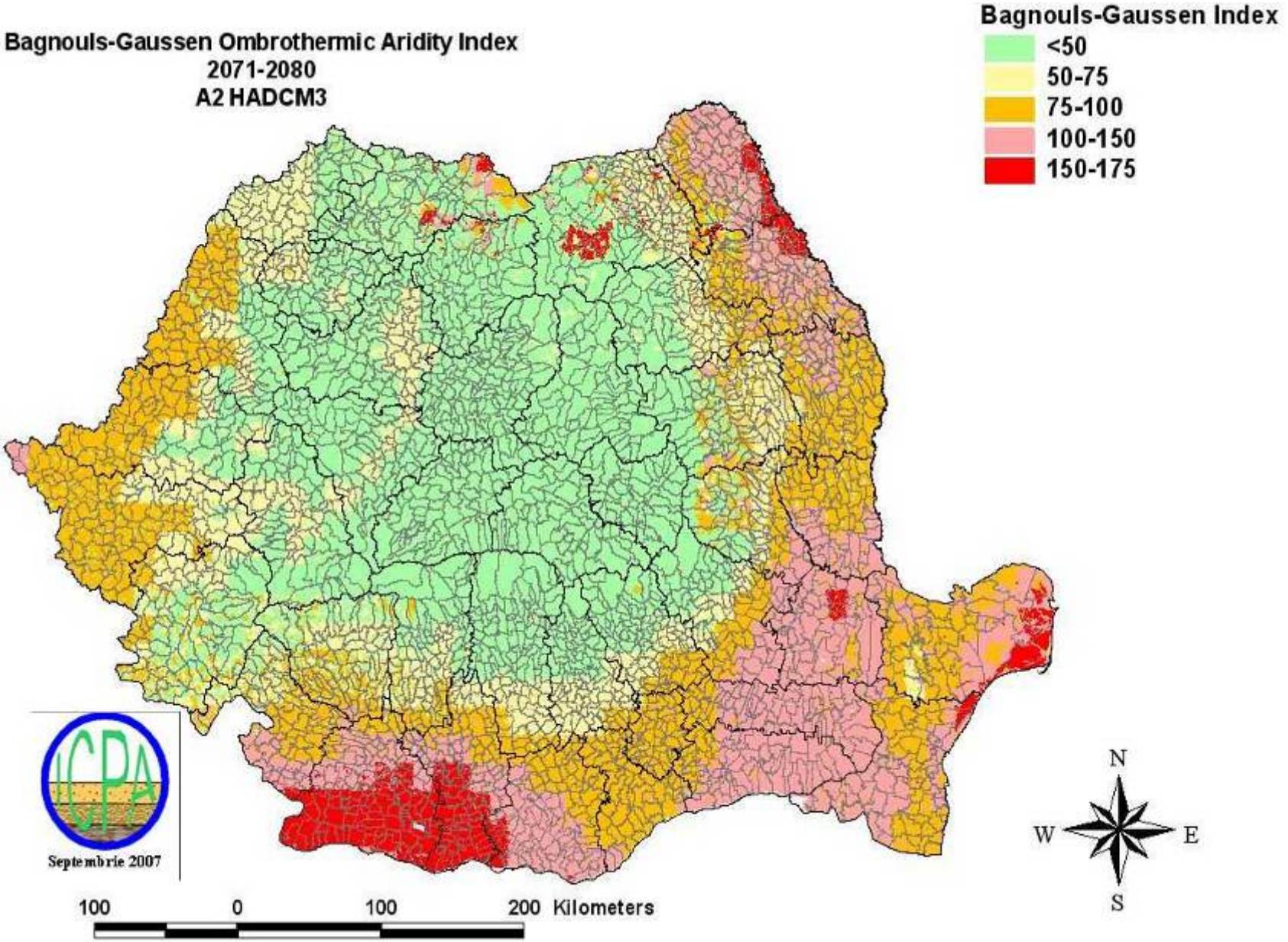
Meteo 2085 h2.shp

- -100 - -35
- -35 - -25
- -25 - -15
- -15 - -5
- -5 - 5
- 5 - 15
- 15 - 30
- 30 - 60
- 60 - 100
- >100
- No Data

N
W E
S


Bagnouls-Gaussen Ombrothermic Aridity Index
2010-2020
A2 HADCM3
Bagnouls-Gaussen Index
<50
50-75
75-100
ICPA
Septembrie 2007
N
W
E
S
200
0
200
400 Kilometers


Bagnouls-Gaussen Ombrothermic Aridity Index
2041-2050
A2 HADCM3
Bagnouls_Gaussen Index
<50
50-75
75-100
100-125
125-150
>150
ICPA
Septembrie 2007
100 0 100 200 Kilometers
N
W
E
S


Bagnouls-Gaussen Ombrothermic Aridity Index
2071-2080
A2 HADCM3
Bagnouls-Gaussen Index
<50
50-75
75-100
100-150
150-175
ICPA
Septembrie 2007
100 0 100 200 Kilometers
N
W
E
S

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 Forest Administration, National Institute for Soil Science)

  -Ministry of Environment and Sustainable Development (National Administration “Romanian Waters”, National Administration for Meteorology)
- Improving consultancy capacity in rural area

Improving legislative framework

- Water Law
- Forest Code
- Law for improving degradated lands by afforestation
- Law of land reclamation
- Law ratifying the UN Convention on desertification

Developing a long term strategy

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

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

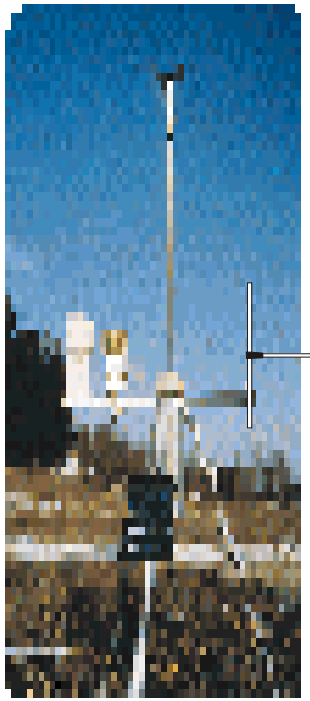
Establishment and implementation of the adaptation measures

- 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

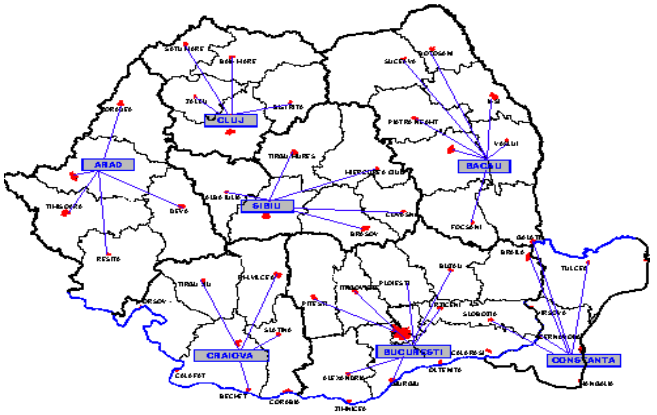
Measure implementation

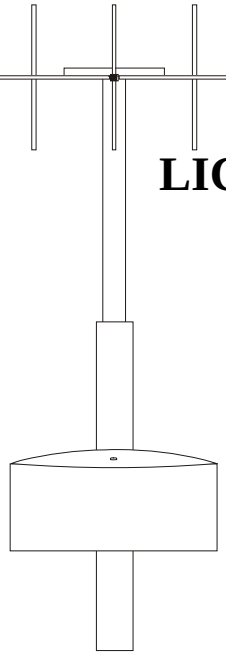
Few examples

SIMIN: AUTOMATICAL MEASURE POINTS

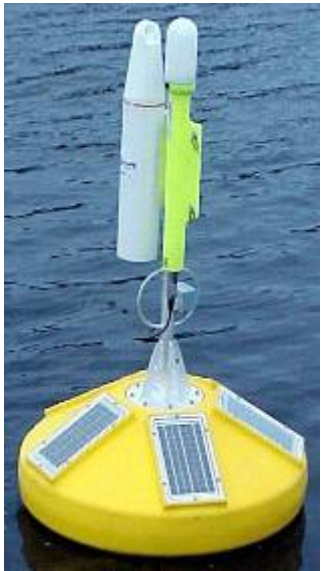


WEATHER AUTOMATICAL STATIONS (60)



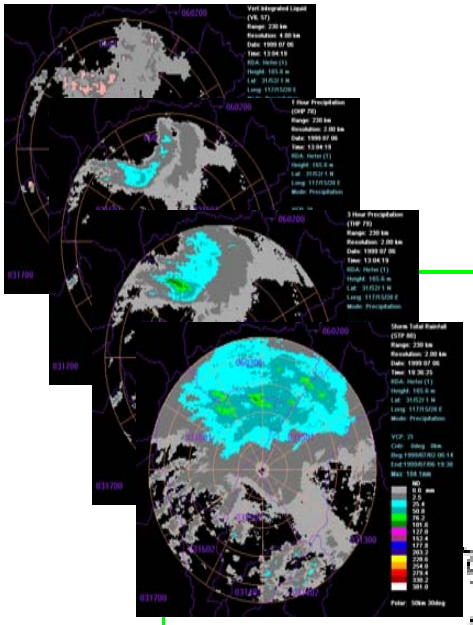


LIGHTNING DETECTORS NETWORK (8 Sensors)

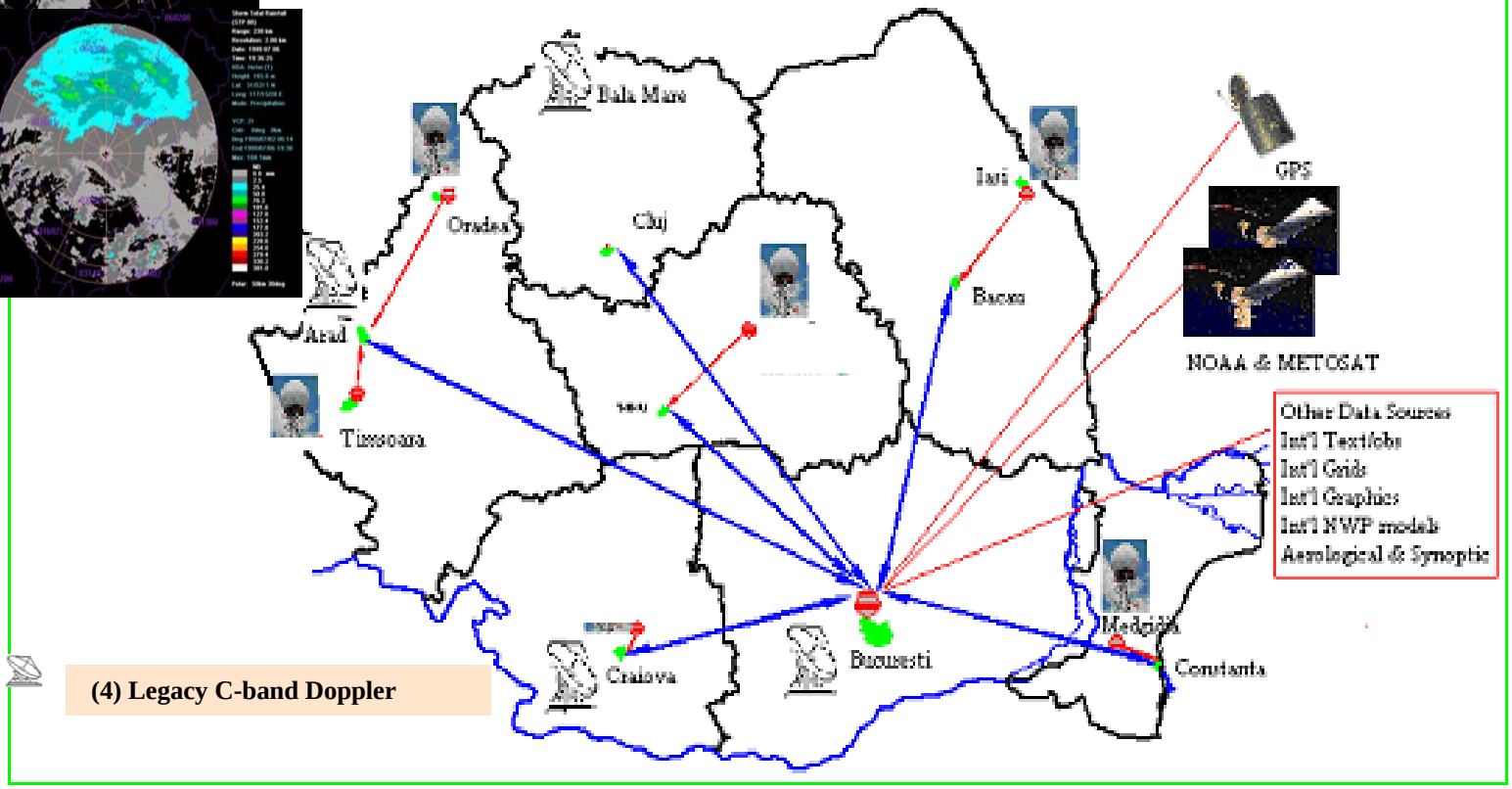


Hydro-meteorological river and sea buoys (8 River, 3 Sea)

SIMIN: RADARS NETWORK



RADAR DOPPLER WSR-98D



(4) Legacy C-band Doppler

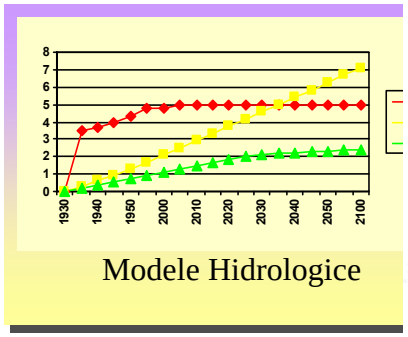
UPGRADE HYDROLOGICAL MONITORING STATIONS

UPGRADE OR REPLACE EXISTING STRUCTURES

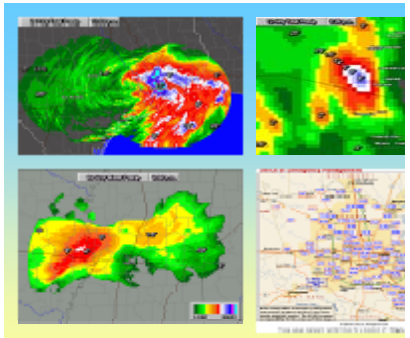
581 HYDROLOGICAL STATIONS

70 QAULITITY STATIONS

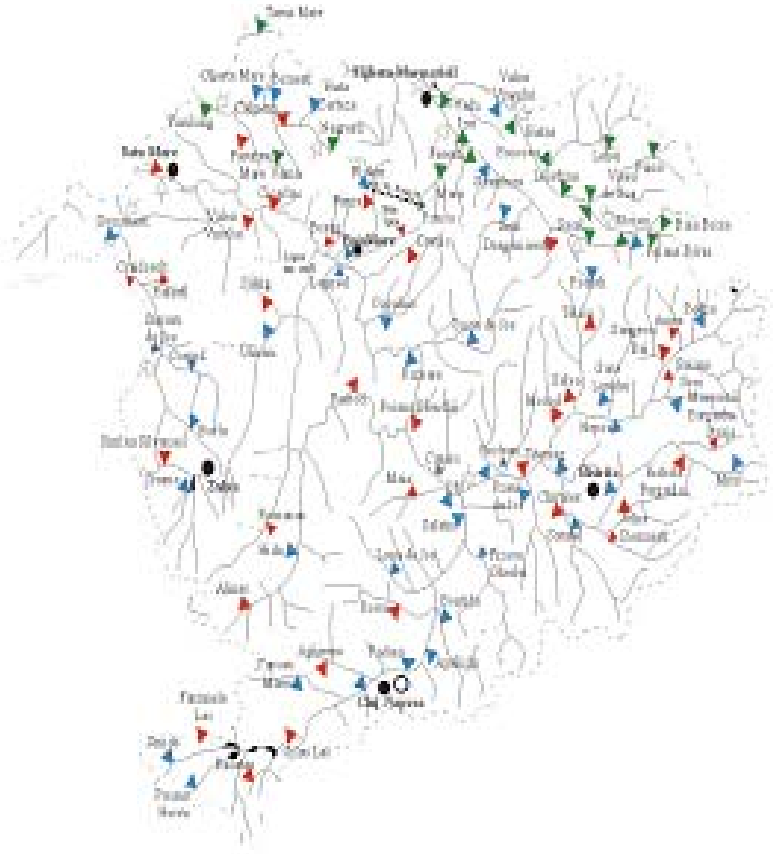
250 RAINGAGE STATIONS

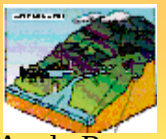


Modele Hidrologice



SIMIN hydrological produc





WAT

Apele Romane

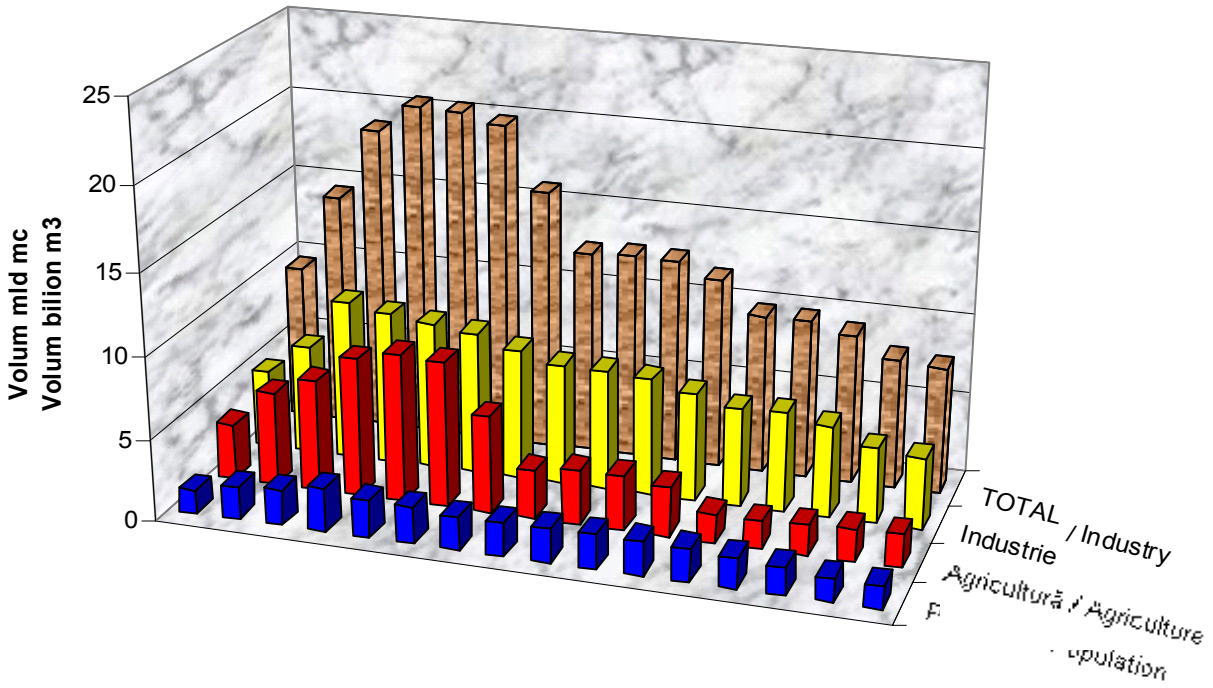
hidrologice automate si
teaua de comunicatii

nului Dâmboviþa Harta topografică suprapusă imaginii

date pentru modele hidrologice
recasting si hidraulic)

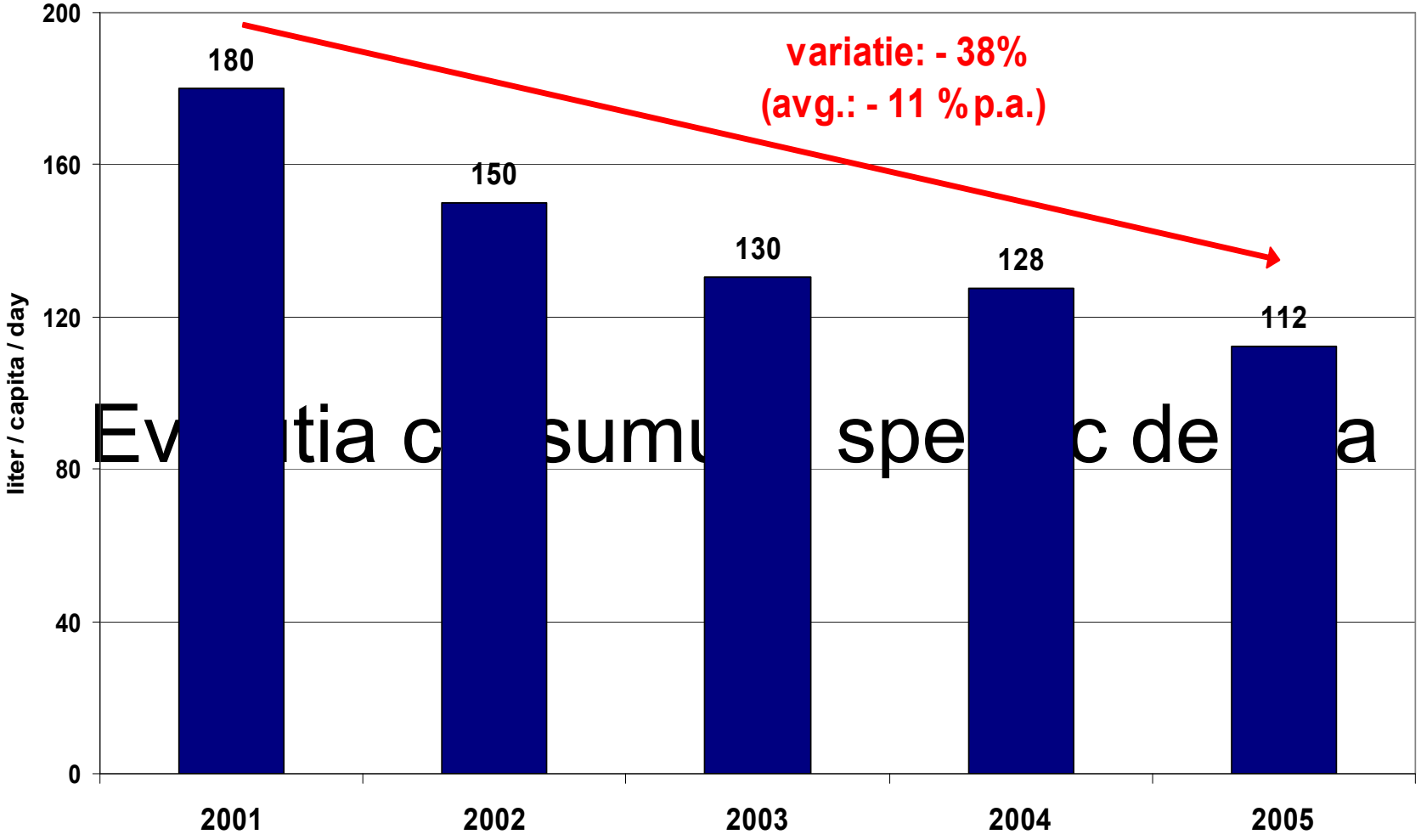
DEVELOPING THE HYDROLOGICAL FORECASTING SYSTEM

Fig. 1 Evoluția cerințelor de apă în România
Evolution of Water Demands in Romania

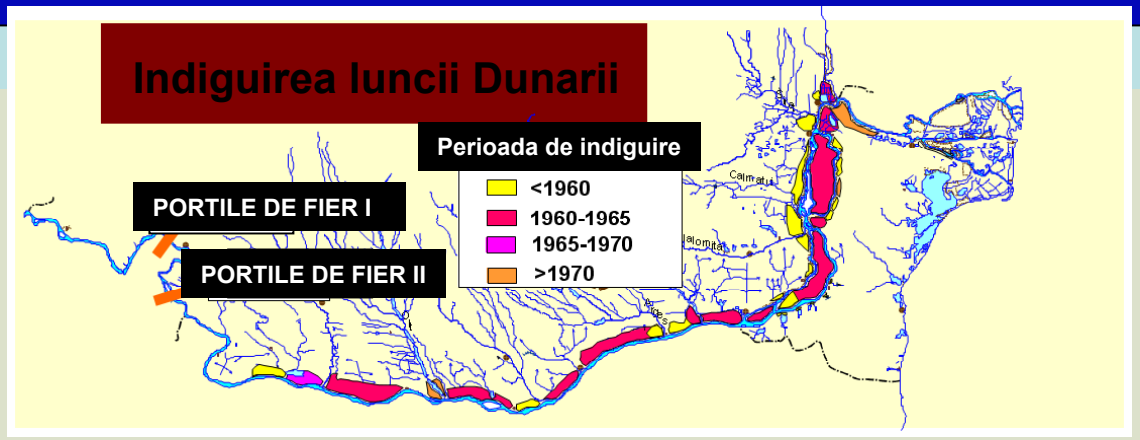


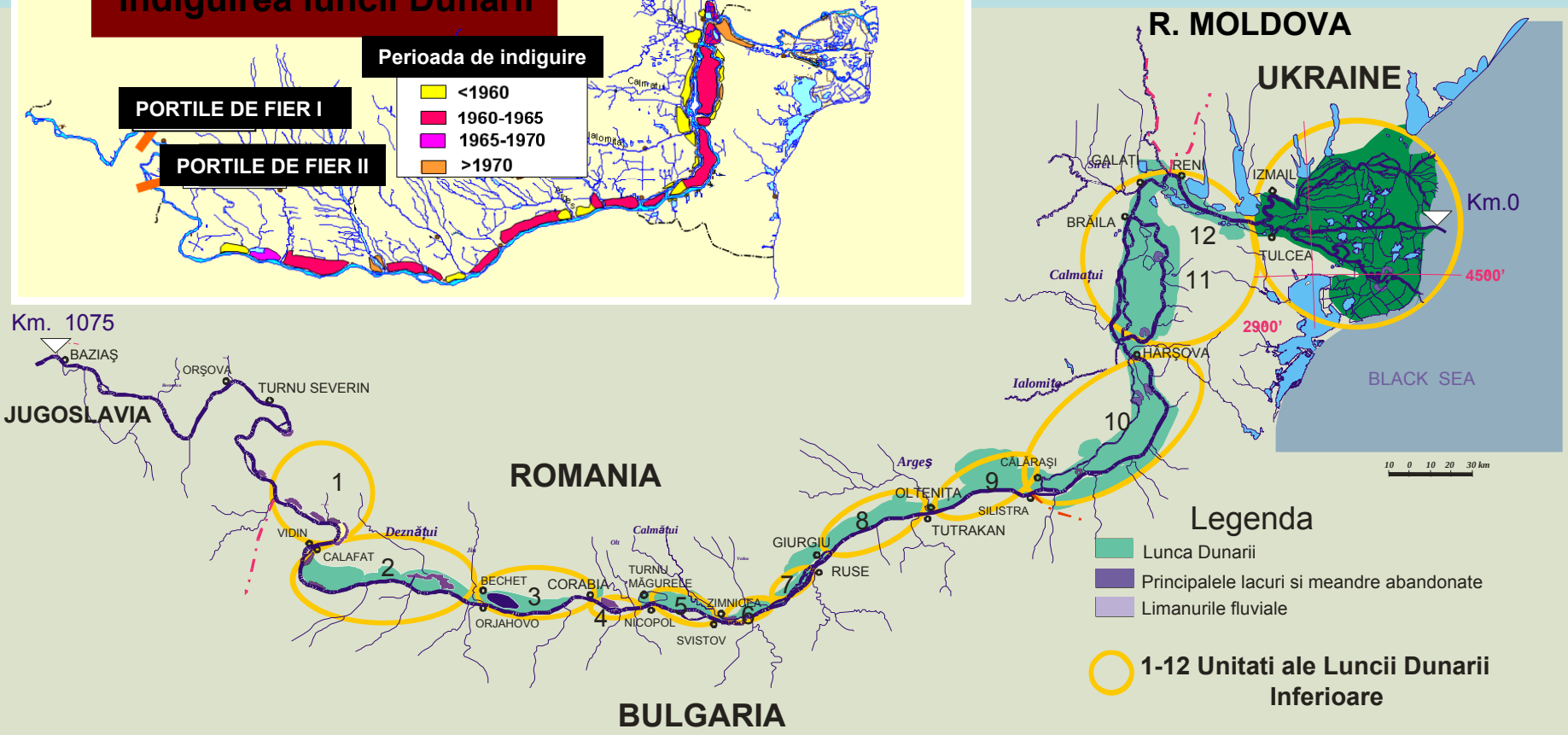
	1970	1975	1980	1985	1990	1993	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005
Populație / Population	1,47	2	2,2	2,67	2,25	2,25	2	2,05	2,08	2,11	2,07	2	1,86	1,69	1,42	1,35
Agricultură / Agriculture	3,4	5,75	6,79	8,49	9,1	8,95	5,98	2,98	3,33	3,36	3,03	1,74	1,75	1,86	1,98	2,05
Industrie / Industry	4,72	6,65	9,81	9,34	9,06	8,74	8,02	7,43	7,35	7,18	6,64	6,04	6,17	5,64	4,62	4,4
TOTAL	9,59	14,4	18,8	20,5	20,4	19,9	16	12,46	12,67	12,65	11,74	9,78	9,78	9,19	8,02	7,8

Evolutia consumului specific de apa

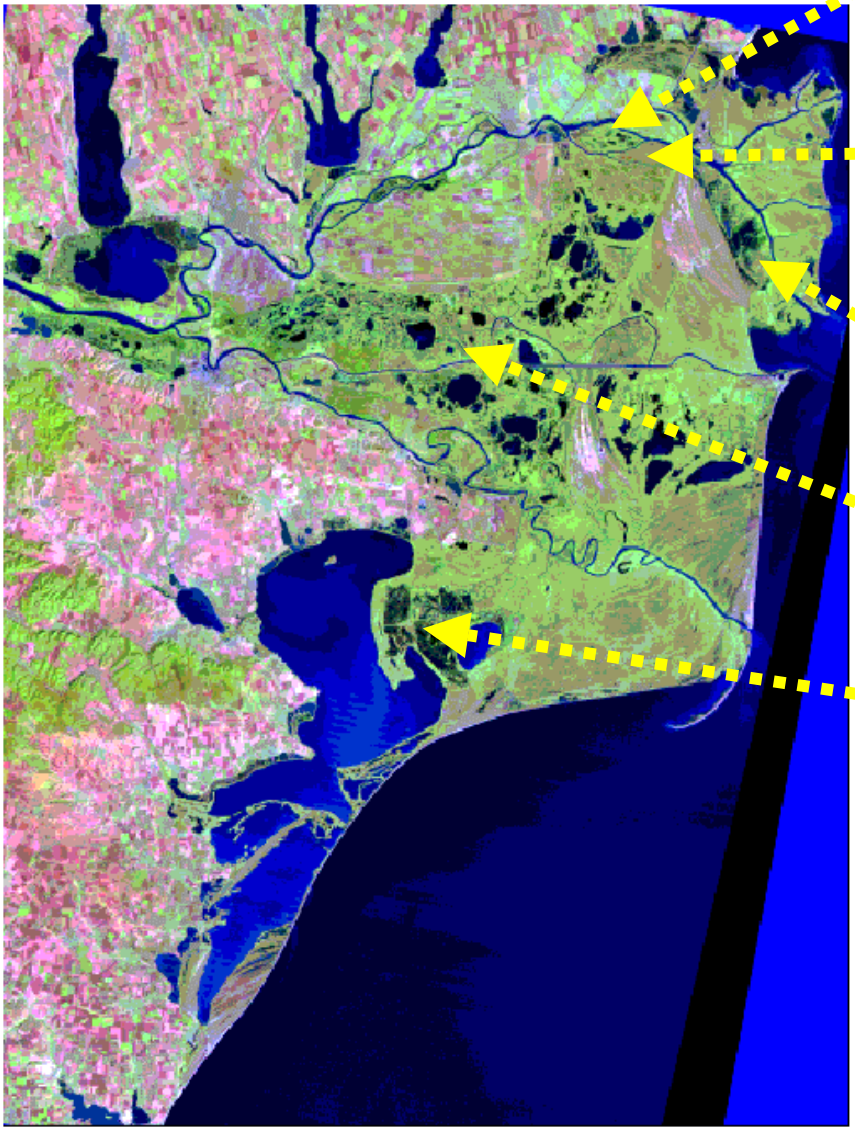


Rehabilitation of the wetland areas in the Danube floodplain





WETLAND REHABILITATION



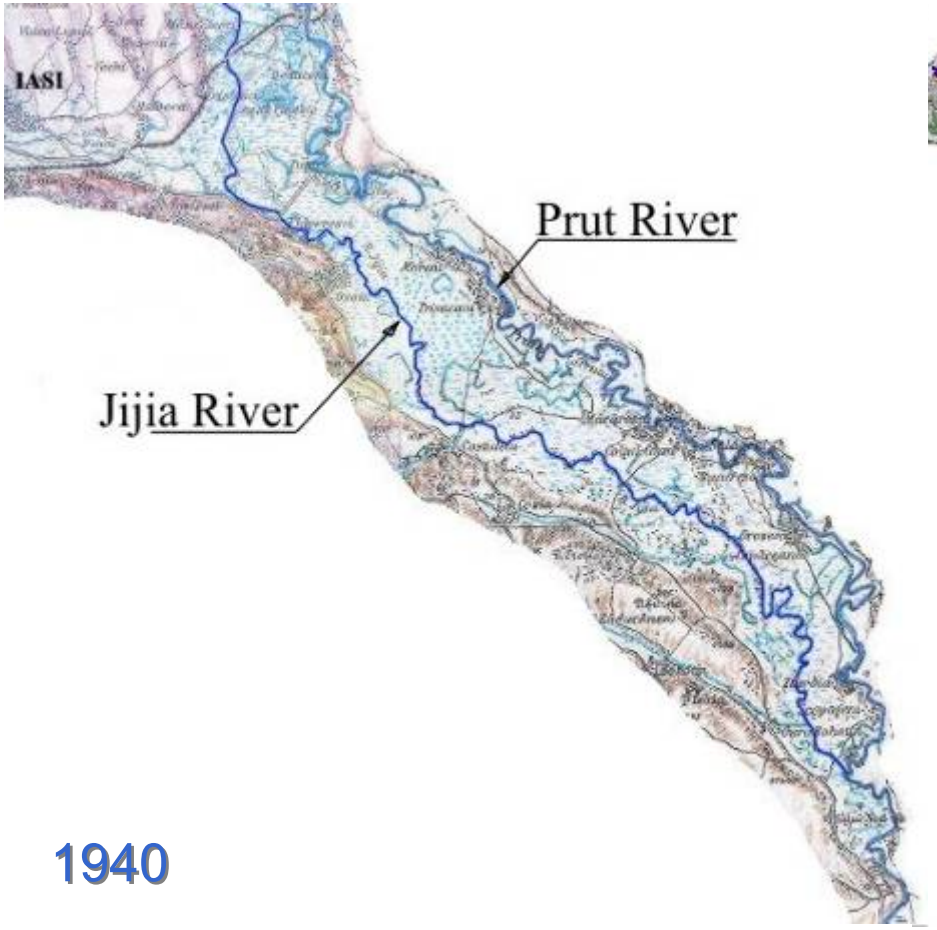
- Babina, 1994 (2.100 ha),
  - agricultural exploatation -
- Cernovca, 1996 (1.580 ha)
  - agricultural exploatation -
- Popina, 2000 (3.600 ha)
  - fish farm -
- Fortuna, 2002 (2.115 ha)
  -agricultural/forestry exploatation -
- Holbina– Dunavăț, 2006 (5.630 ha)
  - fish farming -

TOTAL: 15.025 ha

Ecological rehabilitation works

Improving water circulation

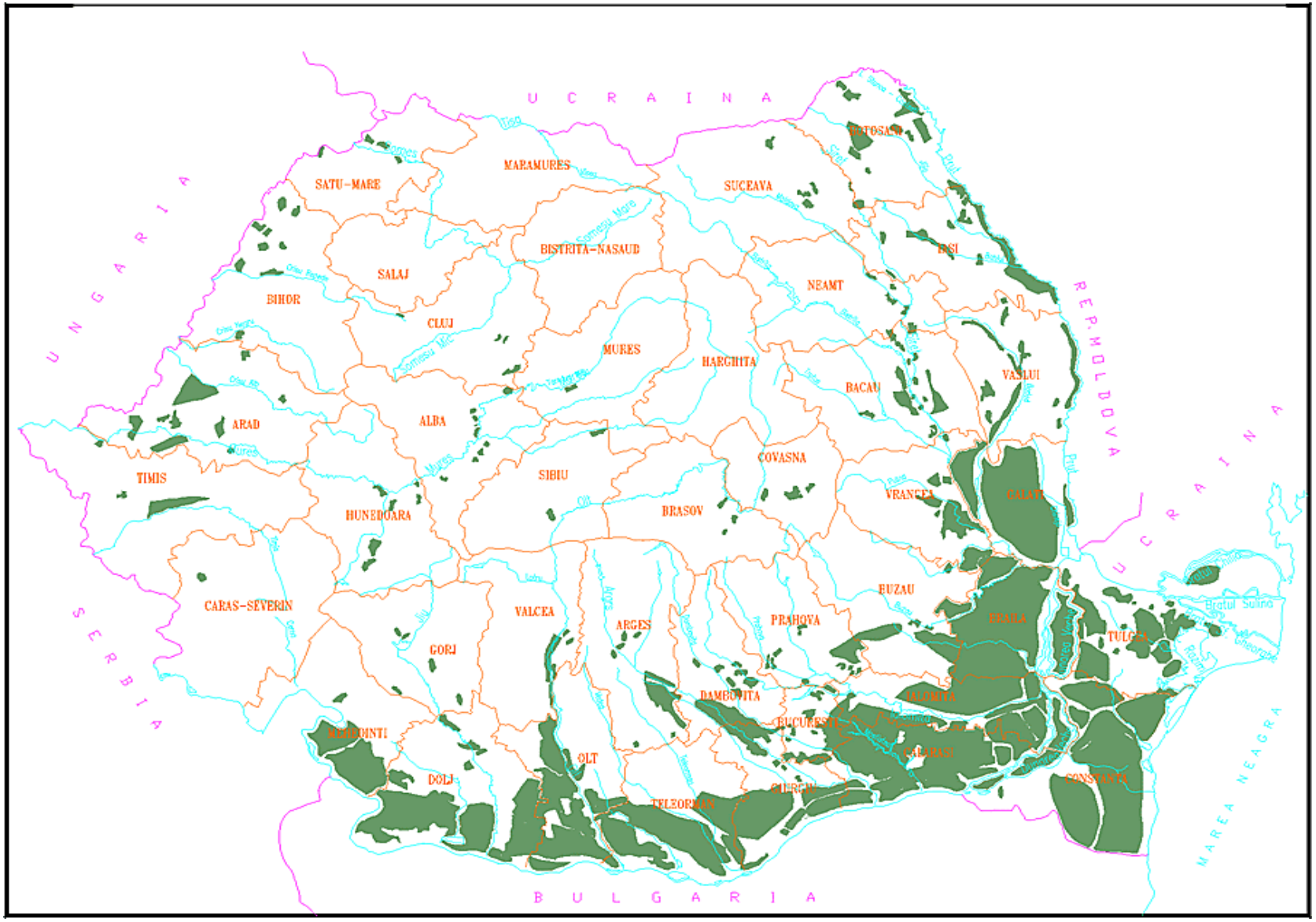
Costuleni area project



1940

Present

Irrigated areas in Romania



Afforestation of river floodplain in 2003

Afforested area – Independenta commune, August 2003


The same area in August 2004
PADUREA PENTRU VIATA
VIATA PENTRU PADURE


Thank you for your attention!