Ministry of Environment - Romania

The Lakes Iron Gates I and II

International Workshop on
transboundary water resources management
in South-Eastern Europe

Sarajevo, 18 – 20 MAY 2009

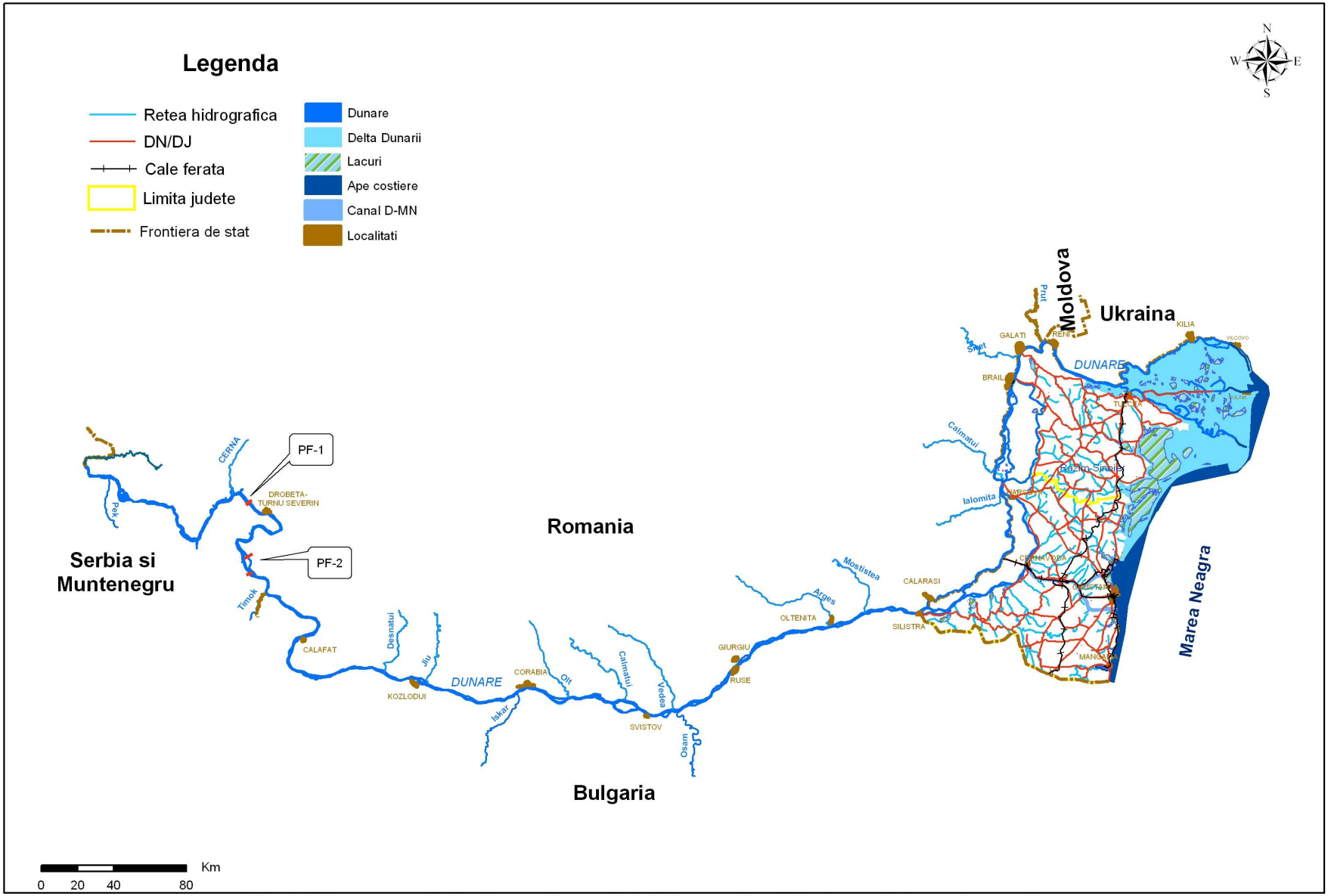


Fig.1.1 Dunarea, Delta Dunarii, spatiul hidrografic al Dobrogei si apele costiere

The Danube River Basin

97.4% of Romania is part of the Danube River Basin (30.0% of the DRB)

The Danube River Basin - General description

- 19 countries share the basin of the Danube River (AL, AT, BA, BG, CH, CZ, DE, HU, HR, MD, ME, MK, IT, PL, RO, RS, SK, SI, UA)
- Total area: 801, 463 km^2
- Recipient: Black Sea
- Sub-basins: Lech, Inn, Morava, Raba, vah, Ipel/Ipoly, Drava and Mura, Tisza, Sava, Velika Morava, Timok, Siret, Prut
- **Lakes in the basin: Iron Gates I and II (reservoirs),** Lake Neusiedi
- Three main parts (geologic and geographic conditions)
  - The Upper Danube (the Black Forest Mountains to the Gate of Devin)
  - The Middle Danube (the Gate of Devin to the Iron Gate)
  - The Lower Danube (the Romanian – Bulgarian Danube sub-basin downstream of the Cazane Gorge and sub-basins of the Siret and Prut)

Pressure factors

- identified at the level of the Danube River district as well as at the national level
- Organic pollution (caused by discharges of wasterwaters from diffuse and non-diffuse sources – human agglomerations, agricultural and industrial sources)
- Nutrient pollution (from punctiform sources – untreated or insufficient untreated municipal, industrial and agricultural wastewater and diffuse - especially agricultural - sources)
- Pollution by hazardous substances (discharges of wastewaters from punctiform sources or emissions from diffuse sources which contain non-sintetic pollutant (heavy metals) and/or sinthetic pollutants (organic micropollutants)
- Hydromorphological alterations

Point sources of pollution

Municipal point sources:

- wastewater treatment plants
- untreated wastewater

Industrial point sources

Agricultural point sources

Main problems in the basin

- Changing the natural course of the rivers in the Danube River Basin, mainly for hydropower generation, flood defence, and navigation
- Urbanisation
- Result: affecting the ecological quality of the rivers
- Hydromorphological alterations, such as changes in the depth or width of a river typically reduce flow rates, interrupting natural sediment transportation as well as the migration routes of fishes.
- Large dams and weirs: an important effect on the natural sediment transportation, resulting in the retention of sediment upstream of dams.
  - The accumulated sediment has to be extracted to maintain the river's depth for hydropower generation and navigation.
  - The siltation process - problems with the drinking water supply.
  - The loss of sediment downstream of dams, meaning that material must be artificially imported to stabilise the river bed and prevent incision.
- Hydrological engineering works: dams, dykes, reservoirs, navigation channels and irrigation networks.
  - Dams and reservoirs - built in nearly all mountainous areas of the Danube Basin;
  - Navigation channels, dykes and irrigation networks - more widespread in the lowlands along the middle and lower reaches of the Danube.

Impacts of Pressure factors

- Water quality
- Water quantity
- Biodiversity

Transboundary impacts

- Areas in “high and good status”
- Stretches of river which fall under “heavily modified water bodies” – assessed as polluted
- The Upper Danube – chains of hydropower plants - many water bodies provisionally identified as HMWB
- The Middle Danube – possible at risk (due to hazardous substances)
- The Lower Danube – at risk (due to nutrient pollution and hazardous substances) and in large parts due to hydromorfological alterations; - possibly at risk (due to organic pollution)

Trends

- The water quality – improved significantly during the last decade – TNMN locations
- Water and water related-ecosystems in the DRB continue to be at risk from pollution
- Floods events (due to climate changes could increase) in combination with unsustainable human practices could cause economic, social and environmental damages.

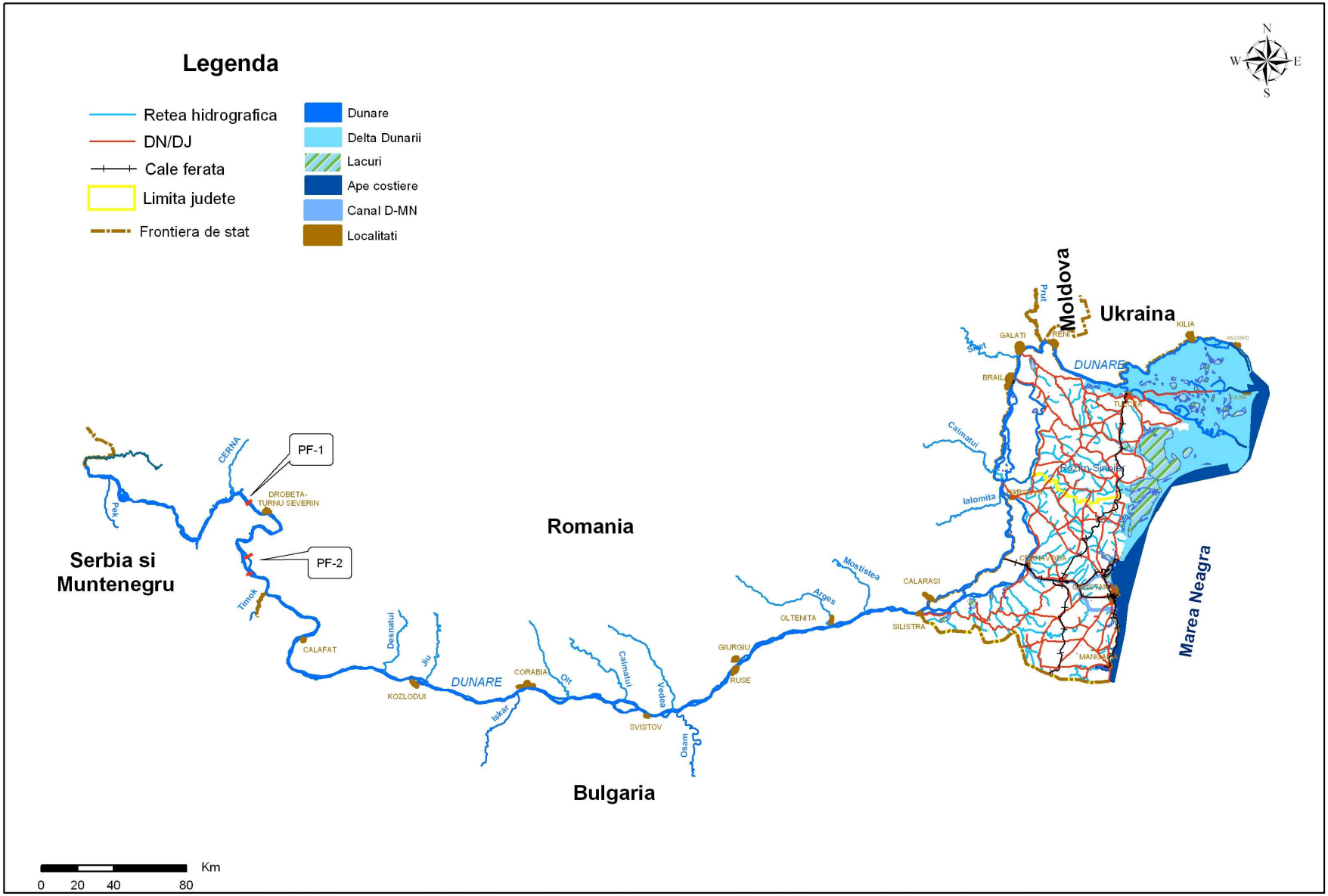
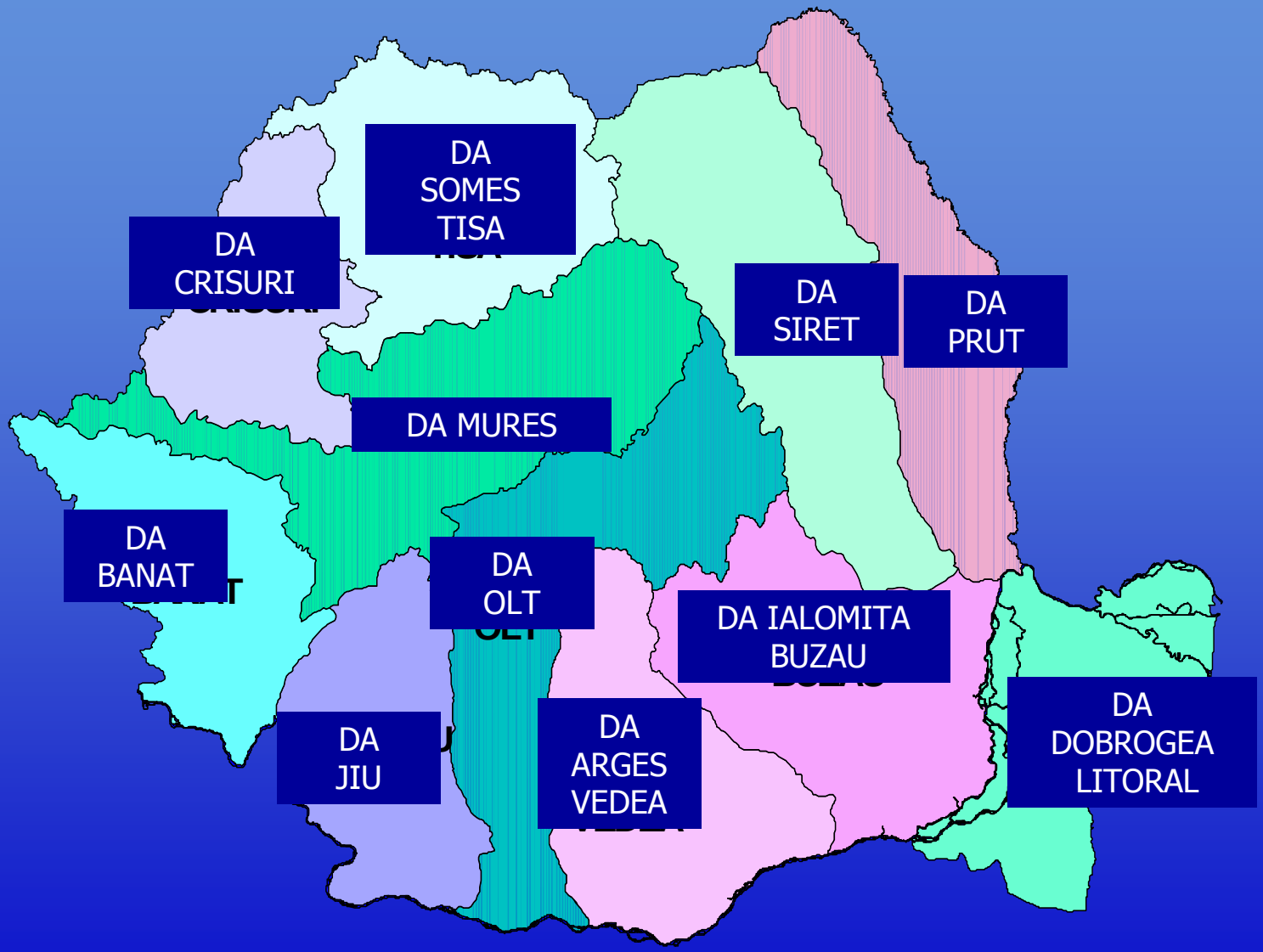


Fig.1.1 Dunarea, Delta Dunarii, spatiul hidrografic al Dobrogei si apele costiere


DA SOMES TISA
DA CRISURI
DA SIRET
DA PRUT
DA MURES
DA BANAT
DA OLT
DA IALOMITA BUZAU
DA JIU
DA ARGES VEDEA
DA DOBROGEA LITORAL

Lakes Iron Gates I and II

- **The largest hydropower dam and reservoir system along the entire Danube is located at the 117-km-long Djerdap (Iron Gate)** Gorge. This peak operation system consists of two dams, jointly operated by Romania and Serbia. The average flow rate of the Danube here is 5,500 m^3/sec, and the river drops a total of over 34 metres.
- The Iron Gates system has transboundary effects. The reservoirs have a total volume of 3.2 billion m^3, and a total length of 270 km. They trap some 20 million tonnes of sediment per year, serving both as an important nutrient sink and a sizeable deposit of hazardous and toxic pollutants originating upstream of the dam. The corresponding absence of natural sediments downstream has created erosion problems since the dam has been put into operation in 1970.

Lakes Iron Gates I and II

- The Iron Gate Dams I and II, both located where the Danube forms the boundary between Romania and Serbia, impound the Danube as far upstream as Belgrade (from the confluence with the Tisza River until km 863 (IG II); on the Romanian territory from km 1075 up to km 943 (IG I) and up to km 863.

- Main uses: hydropower generation, navigation.
- Other uses: the flow regulation on the Danube River, industrial water supply, pisciculture and leisure.
- Major impacts: considerable reductions in flow velocity and sediment transportation, and raised groundwater tables in the Serbian lowlands.

Lake Iron Gates I

- A gorge between the Carpathian and Balkan mountains on the Danube River
- Border between Romania and Republic of Serbia
- Upstream of Drobeta Turnu Severin town
- IG I – one of Europe's largest hydroelectric power dams.
- Dam – built by Romania and the former Yugoslavia (1970 – 1972)
- Total area of lake: 260 km^2
- Total volume: 2 100 mill. m^3
- Relatively shallow (mean depth – 25 m, deepest point - 40 m)
- Monitoring of determinants – physical, chemical, biological, microbiological and radiological)
- No major water quality problems

Lake Iron Gates II

- Downstream of Drobeta Turnu Severin town (Ostrovu Mare – Gogosu)
- In operation - 1986
- Total area of lake: 78 km^2
- Total volume: 800 mill. m^3 (1/3 of IG I)
- Mean depth – 10 m, the deepest point – 25 m
- Monitored similarly to IG I
- No serious water quality problems

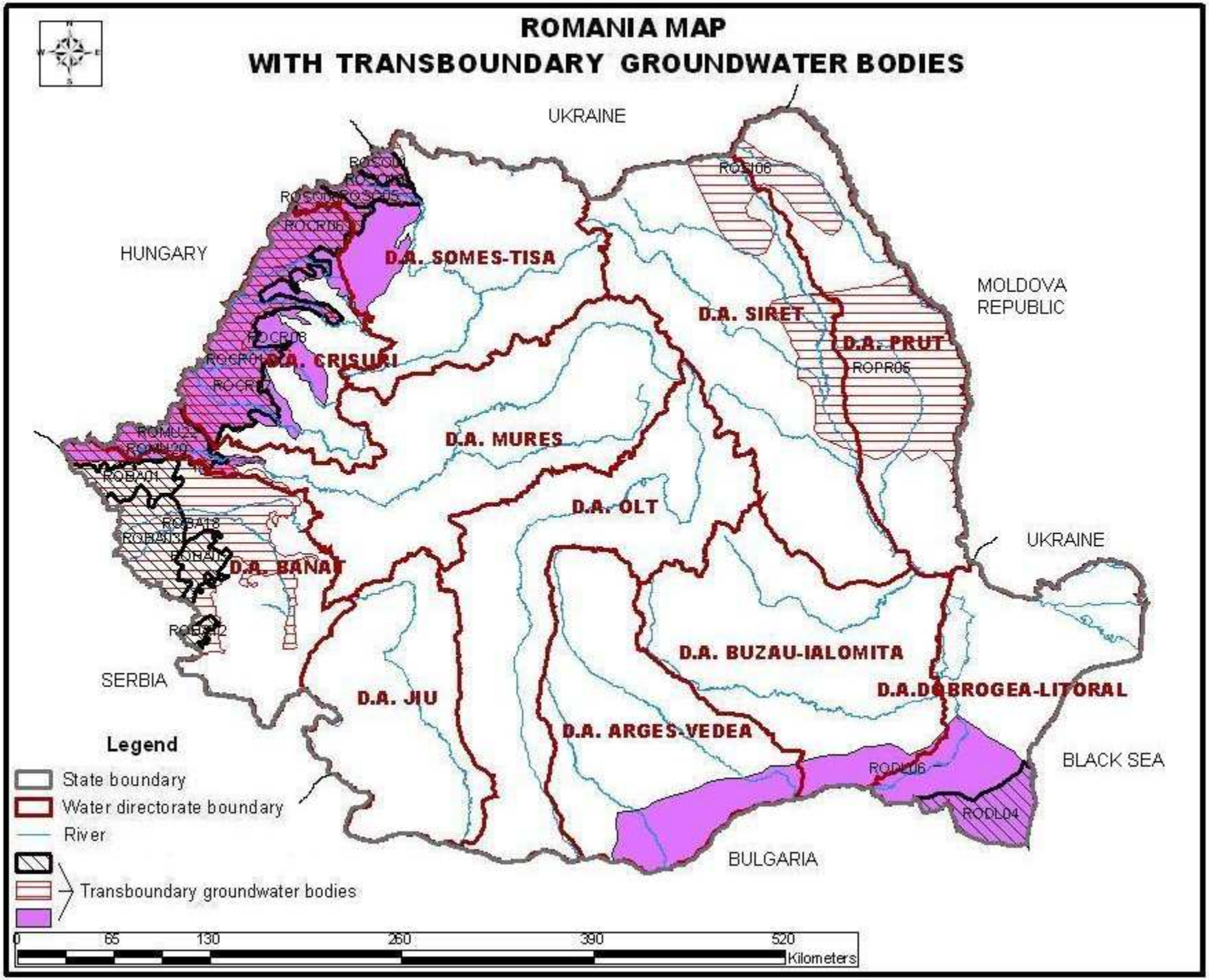
Groundwater in the proximity of the reservoirs

IRON GATES I

- No groundwater bodies, because of the lake location in the gorges

IRON GATES II

- Meadow acquifer under the influence of the lake
- 5 terace aquifers not connected with the lake, but discharging by springs or through delluvial deposits, each in the inferior one


ROMANIA MAP
WITH TRANSBOUNDARY GROUNDWATER BODIES
UKRAINE
HUNGARY
MOLDOVA
REPUBLIC
UKRAINE
SERBIA
BULGARIA
BLACK SEA
D.A. SOMES-TISA
D.A. CRISURI
D.A. MURES
D.A. BANAT
D.A. OLT
D.A. SIRET
D.A. PRUT
D.A. BUZAU-IALOMITA
D.A.DOBROGEA-LITORAL
D.A. JIU
D.A. ARGES-VEDEA
ROSI06
ROPR05
ROCR06
ROCR01
ROCR07
ROMU22
ROMU20
ROBA01
ROBA18
ROBA03
ROBA19
ROBA12
RODL06
RODL04
Legend
State boundary
Water directorate boundary
River
Transboundary groundwater bodies
0
65
130
260
390
520
Kilometers

Groundwater in the up-stream Danube River Basin

Even this would mean groundwater bodies within 10 countries, only the Romanian transboundary groundwater bodies bilaterally agreed with Hungary and Serbia will be refered to:

1. Somes/Szamos alluvial fan, *RO & HU:* supplying drinking water to 170,000 inhabitants in Romania and 50,000 inhabitants in Hungary. In the Hungarian side, there are terrestrial ecosystems directly dependent, so 7 % of the area of the water body is under nature conservation.

- Thickness of the alluvial deposits 30 – 250 m
- The aquifer is divided into several groundwater bodies in both countries:

in Romania -two water bodies are overlapping each other, covering a surface of 1380 km2.(the Holocene-Pleistocene formation is divided vertically by the horizon separating the Upper- and Lower-Pleistocene strata).

2. Mures/Maros alluvial fan *RO & HU:*

- The alluvial deposits of the Maros/Mures River fill the east-southern part of the Great Hungarian Plain on more than 2000 m depth and are progressively thinning in Romania, to the North of the actual river bed of the Maros/Mures. It is an important water resource in particular for drinking water purposes for both countries , water abstractions influencing the water availability of the other country.

In Romania- two water bodies are considered transboundary, separating the Upper- (GWB RO_MU20) and Lower-Pleistocene (GWB RO_MU22) based on age of the strata. Both water bodies can be lithologically characterised by pebbles, sands and clayey interlayers, but the upper part is significantly coarser with better permeability. The covering layer is mainly sandy silt and clay of 3-5 m. The upper water body is unconfined and the lower is confined.

3. Upper Pannonian-Lower Pleistocene GWB from Backa and Banat / Vojvodina *RO & HU & RSE*

In Romania the aquifer system covers around 11408 km2 and is adjacent to the state border with Serbia. The groundwater body is generaly confined, its covering strata being of Quaternary age. The depth of the groundwater level below surface is ranging from 3 to 20 m. The protection degree of the groundwater body is very good

- The main recharge area is in Hungary, in the eolian sand ridge and in Romania. In Hungary the estimated value of the recharge is around 220 Mm3/year. In Serbia only local recharge areas exist (areas of the Deliblat Sands and the Subotica/Horgos Sands)
- The groundwater is mainly discharged by the rivers (and drainage canals) and by the surplus of evapotranspiration of the vegetation in the areas characterised by groundwater level close to the surface. Small lakes and marshes in locally deeper area (i.e. in topographic depressions) must be considered as local discharge areas – they are important from nature conservation point of view. Beside natural discharge there is also a significant groundwater tapping for various uses (drinking water, agriculture, industry, irrigation etc..)

Impact of Iron Gate System on Romanian sector of the Danube River

Important modifications:

- of the morfological caracteristics
- of aquatic biogenosis
- of physical and chemical caracteristics
- of sediments

- From a natural courses to an ecosystem of relatively stagnant water
- Reduction of water flow
- Raising and stabilization of the water level with 2.5 – 19.7 m higher after filling the lake
- Sudden modifications of water level and flow as a result of the daily/weekly regulation of flows, according to the necessities of the IG I;
- Reduction of sediments followed by sedimentation especially between km 1075 and IG I dam, with an intensive sedimentation zone between km 1003 and 970.
- The sediment quantity at Bazias section (at the entry in Romania): 356.69 tones (1971 – 2002) – 33.03% retain in IG I

Impact of Iron Gate System on Romanian sector of the Danube River

- Reduction of sediment transport on the Danube River caused also by the other reservoirs built especially in the Upper Danube River Basin.
- Reduction of sediment transport – erosions of the river banks
- Retention of pollutants and heavy metals in sediments
- A sistematic assessement of sediment pollution – made by ICIM – Bucharest an Cousteau Mission - 1991-1992.
- Reduction of the migration route of sturgerons
- Positive impact of lakes on some fishes species (as Abramis bollerus, Abramis sapa and Pelecus cultratus).

Implemented and planned response measures and gaps

- Legal and policy framework at the national and transboundary level
- Institutional framework
- Non structural management instruments
- Structural/technological measures
- Monitoring of transboundary waters
- Financing and investments
- Involvement of stakeholders
- Climate changes adaptation measures (if any)

… to be completed/future work

Ministry of Environment

Thank you !

Ana Drapa, senior counselor
Ruxandra Balaet, senior counselor