58ICA 2025 EN LOS BALCANES

150 años del Congreso Internacional de Americanistas

Novi Sad, Serbia 30 de junio - 4 de julio de 2025

Assessment of Water Quality in the Iron Gate-Djerdap Natural Parks: A Cross-border Study.

AEPS

common history, common future

www.aeps.upt.ro

Danube – Iron Gate / Djerdap area

UNESCO GLOBAL GEOPARKS - one of the 15 unique geoparks in the world

Danube

Danube river, one of the longest rivers in Europe, along its flow makes natural border, and one of the remarkable areas, between Republic of Serbia and Romania - „Iron gate“, the pearl of the Danube river.

National park „Đerdap”

is one of the five national parks and the largest one in Serbia. For the first time it is proclaimed as protected area by the Low on NP „Đerdap“ (Official Gazette of RS, No. 39/1993)

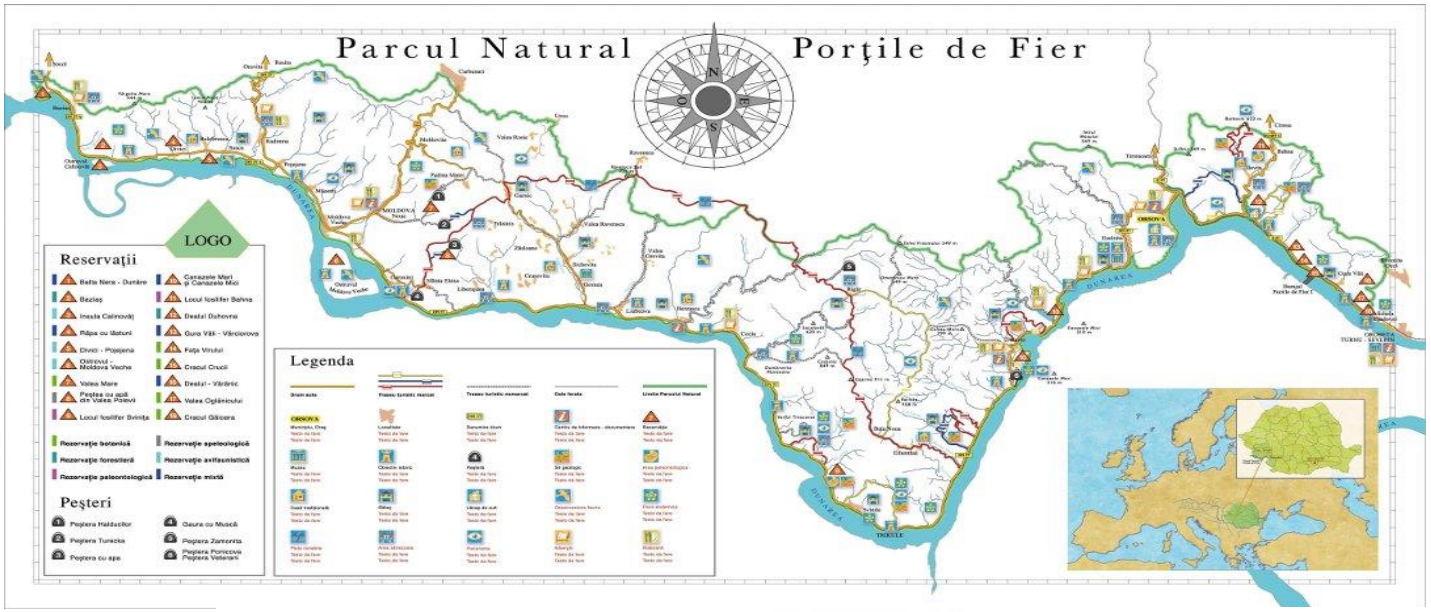
The boundaries of NP „Đerdap“ are established by the Law on National Parks (Official Gazette of RS, No. 84/2015 and 95/2018) where it is defined that it covers area of total 63786,48 ha

Natural park „Iron Gate”

The Iron Gates is a 115666 ha natural park located in southwestern Romania and bordered for 140 km by the Danube, the second largest natural park in Romania.

For the first time it is proclaimed as protected area by the Low 5/2000 and between 2003 – 2007, 18 particular protected areas under various IUCN classification standards were defined.

The most impressive landmark of this area is certainly gorge “Iron gate” the biggest and one of a kind in Europe, consisting of four smallest gorges and three basins, covering 100km in length and reaching the maximum depth of 170m.


Parcul Natural Porţile de Fier
LOGO
Reservaţii
Peşteri
Legenda


1. Golubački grad
2. Bojana
3. Bosman-Sokolovac
4. Čoka Njalta sa Pesačom
5. Lepenski vir
6. Kanjon Boljetinske reke - Greben
7. Tatarski Vis
8. Šomrda
9. Ciganski potok
10. Veliki i Mali Štrbac sa Trajanovom tablom
Orsova
Liubcova
GOLUBAC
Brnjica
Dobra
Tekija
Petrovo selo
Drobeta Turnu Severin
KLADOVO
Boljetin
Svinita
Malo Golubinje
Golubinje
Miroč
Kučevo
DONJI MILANOVAC
MAJDANPEK
Mosna
Topolnica
Kokočevac
NEGOTIN
Crnajka
ZAJEČAR
Legenda:
Nacionalni park
Zaštitna zona
Rezervati prirode

Danube

The water sampling campaign was conducted in 17 spots along Danube in programme eligibility area:

14.08.2020 – Liubcova **(D7)**, Berzasca **(D8)**, Cozla **(D9)**, Svinita **(D10)**, Dubova**(D11)**, Esalnita **(D12)**

24.09.2020 – Bazias **(D1)**, Divic **(D2)**

25.09.2020 – Pojejena **(D3)**

26.09.2020 – Moldova-Noua **(D4)**

27.09.2020 – Coronini **(D5)**, Liborajdea **(D6)**

18.10.2020 – Orsova **(D13)**, Iron Gate I **(D14)**, Drobeta Tr. Severin **(D15)**

19.10.2020 – Ostrovul Corbului **(D16)**, Iron Gate II **(D17)**

Sampling sites on Danube

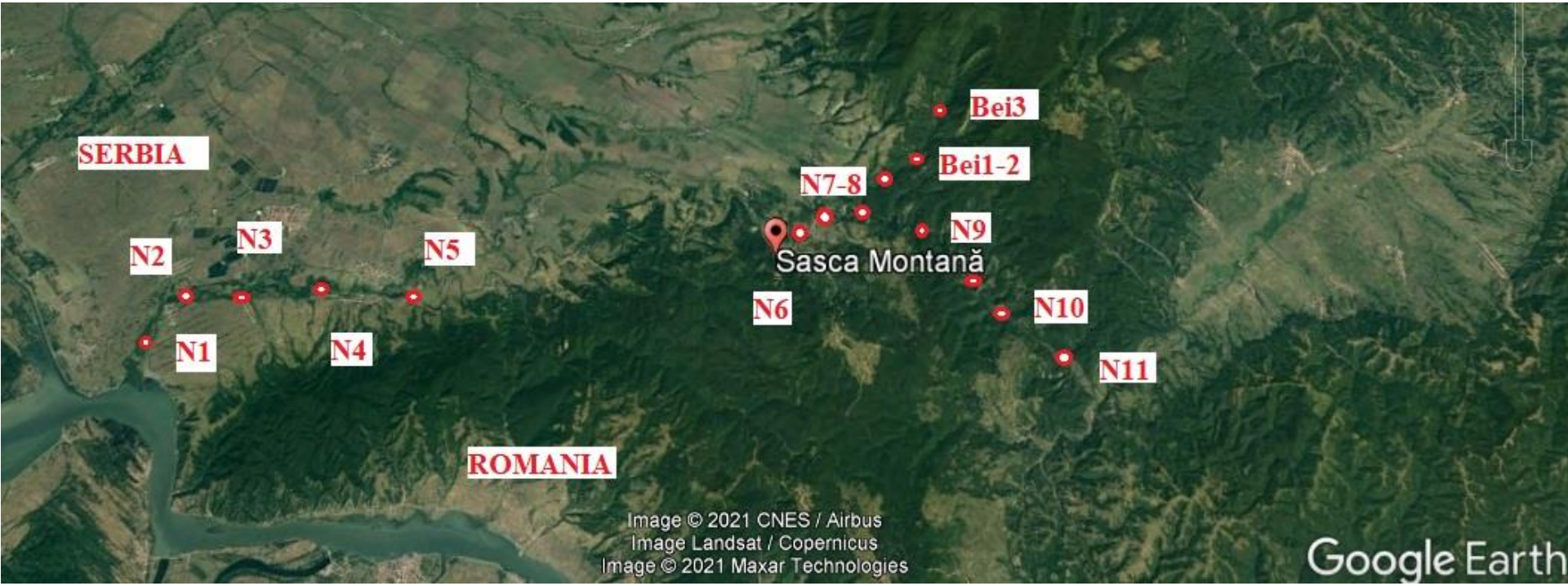
Danube

Danube

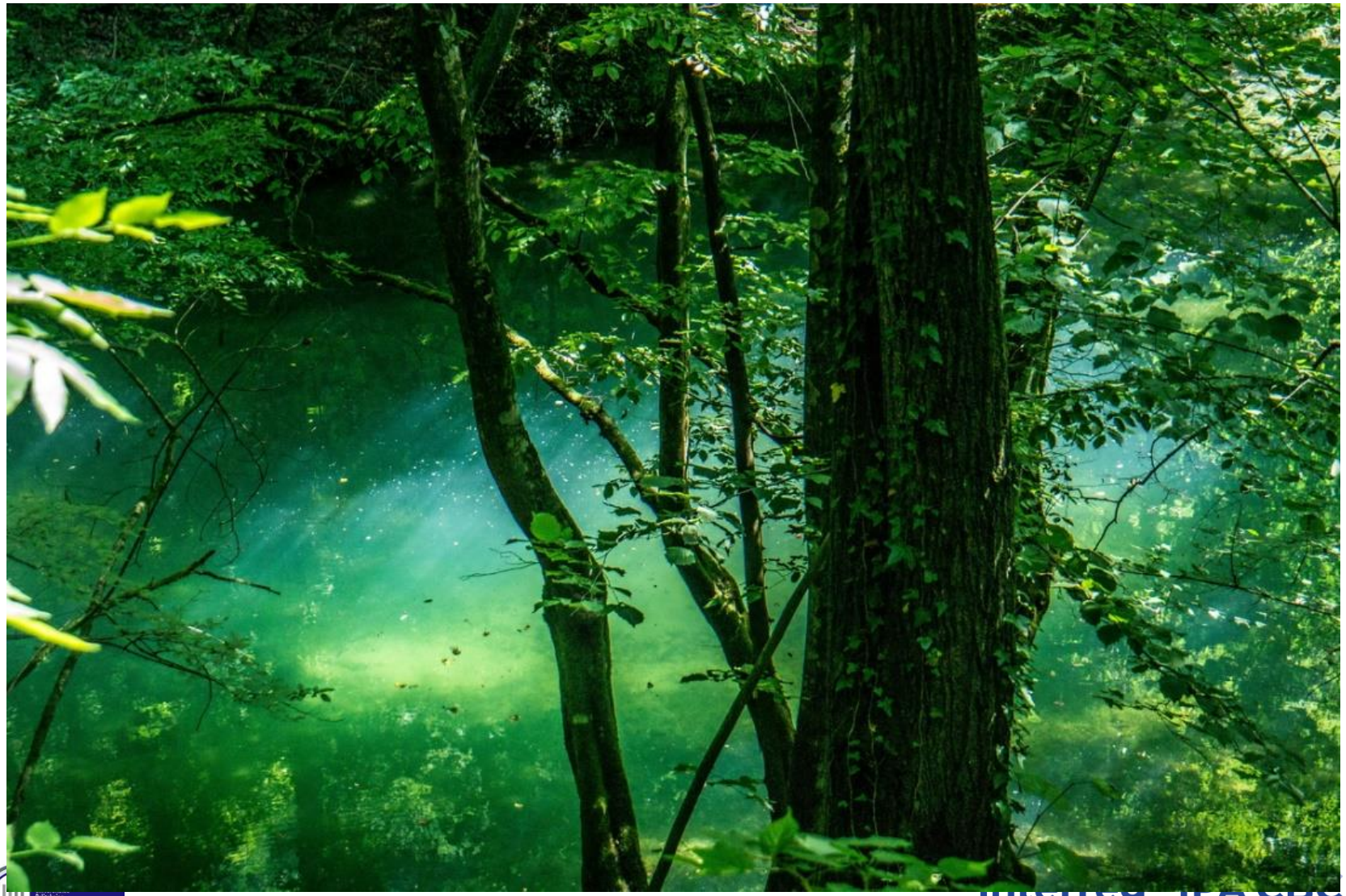
Danube

Danube

Sampling sites – Danube tributary: NERA, 124 km



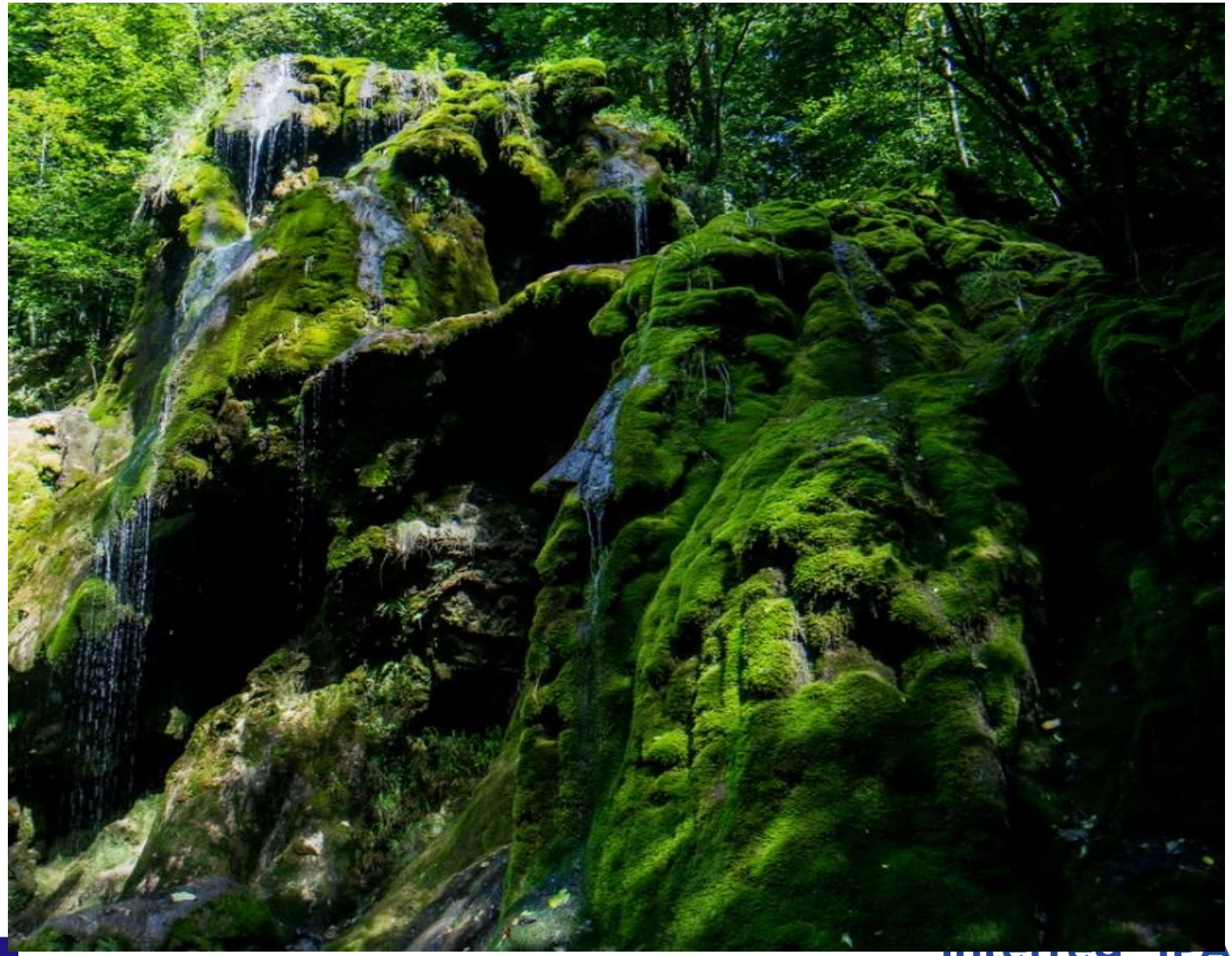
Danube tributary: NERA



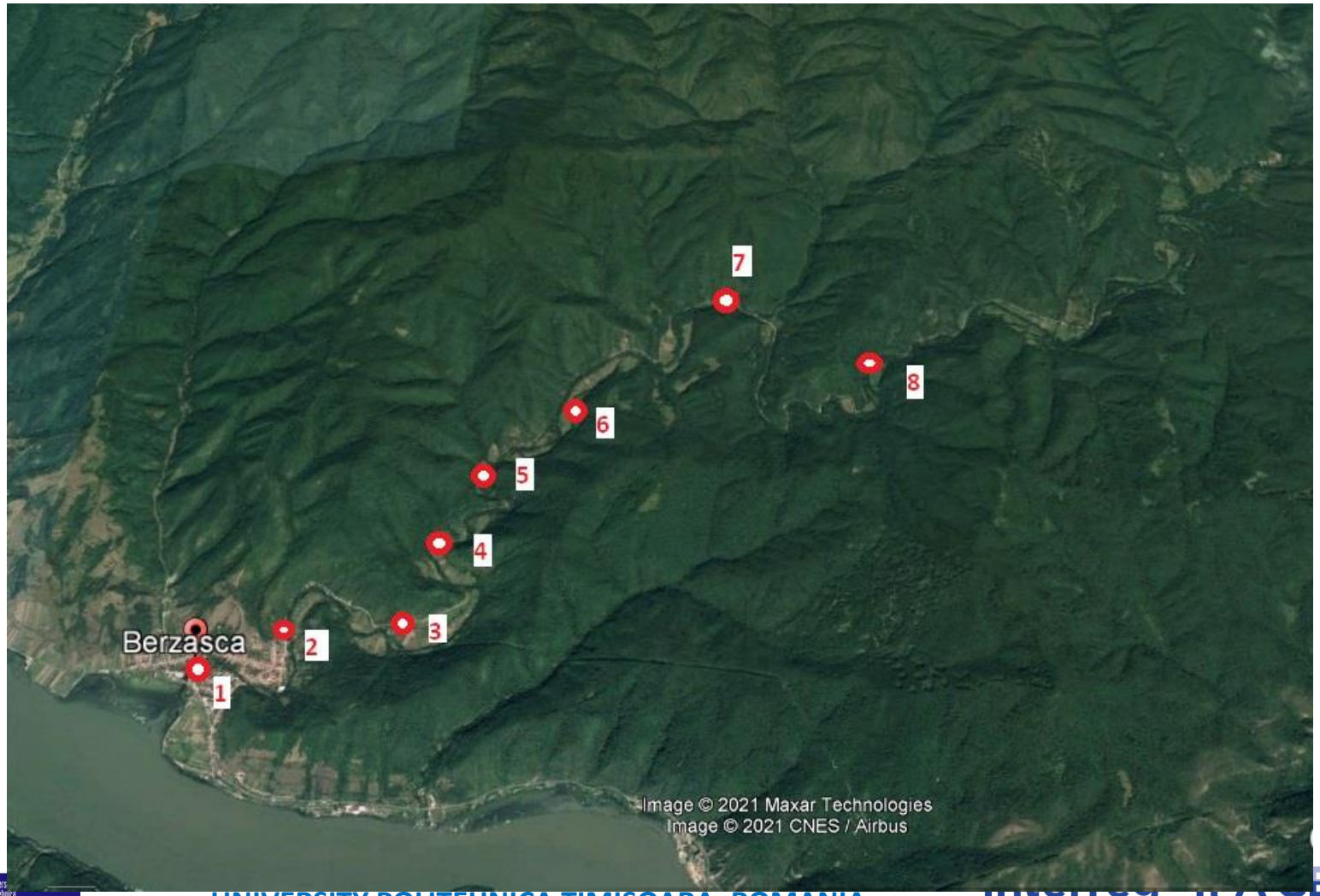
Danube tributary: NERA

Danube tributary: NERA

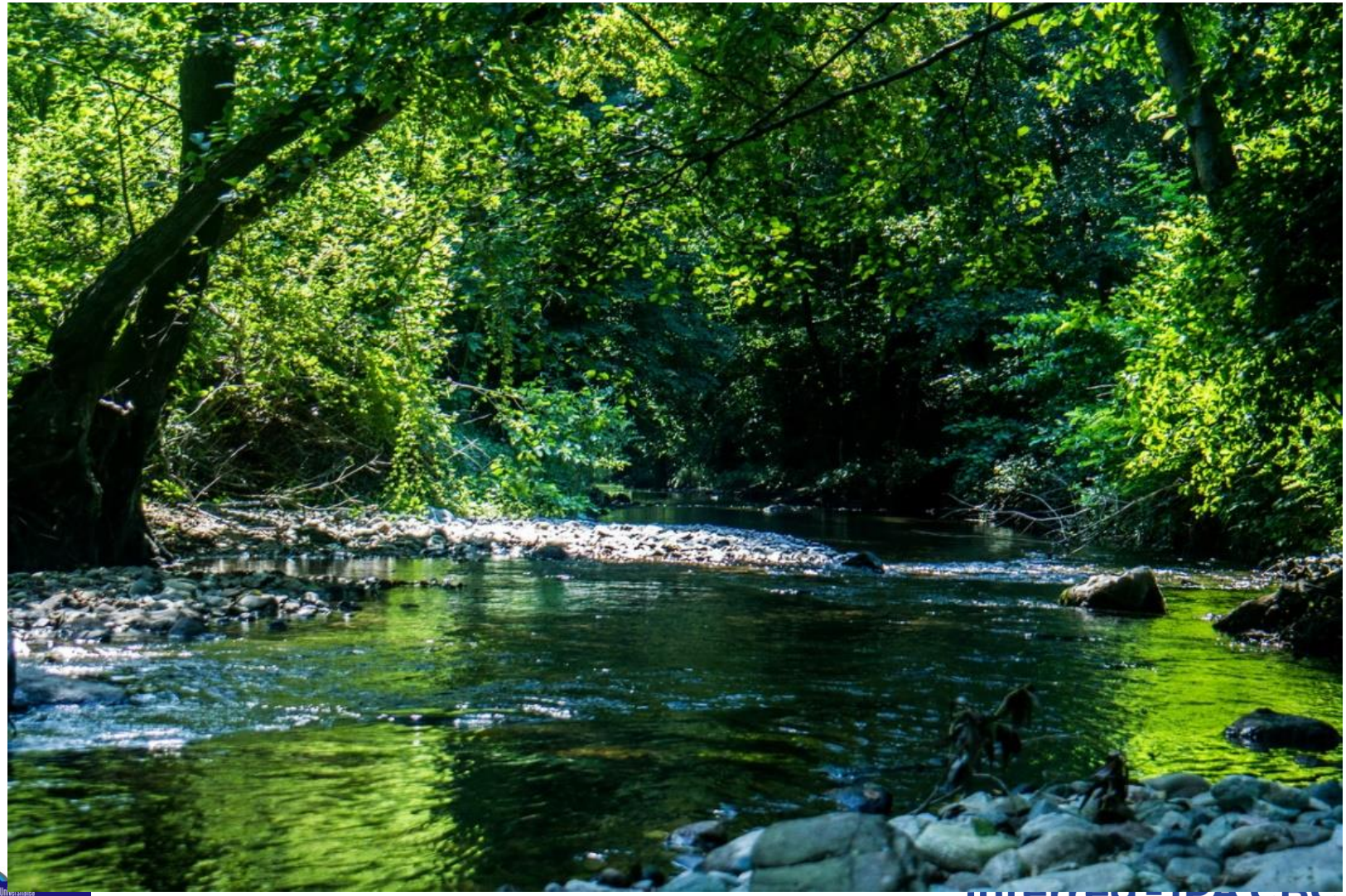
Danube tributary: NERA



Sampling sites – Danube tributary: BERZASCA, 42 km



Danube tributary: BERZASCA



Danube tributary: BERZASCA

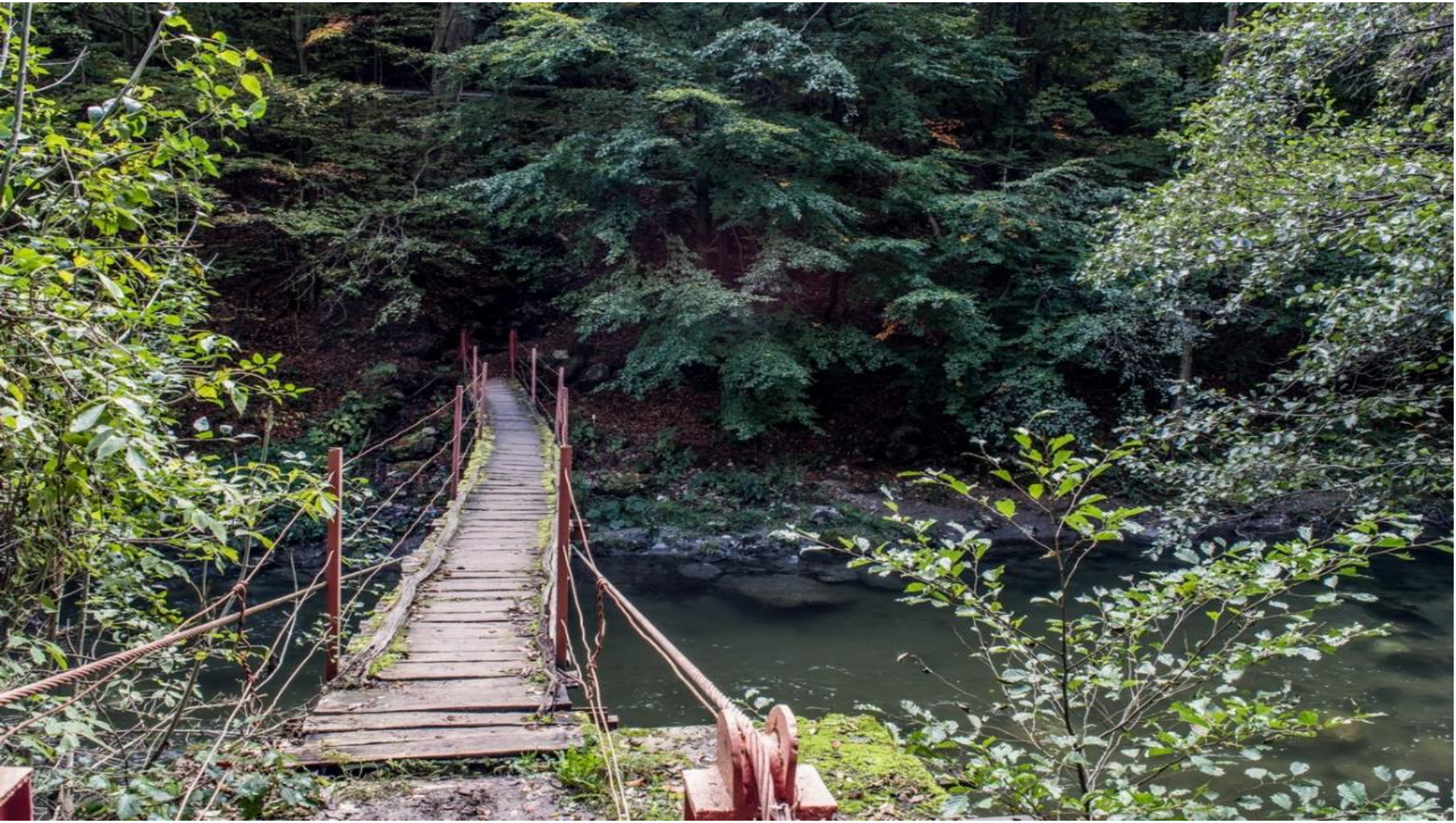
Danube tributary: BERZASCA

Sampling sites – Danube tributary: CERNA, 79 km

Danube tributary: CERNA

Danube tributary: CERNA

Danube tributary: CERNA



Danube tributary: CERNA

Limit values of pollutants in surface waters, Romania

Parameter	Unit	Limit values				
		I class	II class	III class	IV class	V class
pH	-	6.5 – 8.5				
Conductivity	µS/cm	-				
Dissolved oxygen (DO)	mgO_2/l	9	7	5	4	< 4
Biochemical oxygen demand (BOD – CBO5)	mgO_2/l	3	5	7	20	> 20
Chemical oxygen demand (COD – CCO-Cr)	mgO_2/l	10	25	50	125	> 125
Ammonia (NH_4^-)	mg/l	0.01	0.3	0.06	0.3	> 0.3
Nitrates (NO_3^-)	mg/l	1	3	5.6	11.2	> 11.2
Nitrites (NO_2^-)	mg/l	0,01	0,03	0,12	0,3	>0,3
Total Nitrogen (TN)	mg/l	1.5	7	12	16	> 16
Orto phosphate ($P\text{-}PO_4^{3-}$)	mg/l	0.1	0.2	0.4	0.9	> 0.9
Sulphates (SO_4^{2-})	mg/l	60	120	250	300	>300
Chloride (Cl^-)	mg/l	25	50	250	300	> 300
Sodium (Na+)	mg/l	25	50	100	200	> 200
Calcium (Ca2+)	mg/l	50	100	200	300	> 300
Mercury (Hg)	µg/l	0.1	0.3	0.5	1	> 1
Arsenic (As_3^+)	µg/l	10	20	50	100	> 100
Lead (Pb)	µg/l	5	10	25	50	> 50
Zinc (Zn_2^+)	µg/l	100	200	500	1000	> 1000
Cadmium (Cd)	µg/l	0.5	1	2	5	> 5
Manganese (Mn - total)	mg/l	0.05	0.1	0.3	1	> 1
Iron (Fe – total)	mg/l	0.3	0.5	1.0	2	> 2

Physical-chemical parameters measured on surface water

Parameters	Measurement methods
pH	Electrode - electric potential difference
Conductivity	Electrolytic probe
Dissolved oxygen (DO)	Galvanic probe
Biochemical oxygen demand (BOD – CBO5)	Specord 250Plus – photometric method
Chemical oxygen demand (COD – CCO-Cr)	
Ammonia (NH_4^-)	
Nitrates (NO_3^-)	
Nitrites (NO_2^-)	
Total Nitrogen (TN)	Multi N/C 3100. Corrosion-free Focus-Radiation NDIR detection and furnace technology of combustion.
Orto phosphate ($P\text{-}PO_4^{3-}$)	Specord 250Plus – photometric method
Sulphates (SO_4^{2-})	
Chloride (Cl^-)	
Sodium (Na+)	
Calcium (Ca2+)	
Mercury (Hg)	ZEEnit 700 P Compact Tandem Spectrometer. Atomic Absorption Spectrometry – equipped with flame, hydride and graphite furnace, with Zeeman magnetic field control and Deuterium and Zeeman background correction.
Arsenic (As_3^+)	
Lead (Pb)	
Zinc (Zn_2^+)	
Cadmium (Cd)	
Manganese (Mn - total)	
Iron (Fe – total)	

Results obtained for parameter analysis in samples on Danube

Parameter	Unit	Measured values					
		D1 Bazias	D7 Moldova-Noua	D11 Dubova	D16 Ostrovul Corbului	D17 Iron Gate II	ecological state
		Summer (08-09)			Autumn (10)		
pH	-	6.9	6.5	6.8	6.7	6.7	-
Conductivity	µS/cm	399	411	403	388	404	-
Dissolved oxygen (DO)	mgO_2/l	7.1	7.1	6.5	6.5	6.4	I^{st}-II^{nd}
Biochemical oxygen demand (BOD – CBO5)	mgO_2/l	3.6	3.7	3.5	3.3	3.2	II^{nd}
Chemical oxygen demand (COD – CCO-Cr)	mgO_2/l	26	25	27	18	18	II^{nd}-III^{rd}
Ammonia (NH_4^-)	mg/l	0.11	0.16	0.14	0.31	0.33	V^{th}
Nitrates (NO_3^-)	mg/l	0.77	0.81	0.72	0.68	0.66	I^{st}
Nitrites (NO_2^-)	mg/l	0.022	0.025	0.028	0.017	0.016	I^{st}
Total Nitrogen (TN)	mg/l	1.21	1.11	1.15	1.01	0.98	I^{st}
Orto phosphate ($P\text{-}PO_4^{3-}$)	mg/l	0.31	0.35	0.32	0.21	0.22	III^{rd}
Sulphates (SO_4^{2-})	mg/l	8.3	7.5	8.1	7.2	7.1	I^{st}
Chloride (Cl^-)	mg/l	3.5	3.2	3.6	18.5	11.1	I^{st}
Sodium (Na+)	mg/l	2.1	1.9	2.2	3.8	2.9	I^{st}
Calcium (Ca2+)	mg/l	4.5	5.1	4.7	5.1	3.9	I^{st}
Mercury (Hg)	µg/l	0.011	0.011	0.009	0.016	0.015	I^{st}
Arsenic (As_3^+)	µg/l	0.09	0.11	0.11	0.14	0.14	I^{st}
Lead (Pb)	µg/l	0.21	0.25	0.22	0.28	0.31	I^{st}
Zinc (Zn_2^+)	µg/l	21.1	17.8	19.1	23.3	18.1	I^{st}
Cadmium (Cd)	µg/l	0.004	0.005	0.008	0.107	0.088	I^{st}
Manganese (Mn - total)	mg/l	0.011	0.011	0.011	0.018	0.012	I^{st}
Iron (Fe – total)	mg/l	0.766	0.891	0.792	1.822	2.193	III^{rd}-V^{th}

Results obtained for parameter analysis in samples on Berzasca river

Parameter	Unit	Measured values								Eco state
		B1	B2	B3	B4	B5	B6	B7	B8	
pH	-	8.11	8.11	8.07	8.10	8.07	8.07	8.07	8.08	-
Conductivity	µS/cm	288	284	284	287	289	291	290	289	-
		Oxygen concentration								
Dissolved oxygen (DO)	mgO_2/l	14.5	14.9	14.1	14.7	14.7	14.8	14.5	14.6	Ist
Biochemical oxygen demand (BOD – CBO5)	mgO_2/l	1.4	1.4	1.5	1.6	1.5	1.4	1.5	1.5	Ist
Chemical oxygen demand (COD – CCO-Cr)	mgO_2/l	5.8	5.9	6.1	5.7	5.5	5.4	5.3	5.4	Ist
		Nutrients and general ions								
Sodium (Na+)	mg/l	2.1	2.2	2.1	2.1	2.1	1.8	1.8	1.8	Ist
Calcium (Ca2+)	mg/l	2.7	3.1	2.8	2.7	2.7	3.0	2.8	2.7	Ist
Ammonia (NH_4^-)	mg/l	0.07	0.06	0.07	0.05	0.05	0.05	0.06	0.06	Ist
Nitrates (NO_3^-)	mg/l	0.22	0.14	0.11	0.09	0.10	0.09	0.08	0.08	Ist
Nitrites (NO_2^-)	mg/l	0.011	0.009	0.007	0.006	0.006	0.006	0.005	0.006	Ist
Orto phosphate ($P\text{-}PO_4^{3-}$)	mg/l	0.06	0.03	0.03	0.02	0.02	0.03	0.02	0.02	Ist
Sulphates (SO_4^{2-})	mg/l	8.4	5.4	4.2	3.8	3.8	4.3	3.9	4.0	Ist
Chloride (Cl^-)	mg/l	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	Ist
Total Nitrogen (TN)	mg/l	0.78	0.51	0.47	0.42	0.43	0.42	0.38	0.38	Ist
		Heavy Metals concentrations								
Mercury (Hg)	µg/l	0.008	0.007	0.007	0.006	0.007	0.006	0.006	0.007	Ist
Arsenic (As_3^+)	µg/l	0.074	0.072	0.062	0.061	0.068	0.061	0.060	0.065	Ist
Lead (Pb)	µg/l	0.014	0.014	0.015	0.013	0.014	0.014	0.012	0.013	Ist
Zinc (Zn_2^+)	µg/l	1.14	0.89	0.77	0.91	0.81	0.75	0.77	0.75	Ist
Cadmium (Cd)	µg/l	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	Ist
Manganese (Mn - total)	mg/l	0.018	0.012	0.014	0.013	0.015	0.012	0.014	0.014	Ist
Iron (Fe – total)	mg/l	0.087	0.068	0.071	0.070	0.068	0.069	0.065	0.066	Ist

Conclusions ?