Interreg
Danube Transnational Programme
SIMONA

40 EXPERTS TRAINED AT STAKEHOLDER WORKSHOP

OUTPUT 3.5

Programme co-funded by the European Union funds (ERDF, IPA, ENI)

Project title

Sediment-quality Information, Monitoring and Assessment System to support transnational cooperation for joint Danube Basin water management

Acronym

SIMONA

Project duration

1st June 2018 to 30th November 2021, 42 months

Date of preparation

30/11/2021

Compiled by Anca-Marina Vijdea (RO-IGR)

Responsible(s) of the deliverable: Anca-Marina Vijdea (RO-IGR)

Co-responsible(s) of the deliverable: Gyozo Jordan (HU-MATE)

Project co-funded by the European Union (ERDF, IPA and ENI)

Contents

1. INTRODUCTION

Output O3.5 is part of activity 3.5 of SIMONA project "Stakeholder workshop at Upper Tisa". This workshop was intented to be organized in Upper Tisa Test Area, at Baia Mare, in Romania, after the 3rd Training Event "Sediment Quality Evaluation and IT Tool Application" organized by WP7 "Training" on 9 November 2021 and the "Scientific Conference" organized by WP2 Communication on the 10th of November.

Initially planned as on-site event, all the above mentioned manifestations were commuted exclusively on-line, due to sanitary harsh conditions in Romania in that period. The responsible with logistic of online organisation was the branch in Baia Mare of the Technical University Cluj Napoca from Romania.

The purpose of the "Stakeholder workshop at Upper Tisa" was to present to interested stakeholders the Case Studies of the three Test Areas (Drava, Upper Tisa and South Danube – local scale) and of the Danube Region Basin (DRB) baseline network (regional scale) of national stations for sediment monitoring in Simona countries.

The main results of the Case Studies were presented to the stakeholders with the obhective of knowledge transfer to experts of water authorithies responsible for the implementation of WFD, leading to capacity building for surface water sediment quality monitoring.

2. EVENT DESCRIPTION

The "Stakeholder workshop" tool place in the afternoon of 10th November 2021, after SIMONA "Scientific Conference" in the morning and the after lunch demonstration of extracting the sediment-box for capture of suspended sediments in Lăpuş River by the SIMONA team of Baia Mare branch of the Technical University Cluj Napoca (Table 2.1)

The presentations of the Case Studies, included in chapter 3 of this report, were followed by comments, questions and answers, which are included in Deliverable D.3.5.1. "Stakeholder workshop collecting the questions and their answers from the workshop". At the end of the day, the SIMONA film produced within WP2 was presented to the participants and this 2 days event was then closed by the project leader.

The list of participants which took part to the event can be found at the end of this report.

Table 2.1 Agenda of SIMONA events on 10th November 2021

10 NOVEMBER, Wednesday (EEST TIME ZONE)	
Scientific Conference and Stakeholder Workshop	
Conference title: Sediment Quality Monitoring – Sampling, Analysis, Evaluation: Methods and Applications	
SESSION 1: Concepts and Principles	
08:30 – 09:00	Registration on site, welcome coffee; Online meeting room will be opened, virtual morning coffee
09:00 – 09:10	Welcome address by local organisers (Dr Monica Marian, Dean of Faculty of Sciences)
09:10 – 09:20	Welcome by the SIMONA project coordinator, introduction to the project (Meta Dobnikar)
09:20 - 11:10	**KEYNOTE SPEECHES**
09:20 – 09:55	Sediment quality: a global perspective (INVITED; GEMAS / IUGS) Alecos Demetriades
09:55 – 10:20	Sediment quality assessment (INVITED; SedNET Jos Brills)
10:20 – 10:40	Sediment quality monitoring needs and challenges in the Danube Basin (INVITED; ICPDR MA EG Igor Liska)
10:40 – 11:00	The scientific approach of the SIMONA project: sediment quality monitoring under the EU Water Framework Directive (Gyozo Jordan)
11:00 – 11:10	**Short Discussion**
SESSION 2: Methods – Sampling, Analysis and Evaluation	
11:10 – 11:25	Talk 1 - Sampling methods (Franko Hummer) – *Requirements for Sediment sampling*

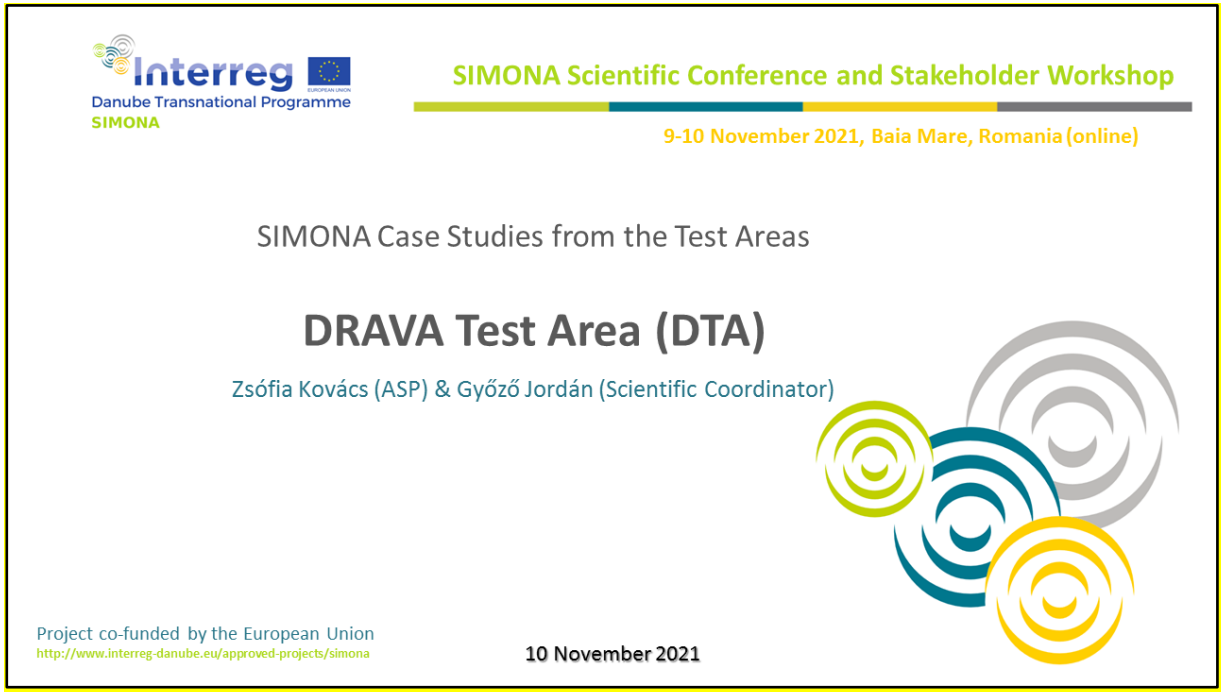
11:25 – 11:50	Talk 2 - Sampling methods (SIMONA case) - Zsolt Szakacs
11:50 – 12:00	Talk 3 - Analysis methods (Boštjan Križanec) - *Sediment analysis on selected pollutants*
12:00 – 12:30	Talk 4 - Analysis methods (SIMONA case) – Gyozo Jordan
12:30 – 12:55	Talk 5 - Evaluation methods (SIMONA case) - Kata Dudas
12:55 – 13:45	**Lunch break**
13:45 – 14:10	Field Demonstration to SIMONA Upper Tisa Test Area Monitoring Site
14:10 – 15:20	**Break**
SESSION 3: Stakeholder Workshop and Case Studies	
15:20 – 15:30	Case Study 1 (Drava) – Zsofia Kovacs
15:30 – 15:40	Case Study 2 (Upper Tissa) – Daniel Nasui
15:40 – 15:50	Case Study 3 (South Danube) – Irena Peytcheva
15:50 – 16:00	Case Study 4 (DRB Baseline) – Anca Vijdea
16:00 - 16:30	Discussion Q/A – moderators Gyozo Jordan, Daniel Nasui and Meta Dobnikar
16:30– 16:40	End of Conference: SIMONA Project VIDEO show

3. CASE STUDIES

There were four case studies presentations, one for each test area of the project (Drava, Upper Tisa and South Danube), followed by the case study of the Danube Region Basin (DRB) baseline network of sediment monitoring stations.

3.1. CASE STUDY 1 - DRAVA TEST AREA

The Drava Case Study was presented by Zsófia Kovács from the General Directorate of Water Management in Hungary.



SIMONA Scientific Conference and Stakeholder Workshop

0. BACKGROUND - RIVER DRAVA

The **River Drava** is one of the largest and most significant rivers in Central Europe.

- The whole length of the river is approximately 749 km, it is running 140 km long, along the **border** between Hungary and Croatia.
- These countries are **downstream regions** of the river with meandering character, different biogeographical properties and sedimentation.
- There is a regional **historical pollution**, originating mainly from **mining and smelting industry** in the Alps can be found in the sediments and in the soils in the floodplain.
- Moreover, **industrial areas, water power plants**, water reservoirs, agricultural areas, forests and numerous settlements can be found all along the river.

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 2

SIMONA Scientific Conference and Stakeholder Workshop

1. AIM OF THE CASE STUDY

Testing of chosen samplers and evaluating the sediment samples

The testing of chosen samplers according to the following major criteria:

✓Selection of monitoring sites based on preliminary survey

✓Testing of different sampling methods

✓Feedback of the results.

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 3

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

2. SITES - INITIAL PLAN

Nr.	Code	Name of the river	Name of the site	WGS Long	WGS Lat	Owner of water monitoring data	Owner of sediment monitoring data	Responsible for sampling	Exists in archive water; sediment monitoring data	Comments
1.	AEP543	Gyöngyös-stream	Kétújfalú	17°43'52"	45°59'06"	OVF	SIMONA Prj	HU-SZIE	Only water	Relocated, modified water body
2.	AEP852	Okor-Bükkösdi víz	Szentdénes	17°55'45"	45°59'23"	OVF	SIMONA Prj	HU-SZIE	Only water	-
3.	AEP875	Pécsi-víz	Zók	18°05'54"	46°00'20"	OVF	SIMONA Prj	HU-SZIE	Only water	Relocated
4.	AEP361	Bükkösdi-árapasztó	Gilvánfa	17°57'32"	45°54'58"	OVF	SIMONA Prj	HU-SZIE	Only water	-
5.	AEP571	Hegyadó-stream	Hegyszent-márton	18°05'28"	45°54'18"	OVF	SIMONA Prj	HU-SZIE	Only water	Replaced
6.	AEP453	Egerszegi-csatorna	Kovácshida	18°11'14"	45°50'09"	OVF	SIMONA Prj	HU-SZIE	Only water	-
7.	AEP478	Fekete-víz	Cún	18°04'52"	45°49'04"	OVF	SIMONA Prj	HU-SZIE	Only water	Relocated, modified water body
8.	AEP438	Dráva	Drávaszabolcs	18°12'01"	45°47'00"	OVF	SIMONA Prj	HU-SZIE	Only water	Relocated
9.	CROATIA (HRS)	Drava	Donji Miholjac	18°12'00"	45°46'57"	OVF	SIMONA Prj	HU-SZIE	Only water	Replaced
10.	SIMONA CODE	Dráva	before the Fekete-víz estuary	18°08'57"	45°47'22"	OVF	SIMONA Prj	HU-SZIE	new site	Replaced

List of the originally planned sampling sites

The selection of monitoring sites is based on the following major criteria:

- ✓ Monitoring sites that have been monitored in the past and therefore suitable for long term trend analyses
- ✓ Trans-national character
- ✓ The catchment area is characterized by small watercourses
- ✓ Existing authority water monitoring sites and moderate water quality (polluted area)
- ✓ Different typology and hydro-morphology
- ✓ Diverse pollution points and diffuse sources
- ✓ Good infrastructure (accessibility, depth of water, parking place etc.)

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

2. SITES - DETAILED PRELIMINARY SURVEY

1/ Relocation of the sampling sites due to inadequate site conditions

Two sites (Zók, Drávaszabolcs) had to be replaced with new sites (Kémes, Barcs).

WHY?

a) Pécsi-víz, Zók

The site was not suitable for sediment sampling due to dense vegetation cover inhibiting access to sampling points.

b) Dráva, Drávaszabolcs

The large river Drava bottom sediment at sampling site Barcs will be collected from boat by the Water Management Directorate. This location will be the Training Event venue, too.

Landscape photo of the sampling site (Pécsi-víz, Zók). Dense vegetation inhibit sediment sampling.

SIMONA Scientific Conference and Stakeholder Workshop

2. SITES - DETAILED PRELIMINARY SURVEY

2/ Relocation due to hydrological conditions

Two sites (Cún, Kétújfalu) had to be replaced with new sites.

WHY?

a) Fekete-víz, Cún

River water width and depth was too big for manual sampling. A small boat should be used to sample the sediment under such conditions.

b) Gyöngyös-patak; Kétújfalú

Sampling was not possible due to road access to the site.

Landscape photo of the sampling site (Fekete-víz, Cún). Deep water and steep sidewalls inhibit manual sampling.

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 6

SIMONA Scientific Conference and Stakeholder Workshop

2. SITES - DETAILED PRELIMINARY SURVEY

3/ Replacement of a sampling site due to river channel conditions

WHY?

a) Hegyadó-patak, Hegyszentmárton

Riverbed was covered with dense vegetation (extreme vegetation).

b) It is sufficient to select only one sampling site on the large river Drava

- Drava; Donji Miholjac
- Drava; before the Fekete-víz estuary

New monitoring sites:

- Babócsai-Rinya, Babócsa (Training Event Venue)
- Taranyi-Rinya, Bolhás (Somogyszob-Kaszópuszta)
- Almás-patak, Dencsháza

Landscape photo taken on the sampling site (Hegyadó-patak, Hegyszentmárton)

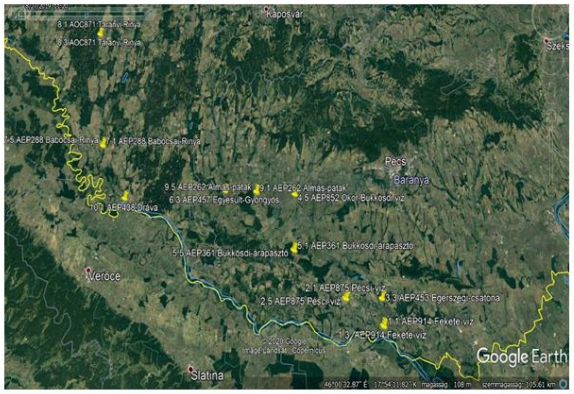
01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 7

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

2. SITES - LIST OF THE FINAL SAMPLE SITES

Nr.	Code	Name of the river	Name of the site	WGS Long	WGS Lat	Owner of water monitoring data	Owner of sediment monitoring data	Responsible for sampling	Existent archive water, sediment monitoring data	Comment
1.	AEP914	Fekete-víz (Régi)	Drávaszabolcs	18°11'45.54"	45°47'30.60"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6S
2.	AEP875	Pécsi-víz	Kémes	18°5'34.32"	45°49'39.26"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6M
3.	AEP453	Egerszegi-csatorna	Kovácshida	18°11'19.68"	45°50'4.77"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6S
4.	AEP852	Okor-Bükkösdi víz	Szentdénes	17°55'50.08"	45°59'24.22"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6M
5.	AEP361	Bükkösdi-árapasztó	Gilvánfa	17°56'36.58"	45°53'44.11"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6S
6.	AEP457	Egyesült-Gyöngyös	Kétújfalú	17°43'57.56"	45°58'58.41"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6M
7.	AEP288	Babócsai-Rinya	Babócsa	17°21'9.44"	46°2'25.60"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6M
8.	AOC871	Taranyi-Rinya	Bolhás (Somogyszob - Kaszópuszta)	17°16'10.39"	45°15'42.82"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 3S
9.	AEP262	Almás-patak	Dencsháza	17°49'22.03"	45°59'11.09"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 6M
10	AEP438	Dráva	Barcs	17°26'46.50"	45°37'2.90"	OVF	SIMONA Prj	HUSZIE	Only water	Typology type: 8N



*Bottom sediment sampling will be carried out by the Water Management Directorate.

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

„HARMONISATION MEETING" – SELECTION of SAMPLING METHOD

SELECTION OF SAMPLING METHOD

*„TEST AREA SAMPLING **HARMONISATION MEETING**"* 14-15 July 2020, Harkány, Hungary

Evaluation Criteria

- ✓ Sampling should be scientifically based: reproducible and representative
- ✓ Sampling should be in full compliance with EU legislation (Water Framework Directive)
- ✓ Sampling should be practice-oriented: Ready to deploy
- ✓ Sampling should be flexible and adaptive to the site-specific conditions such as lowland versus mountainous conditions etc.,

Reference Laboratory (HU)

?

Scoop and Van Veen grab **vs** Romanian grab sampler

Spade system **vs** Austrian cake system

SIMONA Scientific Conference and Stakeholder Workshop

3. SEDIMENT SAMPLING METHODS – Stream/bottom

4-7 August, 2020, Harkány, Szigetvár

Stream sediment/bottom sediment — *5 or 3 sub-samples collected along a 250 m „sampling section"*

1/ Vacuum core system

- the **0-5 cm** and 5-10 cm deep bottom sediment samples were collected.
- **vacuum core sample** all sampling sites

2/ Scoop from the Romanian grab system

- collecting bottom sediment with scoop from the Romanian grab system (**0-5 cm**)
- collecting of bottom sediment from the Van Veen grab system with the scoop – **not used** -

3/ Romanian grab

the Romanian grab sampling collected the uppermost ca. **0-10 cm** bottom sediment separate samples at each of the 5 sampling locations.

Sample type	Sampling system
stream sediment 5 cm	vakuum core
stream sediment 5-10 cm	vakuum core
stream sediment 5 cm	grab-scoop
stream sediment	vacuum core
stream sediment 0-10 cm	grab
floodplain sediment 5 cm	spade
floodplain sediment 40-50 cm	spade
floodplain sediment 5 cm	cake sampler
suspended sediment	barrel

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

3. SEDIMENT SAMPLING METHODS – Suspended sediment

Suspended sediment

***(Only)* 30 L plastic barrel**

- Stream water pumped from the flowing stream into a 30 L plastic barrel
- The sample preparation will begin as soon as possible in the laboratory

Samples are filtered through a 0.45 µm membrane filter and the amount of water passed through is recorded.

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

3. SEDIMENT SAMPLING METHODS – Floodplain sediment

Floodplain sediment

Five 50 cm deep sampling holes were dug using a spade located preferable at the middle of the 250 m stream sampling stretch.

1/ Spade

- Sample collection followed the standard soil sampling procedures and samples were collected at (1) **0-5 cm** depth (top soil) and (2) **40-50** cm depth (bottom soil).

2/ Austrian cake soil sampler

- it was used to collect **0-5 cm** top soil sample

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 12

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

3. SEDIMENT SAMPLING METHODS - Field

Field measurements

Measuring stream water and sediment chemistry with portable electric probes.

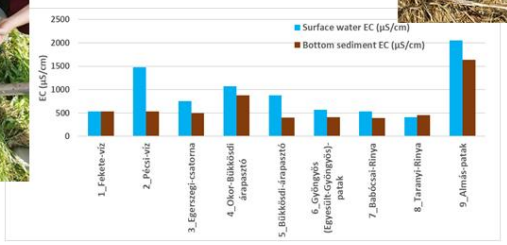
1/ Stream water chemistry

temperature (ºC), electrical conductivity (µS/cm), pH, redox potential (mV), dissolved oxygen (mg/l), oxygen saturation (%), turbidity (NTU)

Field parameters	Unit	Surface water	Bottom sediment (stream)
Temperature	°C	21.26	20.5
pH		7.19	7.63
Redox potential	mV	235.7	-275.2
Electrical Conductivity	µS/cm	410	456
Turbidity (measured)	NTU	9.07	not relevant
Dissolved Oxygen; DO	mg/l	5.75	not relevant
Oxygen Saturation; DO	%	65.11	not relevant

2/ Stream sediment

electrical conductivity (µS/cm), temperature (ºC), pH, redox potential (mV)



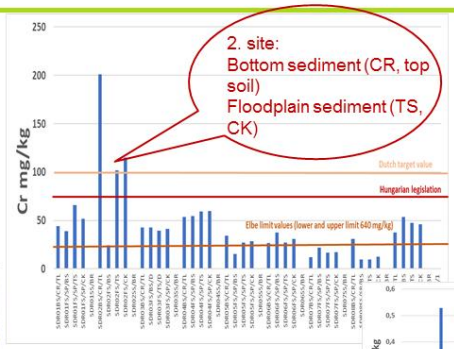
01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 13

SIMONA Scientific Conference and Stakeholder Workshop

4. RESULTS AND EVALUATION

SAMPLING SYSTEM HOMOGENEITY TEST

RECOMMENDATION SAMPLING METHODS



Anthracene measurement results,
- high concentration in the bottom sediment (5 cm) and
- suspended sediment at the second sampling site.

RESULTS

Out of the **8 metals examined**, **outliers were measured** in the case of **arsenic, cadmium, chromium and copper** in comparison with the international limit values.

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 14

SIMONA Scientific Conference and Stakeholder Workshop

3. SEDIMENT SAMPLING METHODS – **Activity 1 (WP8)**

PASSIVE SAMPLING SYSTEM

PILOT TEST AREA	JDS BOX *Unique*	PASSIVE SAMPLER	ONLINE SENSORS
DRAVA RIVER (installed-11.2020)	X	X	Flow rate, Turbidity pH, Dissolved oxygen Conductivity
UPPER TISA- LAPUS RIVER (installed-05.2021)	X	X	Flow rate Turbidity
SOUTH DANUBE-SILISTRA (installed-04.2021)	-	X	-

River Drava site, HU

Continuous monitoring station

Floodplain sediment box Pore water sampler

APPLICATION

River Lapus site, RO

South Danube, Silistra, BG

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 15

SIMONA Scientific Conference and Stakeholder Workshop

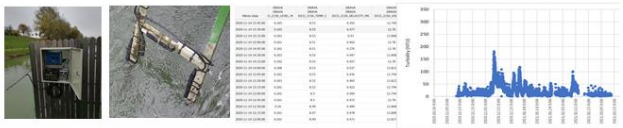
3. SEDIMENT SAMPLING METHODS – **Activity 1 (WP8)**

PASSIVE SAMPLING SYSTEM

New design for the sediment box
(hole in the bottom of the box)

Passive membrane sampler
(pesticide, PAH, heavy metals)

Continuous monitoring with sensors (flow rate, turbidity, pH, DO, conductivity)



Calibration methods

- ✓ standard suspended,
- ✓ Sediment sampling (30 L barrel) / for each sampling
- ✓ Field parameters measured /sensor calibration - monthly
- ✓ The authority takes a monthly sample of suspended sediment in the cross-section

Floodplain sediment JDS box

Pore water sampler

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 16

SIMONA Scientific Conference and Stakeholder Workshop

4-7 August, 2020, Harkány, Hungary

Thank you for your attention!

Dr. Zsófia KOVÁCS
e-mail: zsofia.kovacs@outlook.com
phone:+36303648774

01/12/2021 PROJECT CO-FUNDED BY THE EUROPEAN UNION (ERDF, IPA AND ENI) 17

3.2. CASE STUDY 2 - UPPER TISA TEST AREA

The Upper Tisa case study was presented by Daniel Năsui from the Technical University of Cluj Napoca, Baia Mare branch.

Interreg
Danube Transnational Programme
SIMONA

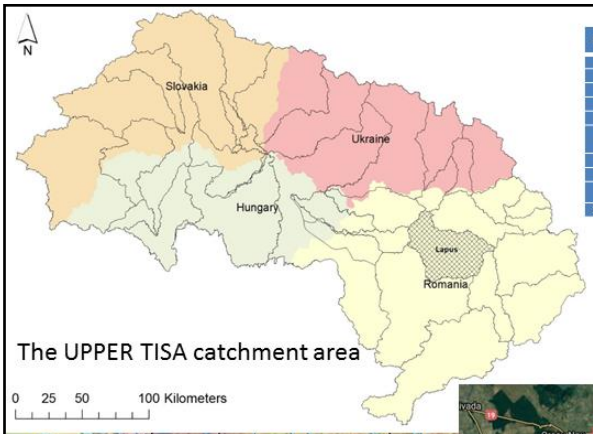
Upper Tisa sampling site selection criteria

Proposed in the *„Upper TISA WG 1st Workshop of the SIMONA Project - 13th September 2019, Baia Mare, Romania"* and defined in the *„SIMONA Working Groups 6 and 7 and Steering Committee Meeting October 21st-22nd, 2019, Sofia, Bulgaria"* the sampling site selection criteria prioritized the following criteria:

- the existence of enough general background data (ISO 5667-12:2017): e.g. climatic, hydrological, geological and biological
- WFD important criteria (ISO 5667-17:2008 and Guidance document No. 25): e.g. proper access, known pollution sources
- TMNM monitoring sites criteria: e.g. Sites relevant for assessing pollutant loads which are transferred across boundaries
- Other proposed criteria (in Baia Mare and Sofia): e.g. point pollution sources for heavy metals.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

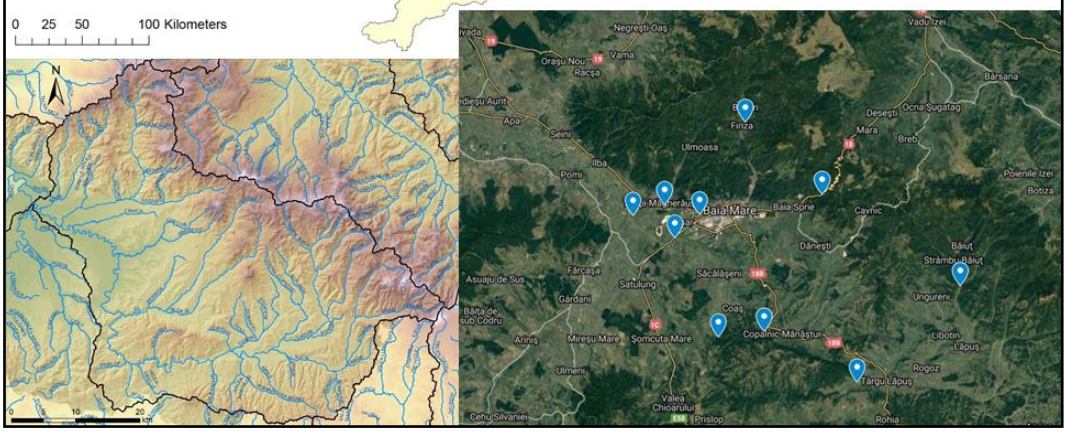
SIMONA Final Conference Meeting
November 10th 2021



The UPPER TISA catchment area

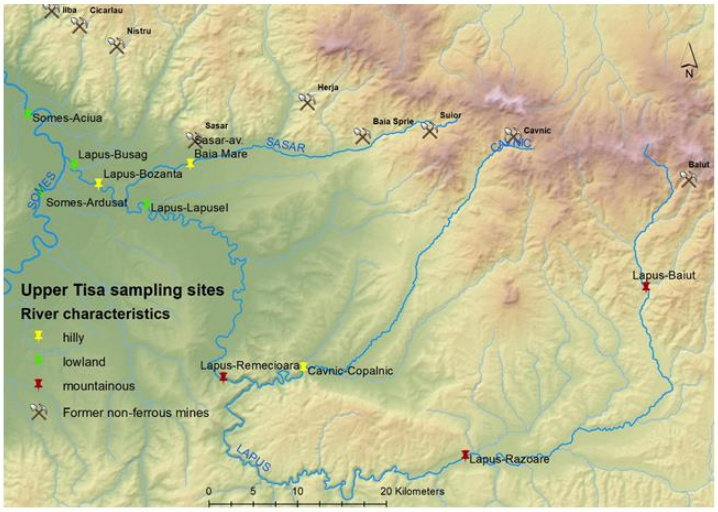
Nr.	Code	Name of the river	Name of the site	WGS Long	WGS Lat
1.	RORW2-1-66_B2	Lapus	Razoare	23,80821	47,45237
2.	RORW2-1-66-16_B1A	Cavnic	Copalnic	23,64414	47,51263
3.	RORW2-1-66-19-2_B1	Firiza	Firiza	23,61163	47,76158
4.	RORW2-1-66_B3	Lapus	Lapusel	23,48536	47,62397
5.	RORW2-1-66-19_B1	Sasar	Baia Sprie	23,74728	47,67525
6.	RORW2-1-66-19_B1	Sasar	Sasar-av. Baia Mare	23,52936	47,65153
7.	SIMONA code	Lapus	Lapus am. Ch. Botiz	23,99154	47,56745
8.	SIMONA code	Lapus	Lapus iesire Chei	23,56298	47,50578
9.	SIMONA code	Baita	V. Baita Tautii-Magheraus	23,46771	47,66387
10.	RORW2-1-66_B3	Lapus	Lapus-Busag	23,41168	47,65097

Deliverable 3.2.1- TABLE OF SAMPLING SITES PROVIDING DETAILS FOR UPPER TISA TEST AREA



Interreg
Danube Transnational Programme
SIMONA

Upper Tisa sampling points

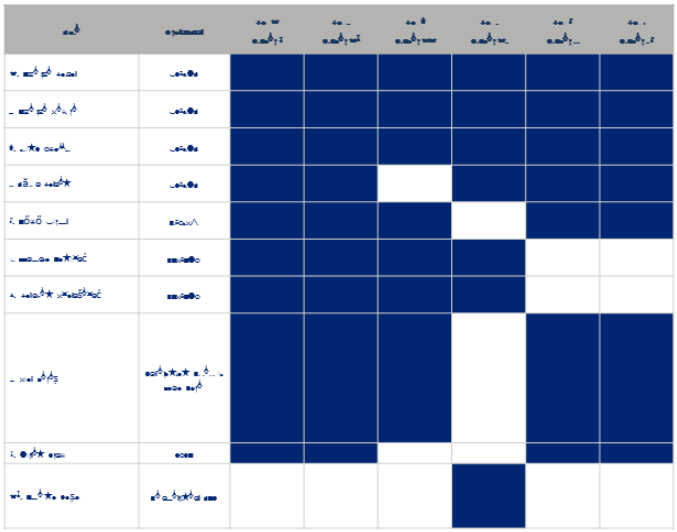


Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg
Danube Transnational Programme
SIMONA

Upper Tisa sampling team

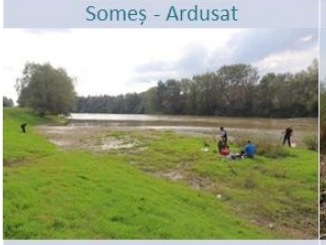
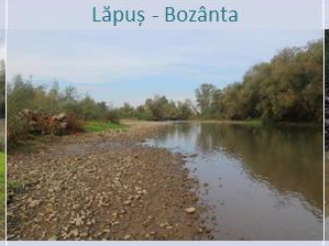
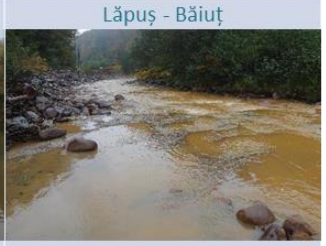


Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Different site characteristics

Lowland	Hilly	Mountainous
Someș - Ardusat	Lăpuș - Bozânta	Lăpuș - Băiuț
		
- 4 sampling sites - Bottom sediment texture: clay, silt (mostly) and sand. - High sedimentation rate.	- 3 sampling sites - Bottom sediment texture: silt, sand (mostly) and gravel. - Equal erosion and sedimentation rates	- 3 sampling sites - Bottom sediment texture: Mostly boulders and gravel with patches of sand and silt. - High erosion rates.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Stream bottom sediment sampling

- Method: vacuum core system

Sediment extraction	Sample measurement	Securing the global sediment sample
e.g. Lăpuș - Lăpușel	e.g. Săsar - Baia Mare	e.g. Săsar - Baia Mare
		

Lowland	Hilly	Mountainous
e.g. Somes - Ardusat	e.g. Săsar - Baia Mare	e.g. Lăpuș - Remecioara
		
- Easy collection of samples in the 4 sampling sites along the flow line of the stream.	- Hard to find suitable sampling points (due mainly to the presence of gravel) in the 3 sites.	- Not suitable for mountainous areas. 2 sites out of 3 were sampled using this method.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Stream bottom sediment sampling

- Method: scoop system

Lowland	Hilly	Mountainous
e.g. Someș - Ardusat	e.g. Lăpuș - Bozânta	e.g. Lăpuș - Băiuț
		
- Not needed.	- Usable in areas were sediment layer is too thin.	- Perfect for thin sediment patches on rock riverbeds.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Site Homogeneity Test

- Method: the Romanian grab and grab-scoop system

Sediment extraction	Scooping upper layer sediment from the grabber	Loading the bag with the global sediment sample
e.g. Lăpuș - Remecioara	e.g. Someș - Ardusat	e.g. Lăpuș - Bușag
		

Lowland	Hilly	Mountainous
e.g. Someș - Ardusat	e.g. Săsar - Baia Mare	e.g. Lăpuș - Remecioara
		
- Easy collection of samples in all 4 sampling sites.	- Hard to find suitable sampling points (due mainly to the presence of gravel) in the 3 sites.	- Very hard to find suitable sampling points.

Interreg Danube Transnational Programme SIMONA

Floodplain sediments

- Method: the Austrian cake soil sampler

Lowland	Hilly	Mountainous
e.g. Someș - Ardusat	e.g. Săsar - Baia Mare	e.g. Lăpuș - Remecioara
		

Easy collection of samples in all 10 sampling sites.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Floodplain sediments

- Method: the spade

Hole digging	0-5 cm sampling	40-50 cm sampling
e.g. Lăpuș - Bușag	e.g. Lăpuș - Bușag	e.g. Lăpuș - Bușag
		

Lowland	Hilly	Mountainous
e.g. Lăpuș - Bușag	e.g. Cavnic - Copalnic	e.g. Lăpuș - Răzoare
		

Easy collection of samples in all 10 sampling sites.

Interreg Danube Transnational Programme SIMONA

Suspended sediments

- Method: barrel system

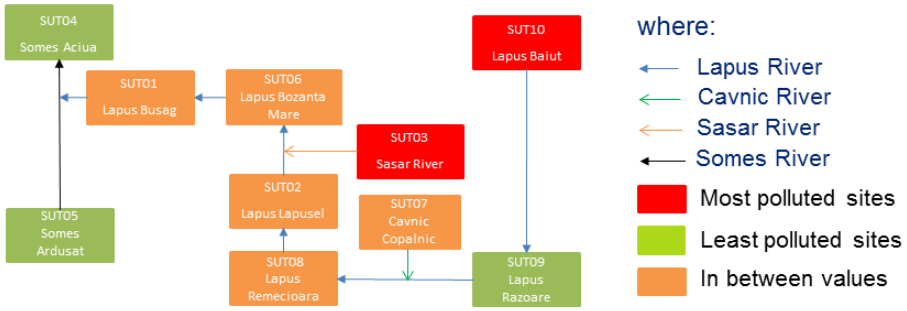
Lowland	Hilly	Mountainous
e.g. Lăpuș - Bușag	e.g. Săsar - Baia Mare	e.g. Lăpuș - Răzoare
		

Easy collection of samples in all 10 sampling sites.

Interreg Danube Transnational Programme SIMONA

Upper Tisa Laboratory results

- The preliminary analysis shows moderate to high values of heavy metal concentration values in most of the sites, whereas all the other contaminants show moderate to low values, almost for all EQS's taken into account during the study. The most polluted sites are placed on the Lapus River tributaries: SUT03 Sasar River and SUT10 Lapus Baiut, while the least polluted are placed on Somes River (SUT05 Somes Ardusat & SUT04 Somes Aciua) and



Interreg Danube Transnational Programme SIMONA

Possible sources of contamination

Correlation analysis of heavy metal concentration behavior

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
As								
p adj R^2								
Cd	0.6913							
p adj R^2	3.8E-08 0.467							
Cr	0.3237	0.2791						
p adj R^2								
Cu	0.8552	0.8097	0.4605					
p adj R^2	5.2E-15 0.726	1.9E-12 0.648						
Hg	0.8975	0.5499	0.4462	0.7833				
p adj R^2	2.5E-18 0.801			2.9E-11 0.605				
Ni	0.2952	0.2736	0.9727	0.4175	0.4190			
p adj R^2			1.8E-31 0.945					
Pb	0.7041	0.7782	0.2621	0.8227	0.5866	0.1793		
p adj R^2	1.7E-08 0.485	4.7E-11 0.597		4.1E-13 0.670				
Zn	0.7079	0.9698	0.2701	0.8246	0.5682	0.2663	0.7970	
p adj R^2	1.3E-08 0.491	1.9E-30 0.939		3.3E-13 0.673			7.3E-12 0.627	

- The behavior of each Heavy Metal concentration in all sampling sites considered together as a whole, can be used as an input to identify the contamination sources.

As can be seen in the table, strong and significant correlations can be identified between the following groups of metals:

1) *Zn, Cd, Cu, Pb, As*
2) *Cu, As, Hg,*
3) *Ni, Cr*

Main sources of contamination

1. Former mining activities: mine galleries, mining tailings, tailing ponds.
2. Domestic sewage: households and localities untreated sewage.
3. Agricultural activities.
4. Some identified organic compounds are generated during incomplete or low temperature combustion processes occurring in households (mainly in rural areas) or during road transportation (in urban areas or where the rivers flow near heavy traffic national and express roads).

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021

Interreg Danube Transnational Programme SIMONA

Conclusions

Following the Upper Tisa sampling action, some conclusions were drawn:

- For suspended and floodplain sediments all the proposed sampling methods were easily implemented in all of the 10 sampling sites.
- For stream bottom sediment sampling, the lowland sites proved suitable for all the proposed sampling methods. The hilly and mountainous sites presented difficult conditions in using the vacuum core system and the Romanian grab and grab-scoop system, yet they were covered by the scoop method.
- All of the methods described in the SIMONA's project sampling protocol could be used by the national ASP, especially in the lowland river sectors.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

SIMONA Final Conference Meeting
November 10th 2021


Thank you!
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona
SIMONA Final Conference Meeting
November 10th 2021

3.3. CASE STUDY 3 - SOUTH DANUBE TEST AREA

The South Danube case study was presented by Irena Peytcheva from the Geological Institute of the Academy of Sciences in Bulgaria.

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

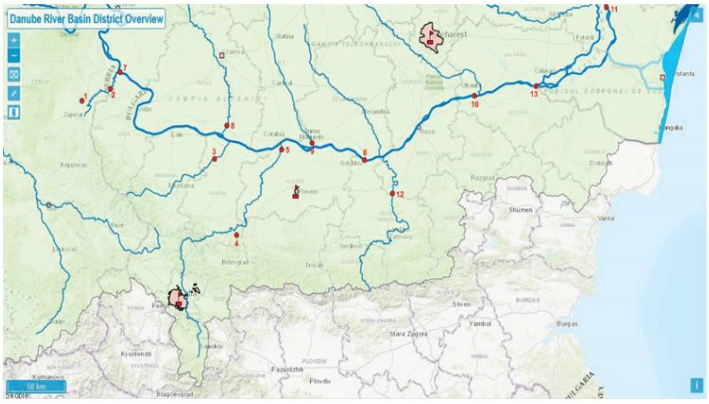
The South Danube test area comprises part of the Lower Danube River, including a number of large and small tributaries.

The area is characterized by present and past mining activities and industrial and agricultural activities, which could contribute to the overall sediment pollution.

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop



Sampling sites in the South Danube test area were selected based on the following major criteria:

- Trans-national character;
- Covering rivers of different size (small, medium, and large), including the Danube River;
- Existing sediment/water monitoring sites;
- Different geology;
- Diverse pollution sources;
- Good infrastructure.

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

Nr.	Name of the river	Name of the site	WGS Long	WGS Lat	Suspended sediment	Bottom sediment	Floodplain sediment	Responsible for sampling	Comment
1.	Borska Reka	Rgotina	44º01'49,78"	22º12'39,18"	no	yes	yes	UB/ GI-BAS	Site moved upstreem
2.	Timok	Timok at Bregovo	44º06'14,3"	22º34'13,5"	no	yes	yes	UB/ GI-BAS	Site moved upstreem
3.	Ogosta	Ogosta before Danube at Mizia	43.691609	23.826234	no	yes	yes	GI-BAS	Site moved slightly upstreem
4.	Malak Iskar	Malak Iskar near Roman	43.135981	23.926079	no	yes	yes	GI-BAS	New coordinates
5.	Iskar	Iskar before Danube at Baykal	43.703047	24.456328	no	yes	yes	GI-BAS	Site moved downstreem
6.	Danube	Danube at Svishtov - Zimnicea	43.620321	25.360049	In contracting stage-Ro	In contracting stage-Ro	yes	GI-BAS/ IGR	New coordinates
7.	Danube	Danube at Pristol	44.2132	22.682069	In contracting stage	In contracting stage	yes	IGR/ GI-BAS	
8.	Jiu	Zaval, downstream of bridge	43.841761	23.844953	In contracting stage	In contracting stage	yes	IGR	
9.	Olt	Islaz, upstream Danube confluence	43.717558	24.792675	In contracting stage	In contracting stage	yes	IGR	
10.	Danube	Oltenita (upstream confluence Argeș)	44.054251	26.605097	In contracting stage	In contracting stage	yes	IGR/ GI-BAS	
11.	Danube	Hârșova	44.68058	27.95259	In contracting stage	In contracting stage	yes	IGR	Additional station

Serbian, Romanian, and Bulgarian Project Partners (PPs) from the South Danube Catchment area countries agreed upon the following sites:

- 1 sampling point at the Borska Reka tributary (SRB);
- 1 sampling point at the Timok River in its transboundary part (BG/SRB);
- 1 sampling point at the Ogosta River (BG);
- 2 points in the Iskar River basin (BG) – one above the confluence with the Danube and one at its tributary Malak Iskar River;
- 1 sampling point at the lower Jiu River (RO);
- 1 sampling point at the Lower Olt River (RO);
- 3 transnational sampling points/transects (RO/BG) at the Danube River: near Pristol (Romania), near Svishtov (Bulgaria) and near Oltenita (Romania).

Project co-funded by the European Union

http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

Detailed preliminary survey of the sampling sites is required (according to the accepted ISO standards and WFD Guidance Documents) following the minimum criteria:

a. Logistic issues;

b. Accessibility of the sampling location under different environmental conditions;

c. Characteristics of the river/stream section to be sampled;

d. Possible local influences on the sampling site;

e. Security of sampling staff;

f. Need for special equipment to access the sampling site;

g. Heterogeneity of the sediment at the sampling site;

h. Bottom sediment, floodplain sediments and suspended sediment issues.

The right bank of Iskar R., view from the bridge near Orehovitsa village

- local contamination with waste from quartz-kaolinite mine

New sampling site of Iskar R. at Baykal village

Project co-funded by the European Union

http://www.interreg-danube.eu/approved-projects/simona

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

Detailed preliminary survey of the sampling sites

- The pre-sampling survey of the Bulgarian part at Ogosta River Oryhovo site revealed potential danger to the sampling staff, bad environment for floodplain sampling and possible contamination from the next motel, so the site was moved upstream to the Miziya town.
- The pre-sampling survey of the Serbian part of the SDTA found out that the Borska Reka site at Rgotina is contaminated and compromised, so the site was moved upstream. The Timok at Bregovo sampling site is on the border between Serbia and Bulgaria, which complicates the sampling procedure and the site was moved upstream.

The right bank of Ogosta R. at Oryahovo with the rusty ladder

The new sampling site of Ogosta R. at Miziya

Contaminated site at Rgotina, Borska R.

New sampling site of Borska R.

Project co-funded by the European Union

http://www.interreg-danube.eu/approved-projects/simona

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

SEDIMENT SAMPLING

After the virtual Sampling Harmonization training event (Harkany, July, 2020) and practical training event in Serbia during the sampling campaign at the Serbian SDTA sites (09.2020).

Equipment

The important rules of the protocol were followed strictly:
Use of gloves! All hand jewellery removed!
Smoking is not permitted! All tools and containers cleaned of contaminants!

Simplified: only metal tools (Fe, no brass)

Setting up the workspace

Project co-funded by the European Union

http://www.interreg-danube.eu/approved-projects/simona


Interreg
Danube Transnational Programme
SIMONA
SIMONA Scientific Conference and Stakeholder Workshop
SEDIMENT SAMPLING
Bottom/stream sediments
Depth: 5 (to 10) cm
Scoop and corer sampler
Simplified: only metal tools
Composite samples (5 sub-samples)
Homogenization on site
Collection of bottom sediment with corer sampler at Malak Iskar site
Collection of bottom sediment with corer sampler at Timok site
Collection of bottom sediment with scoop at Borska R. site
Taking separate samples from undisturbed bottom sediment core sample
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona


Interreg
Danube Transnational Programme
SIMONA
SIMONA Scientific Conference and Stakeholder Workshop
SEDIMENT SAMPLING
Floodplain sediments
Depth: 20 cm – active layer
Auger sampler (metal)
Simplified: only metal tools
Composite samples (5 sub-samples)
Homogenization on site
Collection of floodplain sediment with Auger sampler at Iskar R. site
Transfer of composite floodplain sample for heavy/hazardous metals in the brown glass jar
Floodplain sediment collection with Auger sampler at Timok site
Collection of floodplain sediment with Auger sampler at Svishtov site
Sieving the composite sample of floodplain sediments to <2 mm
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

SEDIMENT SAMPLING

Floodplain sediments

(4 Romanian sites)

Depth: 50 cm – top soil (5 cm) and bottom soil (40-50 cm)

Shovel (metal)

Composite samples

ANAR's sediment monitoring station at Zimnicea (left); Profile on Cheson beach at Zimnicea for floodplain sediment sampling (right)

One of the 5 holes dug for bottom soil sediments, showing an alternation of sand and clay layers at Zaval on Jiu River

Topsoil of the floodplain sediments at Pristol (sampling depth: 0-5 cm)(left); Hole dug for bottom soil sampling at 40-50 cm depth (right)

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

SEDIMENT SAMPLING

SUSPENDED SEDIMENTS

It was only-possible in high turbidity rivers (measured with Secci disk).
20 l plastic can; the sediment settled for 2 days, the water was decanted and the rest of 2 litres + SS sent to Balint Analiticals

In-situ measurements

temperature, electrical conductivity, pH, transparency (according to the standard ISO 7027:2001)
Field observation sheets - printed or using the SIMONA IT tool (tablet)

Collection of suspended sediment with plastic can at Svishtov site

Measurement of turbidity with Secci disk at Silistra site

Taking in situ measurements in the floodplain sediments at Borska reka

Taking in situ measurements in the Iskar River

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

SEDIMENT SAMPLING

Coding, storage and transport

Uniform codes
Storage and transport in cooling boxes – following ISO standards and the SIMONA protocol

RO-SDTA

Test Area ID	sample site	Sample type	Sample number	Sample depth	Duplicate
SDTA	MI (Malak Iskar)	BS	1	0-10 cm	D
	IS (Iskar)		2	10-25 cm	
	OG (Ogosta)	FS	1		
	SV (Svishtov)				
	BR (Borska Reka)	SS	1		
	TI (Timok)				

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg
Danube Transnational Programme
SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

SEDIMENT SAMPLING Coding, storage and transport Uniform codes, comments

Sample ID	Sampling method	Sampling date	Sample type	Package	NOTES	NOTES	NOTES	Depth
SDTA-MIBS-01	vakuum corer	15.09.2020	bottom sediment	1 white jar	composite of 5 samples	for organic components		0-5/10 cm
SDTA-MIBS-01	vakuum corer	15.09.2020	bottom sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-MIBS-01	vakuum corer	15.09.2020	bottom sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-MIFS-01	auger sampler	15.09.2020	floodplain sediment	1 white jar	composite of 5 samples	for organic components	dry sieved to -2 mm	0-20 cm
SDTA-MIFS-01	auger sampler	15.09.2020	floodplain sediment	1 brown jar	composite of 5 samples	for metals	dry sieved to -2 mm	
SDTA-MIFS-01	auger sampler	15.09.2020	floodplain sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-ISBS-01	scoop	16.09.2020	bottom sediment	1 white jar	composite of 5 samples	for organic components		0-5/10 cm
SDTA-ISBS-01	scoop	16.09.2020	bottom sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-ISBS-01	scoop	16.09.2020	bottom sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-ISFS-01	auger sampler	16.09.2020	floodplain sediment	1 white jar	composite of 5 samples	for organic components		0-20 cm
SDTA-ISFS-01	auger sampler	16.09.2020	floodplain sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-ISFS-01	auger sampler	16.09.2020	floodplain sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-OGBS-01	scoop	17.09.2020	bottom sediment	1 white jar	composite of 5 samples	for organic components	wet sieved to -2 mm	0-5/10 cm
SDTA-OGBS-01	scoop	17.09.2020	bottom sediment	1 brown jar	composite of 5 samples	for metals	wet sieved to -2 mm	
SDTA-OGBS-01	scoop	17.09.2020	bottom sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-OGFS-01	auger sampler	17.09.2020	floodplain sediment	1 white jar	composite of 5 samples	for organic components		0-20 cm
SDTA-OGFS-01	auger sampler	17.09.2020	floodplain sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-OGFS-01	auger sampler	17.09.2020	floodplain sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-SVBS-01	scoop	06.10.2020	bottom sediment	1 white jar	composite of 5 samples	for organic components		0-5/10 cm
SDTA-SVBS-01	scoop	06.10.2020	bottom sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-SVBS-01	scoop	06.10.2020	bottom sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-SVFS-01	auger sampler	06.10.2020	floodplain sediment	1 white jar	composite of 5 samples	for organic components		0-20 cm
SDTA-SVFS-01	auger sampler	06.10.2020	floodplain sediment	1 brown jar	composite of 5 samples	for metals		
SDTA-SVFS-01	auger sampler	06.10.2020	floodplain sediment	1 plastic bag	composite of 5 samples	for granulometry		
SDTA-SVSS-01	barrel	06.10.2020	suspending sediment	2 bottles	decanted water from 20 l			

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

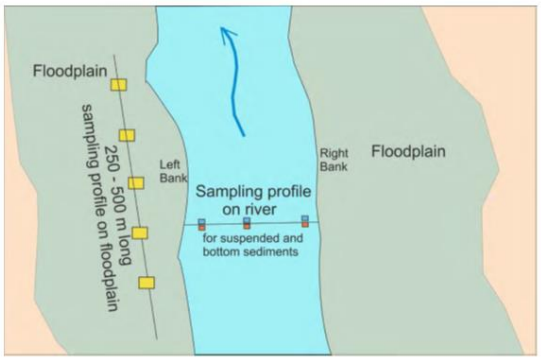
Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

MAIN CONCLUSIONS AND EXPERIENCE GAINED

- the sampling exercise has confirmed the ISO recommendation, which is also reiterated by the WFD Guidance Documents, that prior to any sediment monitoring a detailed **preliminary monitoring site investigation** is required

- **Bottom sediment sampling issues**
  - possible to use different sampling methods and equipment to achieve similar results as prescribed by the SIMONA protocol (scoop for small rivers; corer sampler for large rivers)
  - Separate collection of samples for analyses of organic and inorganic substances: might be not crucial – only metal (not brass) tools for the BN sampling



General scheme of sampling sediments in big rivers (e.g. Danube). Sampling from boat: to be performed at Pristol, Svishtov and Silistra TN sites during the BN campaign

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

MAIN CONCLUSIONS AND EXPERIENCE GAINED

- **Floodplain sediment sampling issues**
  - In the SEDIMENT QUALITY SAMPLING PROTOCOL FOR HSS there are only RECOMMENDATIONS for the MONITORING of ACTIVE FLOODPLAIN sediments. "The floodplain sediments suitable for monitoring are deposits of suspended material onto active, regularly flooded floodplains and levees along rivers." The prescribed sampling depth for floodplain sediments in the FOREGS Atlas 0 – 25 cm was used for all points of SDTA.
  - "the separate sampling of individual flood events (e.g. the pre-industrial level (once) and the latest flood event (occasionally) is preferable and the results are more meaningful" ⇒ **BN sampling**

It has been demonstrated that it is possible to collect floodplain sediment samples using different kind of equipment.

The options that can be considered include:

i. Manual soil corers of different types

ii. Scoop and shovel/spade

Uniform BN sampling:
top (0-5) and bottom (40-50 cm)

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

Interreg Danube Transnational Programme SIMONA

SIMONA Scientific Conference and Stakeholder Workshop

MAIN CONCLUSIONS AND EXPERIENCE GAINED

- **Suspended sediment sampling issues**
  - Specialized equipment is needed for collection of adequate volume of the samples in the field; sampling with a plastic can is possible but may face transport problems in a case of rivers with low turbidity;
  - Suspended sediments in rivers and streams can be extremely varying both in quantity and quality, and often governed by weather events;
  - To collect the sufficient amount of suspended sediments (100-300 g) for the sediment quality analysis, a large volume of water - 200 l (?) might be needed.
  - The quantity of water should be measured (?) to involve a normalization coefficient during laboratory analyses for HSs concentrations;
  - The suspended sediment sampling faces additional scientific problems such as what is the meaning of the gained information, because it would be [illegible]noment situation at the site and [illegible]questions for the sediment source;
  - Which information cannot be obtained by other means and sampling techniques (BS, passive samplers, etc)?
  - ***Need for developing of harmonized techniques for suspended sediment sampling.***

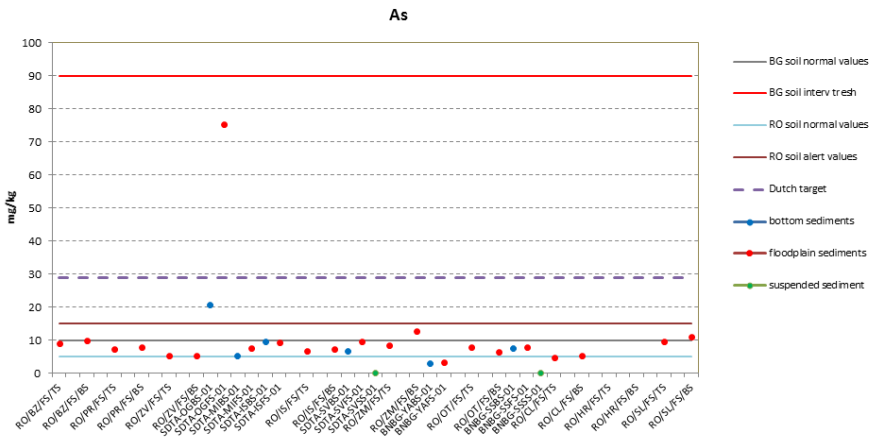
Uniform SS sampling using passive samplers:
3 test stations in the 3 test areas – WP8

Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona

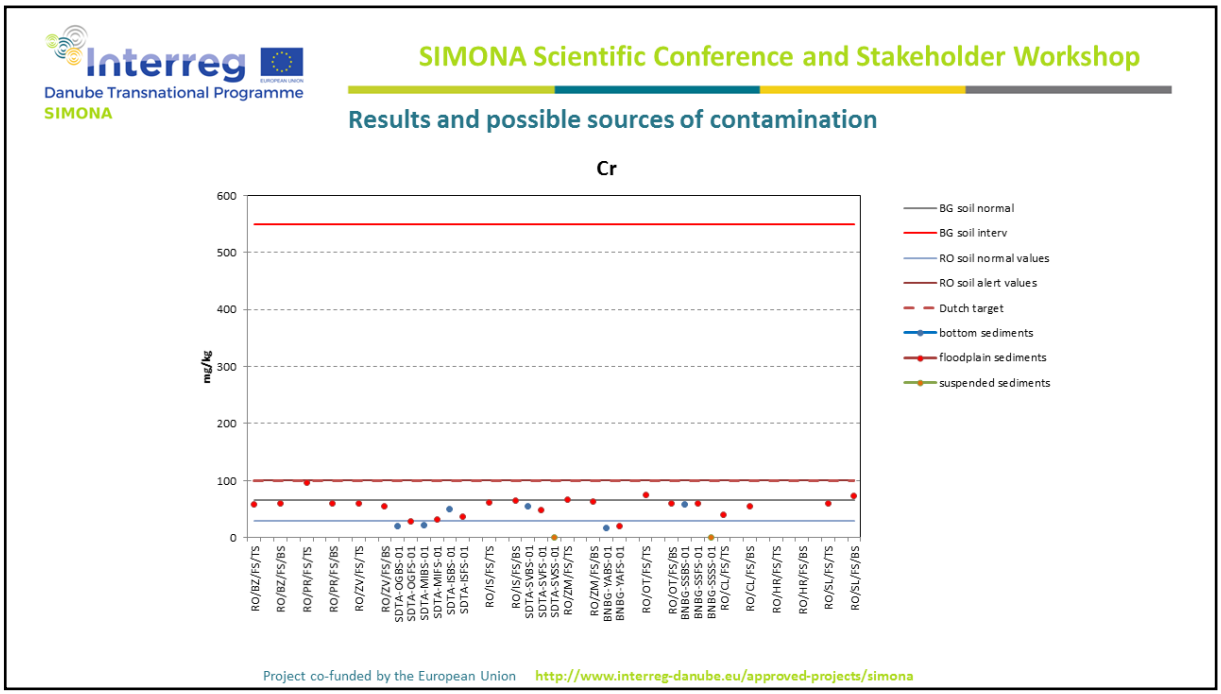
Interreg Danube Transnational Programme SIMONA

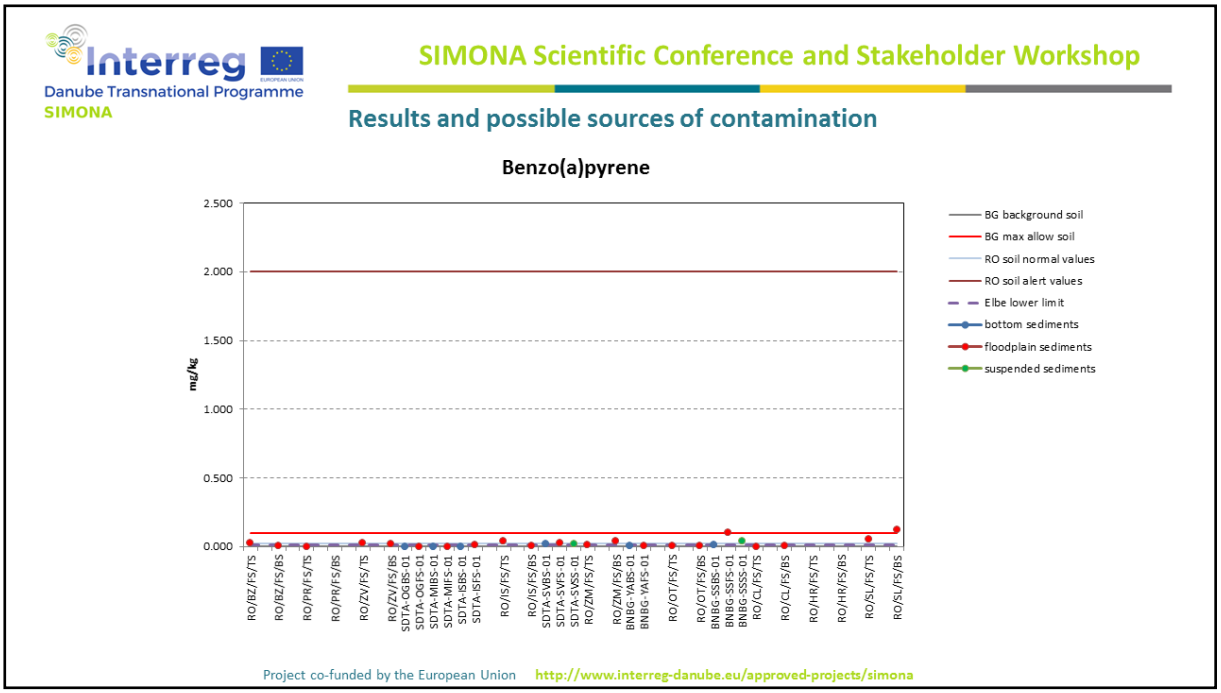
SIMONA Scientific Conference and Stakeholder Workshop

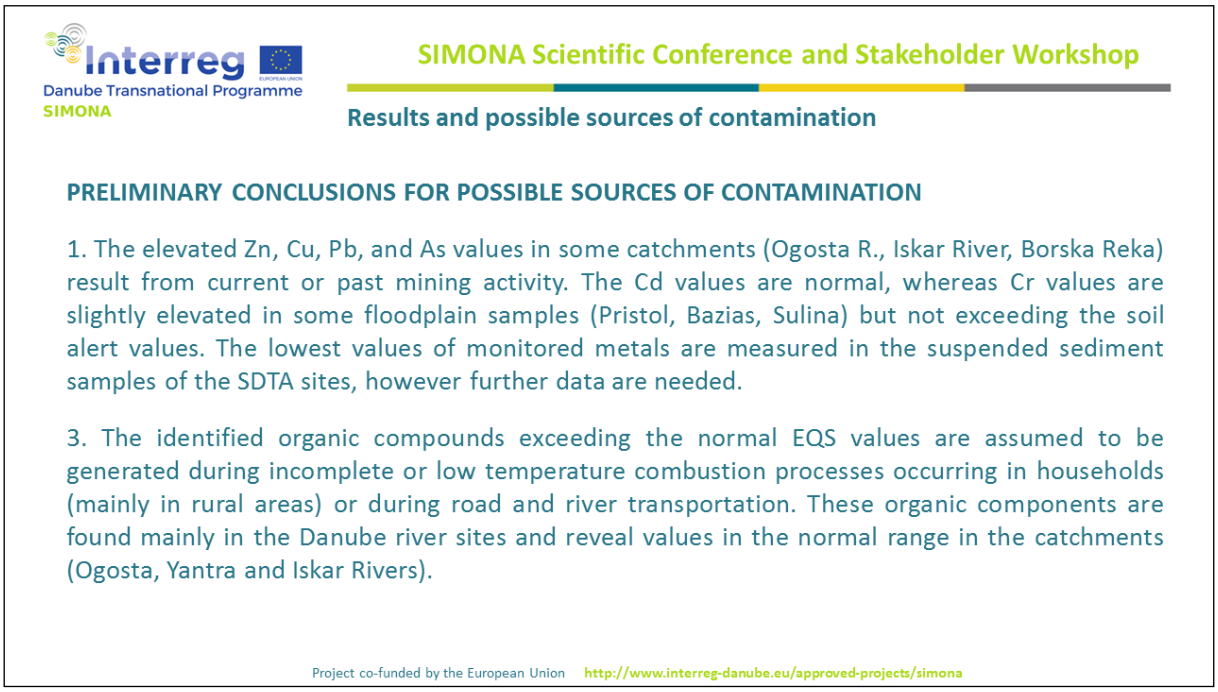
Results and possible sources of contamination



Project co-funded by the European Union http://www.interreg-danube.eu/approved-projects/simona


Interreg
Danube Transnational Programme
SIMONA
SIMONA Scientific Conference and Stakeholder Workshop
Results and possible sources of contamination
Cr
mg/kg
600
500
400
300
200
100
0
BG soil normal
BG soil interv
RO soil normal values
RO soil alert values
Dutch target
bottom sediments
floodplain sediments
suspended sediments
RO/BZ/FS/TS
RO/BZ/FS/BS
RO/PR/FS/TS
RO/PR/FS/BS
RO/ZV/FS/TS
RO/ZV/FS/BS
SDTA-OGBS-01
SDTA-OGFS-01
SDTA-MIBS-01
SDTA-MIFS-01
SDTA-ISBS-01
SDTA-ISFS-01
RO/IS/FS/TS
RO/IS/FS/BS
SDTA-SVBS-01
SDTA-SVFS-01
RO/ZM/FS/TS
RO/ZM/FS/BS
BNBG-YABS-01
BNBG-YAFS-01
RO/OT/FS/TS
RO/OT/FS/BS
BNBG-SSBS-01
BNBG-SSFS-01
BNBG-SSSS-01
RO/CL/FS/TS
RO/CL/FS/BS
RO/HR/FS/TS
RO/HR/FS/BS
RO/SL/FS/TS
RO/SL/FS/BS
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona


Interreg
Danube Transnational Programme
SIMONA
SIMONA Scientific Conference and Stakeholder Workshop
Results and possible sources of contamination
Benzo(a)pyrene
mg/kg
2.500
2.000
1.500
1.000
0.500
0.000
BG background soil
BG max allow soil
RO soil normal values
RO soil alert values
Elbe lower limit
bottom sediments
floodplain sediments
suspended sediments
RO/BZ/FS/TS
RO/BZ/FS/BS
RO/PR/FS/TS
RO/PR/FS/BS
RO/ZV/FS/TS
RO/ZV/FS/BS
SDTA-OGBS-01
SDTA-OGFS-01
SDTA-MIBS-01
SDTA-MIFS-01
SDTA-ISBS-01
SDTA-ISFS-01
RO/IS/FS/TS
RO/IS/FS/BS
SDTA-SVBS-01
SDTA-SVFS-01
RO/ZM/FS/TS
RO/ZM/FS/BS
BNBG-YABS-01
BNBG-YAFS-01
RO/OT/FS/TS
RO/OT/FS/BS
BNBG-SSBS-01
BNBG-SSFS-01
BNBG-SSSS-01
RO/CL/FS/TS
RO/CL/FS/BS
RO/HR/FS/TS
RO/HR/FS/BS
RO/SL/FS/TS
RO/SL/FS/BS
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona


Interreg
Danube Transnational Programme
SIMONA
SIMONA Scientific Conference and Stakeholder Workshop
Results and possible sources of contamination
PRELIMINARY CONCLUSIONS FOR POSSIBLE SOURCES OF CONTAMINATION
1. The elevated Zn, Cu, Pb, and As values in some catchments (Ogosta R., Iskar River, Borska Reka) result from current or past mining activity. The Cd values are normal, whereas Cr values are slightly elevated in some floodplain samples (Pristol, Bazias, Sulina) but not exceeding the soil alert values. The lowest values of monitored metals are measured in the suspended sediment samples of the SDTA sites, however further data are needed.
3. The identified organic compounds exceeding the normal EQS values are assumed to be generated during incomplete or low temperature combustion processes occurring in households (mainly in rural areas) or during road and river transportation. These organic components are found mainly in the Danube river sites and reveal values in the normal range in the catchments (Ogosta, Yantra and Iskar Rivers).
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

3.4. CASE STUDY 4 - DANUBE REGION BASIN (DRB) BASELINE NETWORK

The case study of the Danube Region Basin baseline monitoring stations for hazardous substances in sediments was presented by Anca Vîjdea from the Geological Institute of Romania.

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

The Output O.3.4. DRB baseline network for HSs in sediments is part of Activity 3.4 Evaluation of field data & implementing case studies

Objective: to demonstrate the state-of-the-art good practice for transnational water management by verifying the added value of sediment quality monitoring.

The developed Evaluation Protocol and Excel Tool will provide verification at local scale (the 3 Test Areas), and at regional scale (for the DRB baseline network)

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

SHORT SUMMARY OF WORK DONE TO ACHIEVE THIS OUTPUT

STEP 1. Planning of 2 national sampling stations in each SIMONA country, which fulfill a set o criteria:

- Transnational character
- Covering river of different size (small, medium, and large), including the Danube River
- Existing sediment/water monitoring sites
- Different geology
- Diverse pollution sources
- Good infrastructure

After on-site inspections, some of the initially planned monitoring stations were slightly changed.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

Baseline Stations in SIMONA project countries

Country	Station 1 – Locality, river	Station 2 – Locality, river
Austria	Hainburg on Danube	Lavamünd on River Drau (Drava)
Bosnia and Herzegovina	Karanovak on River Spreča	Rudanka on River Bosna
Bulgaria	Silistra on Danube	Karantsi on River Yantra
Croatia	Kumrovec on River Sutla	Aljmaš on River Drava
Czech Republic	Lanžhot on Morava River	Troubky on Bečva River
Hungary	Babócsai-Rinya	Berettyó
Moldavia (Republic of)	Slobozia Mare on Beleu lake	Costești (Stânca) on River Prut
Montenegro	Gradac on River Ćehotina	Bijelo Polje on River Lim
Romania	Baziaș on Danube	Sulina on Danube
Serbia	Novi Sad on Danube	Ram on Danube
Slovakia	Chalmová on River Nitra	Jaklovce (Ružín reservoir tributary) on River Hnilec
Slovenia	Jevnica on River Sava	Medno on River Sava

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

SHORT SUMMARY OF WORK DONE TO ACHIEVE THIS OUTPUT

STEP 2. Sampling sediments:

- Suspended (SS)
- Stream/bottom sediments (BS)
- Active floodplain sediments FS at two depths:
  - Top layer "top soil" TS (0 - 5 cm depth)
  - Bottom layer "bottom soil" (40 - 50 cm depth)

A set of manuals for sampling and storing sediments were developed by SIMONA Scientific team for accomplishing an harmonized sampling in all the countries for the DRB baseline network task.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

DRB Baseline Case Study

SUSPENDED SEDIMENTS

A 30 L barrel of water and suspended sediment was used in almost all SIMONA countries and left for deposition for 24 hours, after which a quantity of 2-3 L water/sediment was obtained and sent to the laboratory for analyses.

A portable centrifuge was used in Czech Republic (beside the barrel) and the material (cca. 75 - 100 g) was sent to analysis.

A sediment box was used in Austria (beside the barrel), in Bulgaria and at the Upper Tisa Teast Area in NW Romania.

For Danube and its large tributaries Jiu and Olt, 90 L barrels were used in Romania and left for sedimentation. After settling, 8 – 10 L of water with sediments were sent to the national laboratory, for centrifuging, obtaining finally 5 – 18 g of dry sediment. This sediment quantity was enough only for analyzing heavy metals in the national laboratory. Not enough material for PAHs and pesticides.

Conclusion: for Danube and large rivers a portable centrifuge is needed for sampling suspended sediments.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

DRB Baseline Case Study

VESSELS USED FOR SAMPLING SUSPENDED SEDIMENTS IN THE DANUBE

Ship (property of INHGA) used for sampling DRB baseline stations in Romania

Boat (property of JCWI) used for sampling DRB baseline stations in Serbia

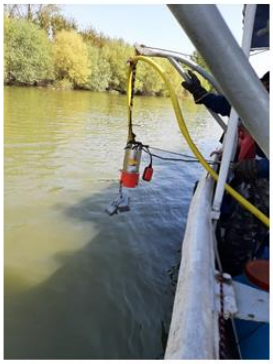
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

SUSPENDED SEDIMENTS BY PUMPING IN BARRELS AT DIFFERENT DEPHTS IN THE DANUBE



Submersible pump ready for launching

Pumping water into a 60 L barrel

Infilled barrels with pumped water (green barrels 30 L, white barrels 60 L) on the Romanian vessel deck

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

SUSPENDED SEDIMENTS BY CENTRIFUGE

Car-mounted centrifuge used in Czech Republic

83g by centrifuge - "filtrated" 4.9m^3

SAMPLE INFORMATION:	
Sampling volume estimated, wet weight [litter]: 83g by centrifuge - "filtrated" 4.9 m³	
Temperature of sample (field observation, right after sampling) [°C]: 14.3	
Sediment pH (undisturbed):	Sediment pH (post-homogenization):
Colour (Munsell soil colour chart number):	
Texture (particle size description): brown-green coloured, muddy.	
Odour: ☐ none; ☒ light; ☐ strong; ☒ earthy; ☐ mildewed; ☐ putrid; ☐ farm slurry; ☐ fishy; ☐ aromatic; ☐ sewage; ☐ fuel/oil	
Information on sediment components (seashells, animals, peat, wood, tar, stones, waste, plastics, etc.):.	
Sample photograph identification:	
Additional comments (e.g. map of the sampling site):	

Amount of suspended sediment obtained after centrifuging ccc. 5 m³ of river water "Czech Republic Field Observation Sheet"

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

DRB Baseline Case Study

SUSPENDED SOLIDS SEPARATION BY CONTINUOUS-FLOW TUBULAR OR DISK BOWL CENTRIFUGE

Tubular centrifuge

Disk Bowl centrifuge

DRB Baseline Case Study

STREAM/BOTTOM SEDIMENTS

Generally the scoop and/or vacuum corer was used in SIMONA countries for small rivers. For Danube river the scoop can be used only for sampling very near the river bank, without the use of boat or ship.

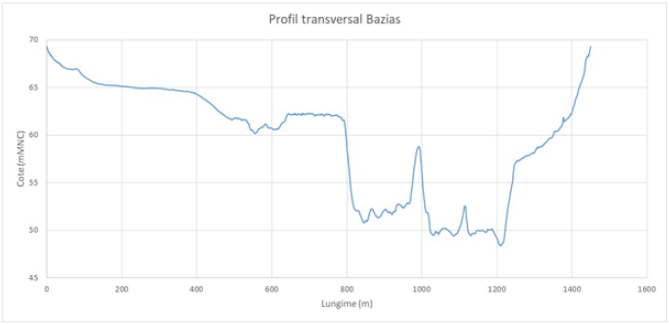
Transverse sections with 3 verticals (left (L) 50 m from the left bank, center (C) in the middle of the river and right (R) 50 m from the right bank) were sampled using Van Veen grab in Romania from a ship. Sometimes, depending on the river profile and sediment distribution, several attempts had to be made in order to be able to fill 3 jars (750 mL volume) with sediment.

Problem: the grab can be filled with stones, shells, animals, and sometimes only limited amount of sediment. The launch has to be repeated. Sometimes also the ship should move from the settled position if the bottom is rocky.

DRB Baseline Case Study

STREAM/BOTTOM SEDIMENTS

Transverse profile of the Danube bottom at Bazias, in Romania, made with ADCP (Acoustic Doppler Current Profiler), from a small boat which crossed the river. The very irregular relief of the profile of the river explains the uneven distribution and grain size of the bottom sediments.



Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

DRB Baseline Case Study

STREAM/BOTTOM SEDIMENTS

On Danube, another encountered problem was the fact that the collected bottom sediment was sandy, so, except Baziaș sampling station, where the waterbody was considered "*lake*", therefore having finer bottom sediments, all the other Romanian stations on Danube River had the regime of "*river*" and the national laboratory said there was not enough material for analyzing the fraction < 0.063 mm.

This happened for the second Romanian station at Sulina, the Bulgarian station at Silistra – Chiciu (Călărași), as well as for other Romanian stations from the Lower Danube Test Area, inclusively on Jiu and Olt rivers.

In the stations where there were collected duplicates and replicates, the laboratory was provided with this extra material in order to analyze both fractions: < 2mm and < 0.063 mm.

Conclusion: when expedition is expensive (as contracting a ship or boat for over 1000 km distance travel), collect always more than 3 jars of bottom sediment (of 750 ml volume).

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

ACTIVE FLOODPLAIN SEDIMENTS

Almost all SIMONA countries used the spade/shovel for collecting active floodplain sediments at the 2 mentioned depths (0 – 5 cm TS and 40 – 50 cm BS).

Sometimes the auger was used.

No problems encountered with the amount of active floodplain sediments (composite sample made of 3 – 5 subsamples delivered to the laboratory).

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

SHORT SUMMARY OF WORK DONE TO ACHIEVE THIS OUTPUT

STEP 3. Laboratory analyses in SIMONA Reference Laboratory and national laboratory
Deliverable D.3.3.4. – data tables input for the Excel Tool developed in WP5 which serves for implementing the Evaluation Protocol

STEP 4. Evaluation and interpretation of results
Output 3.4. – each country together with the project Evaluation Work Group will assess the laboratory results and explain the possible causes of values surpassing the Quality Standard limits QS

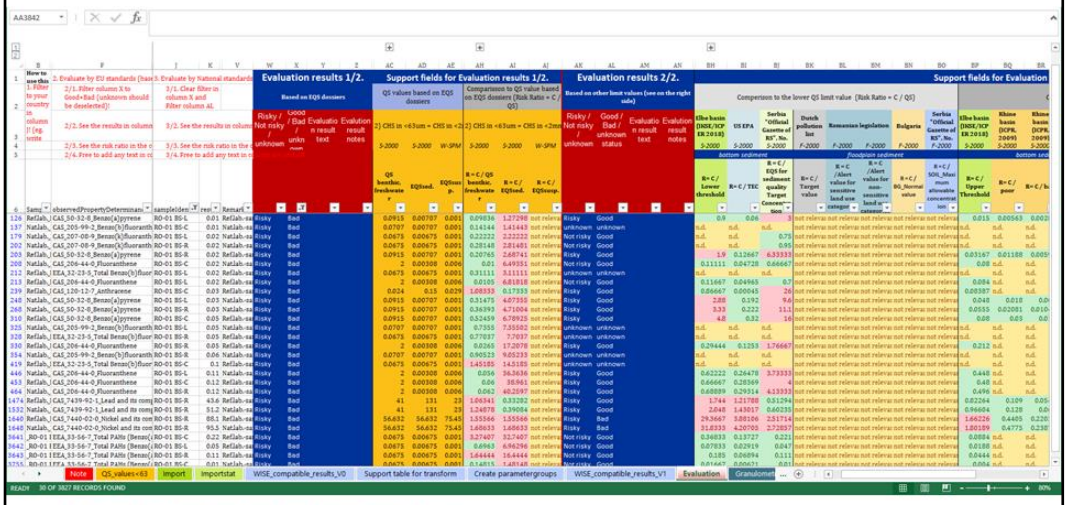
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

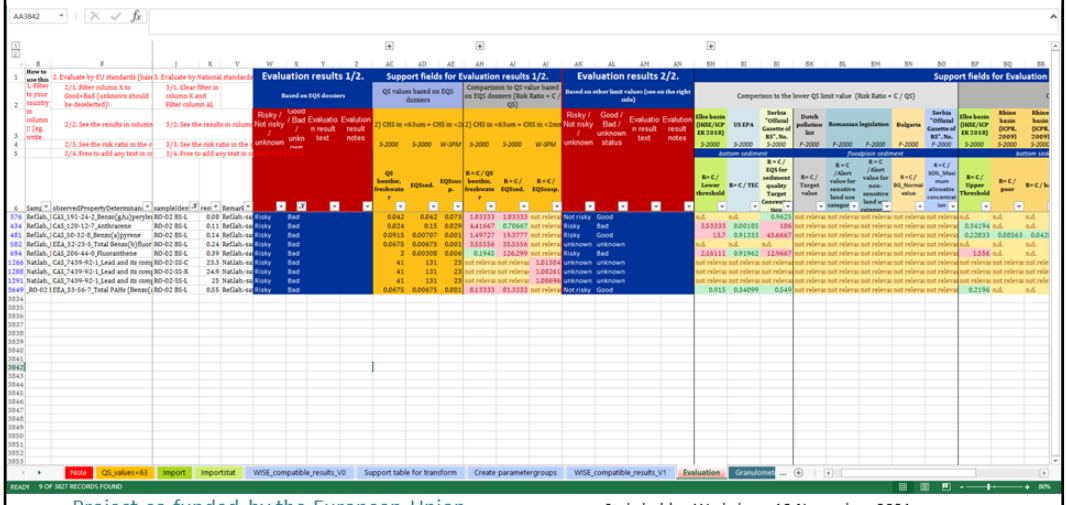
Excerpta from the General Table for evaluation of the Danube waterbody status – example for Bazias station (Romania)



Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

Excerpta from the General Table for evaluation of the Danube waterbody status – example for Sulina station (Romania)



Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

Preliminary interpretation of HSs in sediments of the Romanian baseline stations

Heavy metals:

- In both stations (Baziaș and Sulina), the Pb content in suspended sediments SS (center and right points of the profile) exceeds 1-2 times the EQS value. This pollution could be explained by navigation and air pollution on the Danube (fuel transport and burning)
- The Ni content of the BS of Baziaș is 1.5 times higher than the EQS. In SS Ni is below the EQS. The high content in Ni is explained by the geological background, consisting of basic igneous rocks and tuffs.
- Cu, Cr, Cd, Hg are below the EQS values in the two stations, in BS and SS of the Danube.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021

Interreg Danube Transnational Programme SIMONA

DRB Baseline Case Study

Preliminary interpretation of HSs in sediments of the Romanian baseline stations

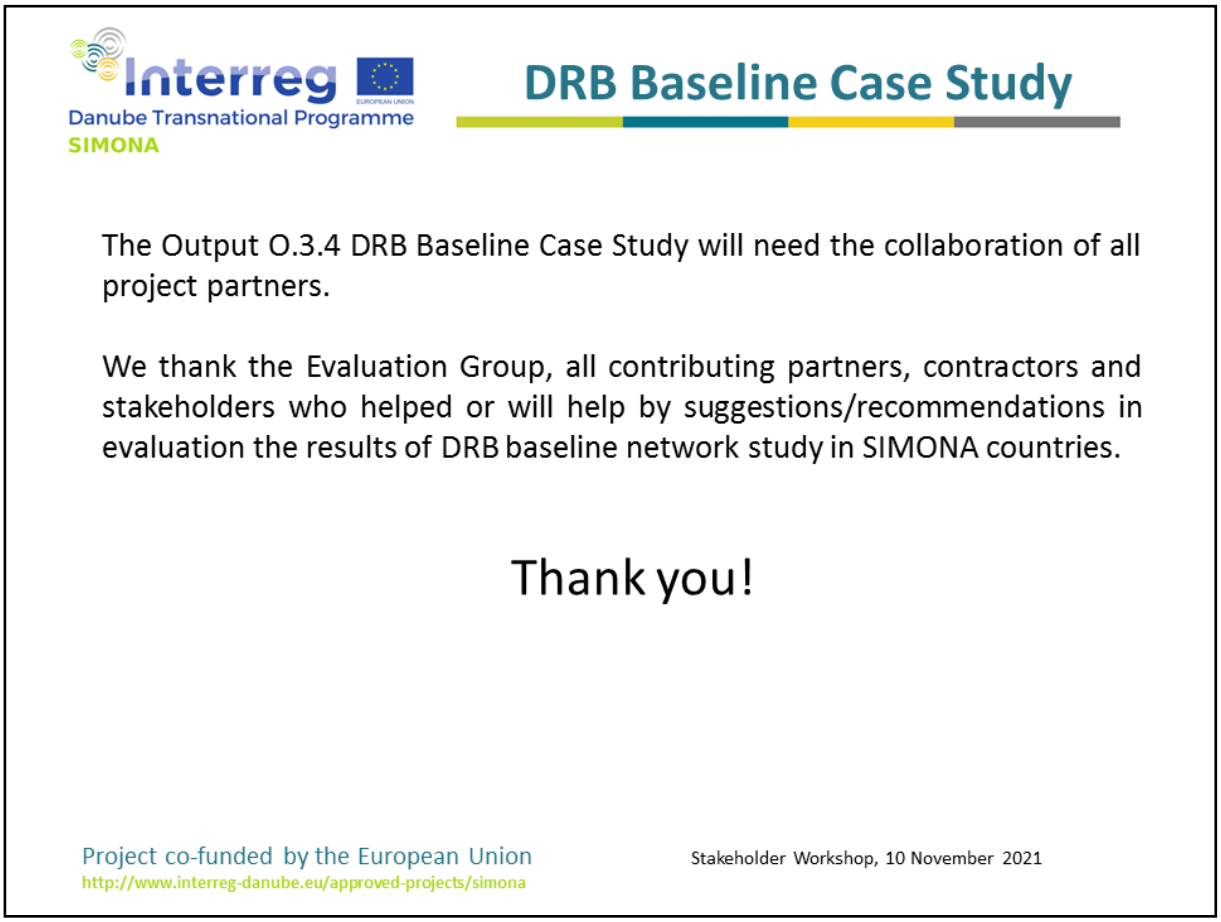
Organic subtances :

- At both stations PAHs (Fluoranthene, Benzo(b)fluoranthene) values in BS vary between 30 – 40 times larger than EQS values. At Sulina Fluoranthene is 126 times higher than EQS. The Anthracene content at Sulina is 4 times higher than EQS.
- The pollution is caused by wastewater discharge, naval traffic and insecticides.

Next step: We shall complement the interpretation for heavy metals and organic substances for the 2 Romanian baseline stations with the national thresholds in the Romanian legislation, as soon as they will be implemented in the Excel Tool.

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Stakeholder Workshop, 10 November 2021


Interreg
Danube Transnational Programme
SIMONA
DRB Baseline Case Study
The Output O.3.4 DRB Baseline Case Study will need the collaboration of all project partners.
We thank the Evaluation Group, all contributing partners, contractors and stakeholders who helped or will help by suggestions/recommendations in evaluation the results of DRB baseline network study in SIMONA countries.
Thank you!
Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona
Stakeholder Workshop, 10 November 2021

LIST OF PARTICIPANTS

No.	Name		E-mail	Organisation
1.	Adela	Pasca	pasca.an7@gmail.com	UASVM Cluj Napoca
2.	Adrienne	Clement	clement.adrienne@emk.bme.hu	BME
3.	Ahmedin	Salčinović	ahmedin.salcinovic@fzap.gov.ba	Agropedological Institute of Federation of BiH
4.	Ajka	Šorša	asorsa@hgi-cgs.hr	Croatian Geological Survey
5.	Ana	Čaić Janković	acaic@hgi-cgs.hr	Croatian Geological Survey (HGI-CGS)
6.	Anca	Vijdea	ingamvir@gmail.com	Geological Institute of Romania
7.	András	Székács	szekacs.andras@uni-mate.hu	MATE-HU
8.	Atanas	Hikov	ahikov@geology.bas.bg	Geological Institute, Bulgarian Academy of Sciences
9.	Balazs	Horvath	horvath.balazs@ovf.hu	EU Strategy for the Danube Region, Priority Area 4 "Water Quality"
10.	Barbara	Simić	Barbara.simic@geo-zs.si	Geological survey of Slovenia
11.	Barbara	Kéri	keri.barbara@emk.bme.hu	BME
12.	Barbara	Träxler	barbara.traexler@geologie.ac.at	Geological Survey of Austria
13.	Bese	Pál	bese.pal@geonardo.com	Geonardo Ltd.
14.	Boglarka	Toth	toth.boglarka@uni-mate.hu	MATE
15.	Boštjan	Križanec	bostjan.krizanec@nlzoh.si	NLZOH
16.	Carmen	Casado	carmen.casado@centreecotox.ch	Swiss Centre for Applied Ecotoxicology
17.	Cornel	Pricop		OSPA Baia Mare
18.	Dan Lucian	Ciurte	ciurtedanlucian@gmail.com	Romanian Waters - ASP
19.	Daniel	Nasui	nasui.daniel@gmail.com	RO-TUCN
20.	Danijel	Ivanišević	divanisevic@hgi-cgs.hr	Hrvatski geološki institut
21.	Dijana	Oskoruš	oskorus@cirus.dhz.hr	Meteorological and Hydrological Service of the Republic Croatia
22.	Đorđa	Medić	dmedic@voda.hr	Hrvatske vode/Croatian Waters
23.	Dragica	Vulic	dragica.vulic@jcerni.rs	Jaroslav Cerni Water Institute
24.	Dumitru	Drumea	ddrumea559@gmail.com	Institute of Ecology and Geography
25.	Dženan	Vukotić	dzenan.vukotic@fzap.gov.ba	Agropedological Institute of Federation BiH
26.	Emina	Hadžić	eminahd@gmail.com	University of Sarajevo
27.	Eszter	Takács	takacs.eszter84@uni-mate.hu	MATE-HU
28.	Franko	Humer	franko.humer@umweltbundesamt.at	Environment Agency Austria
29.	Gheorghe	Iepure	iepureg@cunbm.utcluj.ro	ROTUCN
30.	Gheorghe	Damian	gdamian_geo@yahoo.com	RO_TUCN
31.	Gusztáv	Csomor	gusztav.csomor@interreg-danube.eu	DTP MA/JS
32.	Gyozo	Jordan	gyozojordan@gmail.com	HU-SZIE
33.	Hanna	Kolos	h.kolos@ukrgeol.com	SE UGC
34.	Heinz	Reitner	heinz.reitner@geologie.ac.at	Geological Survey of Austria
35.	Igor	Liska	igor.liska@icpdr.org	ICPDR

36.	Igor	Ljumovic	igor.ljumovic@jcerni.rs	Jaroslav Cerni Water Institute
37.	Igor	Stríček	igor.stricek@geology.sk	SK-SGIDS
38.	Ioan	Beres	ioan.beres@yahoo.com	Mineralogy Museum
39.	Ioan	Denut	ioandenut@yahoo.com	Mineralogy Museum
40.	Irena	Peytcheva	peytcheva@erdw.ethz.ch	BG-GI-BAS
41.	Ismir	Hajdarević	ismirhajdarevic@yahoo.com	Geological survey of Federation of Bosnia and Herzegovina
42.	Jasmina	Antolić	jasmina.antolic@voda.hr	Hrvatske vode
43.	Jos	Brils	jos.brils@deltares.nl	SedNet
44.	Jovana	Rašeta Bastić	jraseta@savacommission.org	ISRBC
45.	Jozef	Kordík	jozef.kordik@geology.sk	SK-SGIDS,
46.	Katalin Mária	Dudás	kata.9.dudas@gmail.com	HU-MATE
47.	Katinka	Virág	virag.katinka@edu.bme.hu	Budapest University of Technology and Economics
48.	Klemen	Teran	klemen.teran@geo-zs.si	Geological Survey od Slovenia
49.	Kristina	Šarić	kristina.saric@rgf.bg.ac.rs	University of Belgrade - Faculty of Mining and Geology
50.	Kristina	Koret	kristina.koret@geo-zs.si	Geological Survey of Slovenia
51.	Libor	Mikl	libor.mikl@chmi.cz	CHMI
52.	Lidia – Lenuta	Balan	lidia_balan@yahoo.com	Geological Institute of Romania
53.	Luca	Ecaterina	ecaterina.luca@ymail.com	National Institute of Hydrology and Water Manaeement
54.	Manfred	Sengl	manfred.sengl@lfu.bayern.de	Bavarian Environment Agency (Bayerisches Landesamt für Umwelt)
55.	Mária	Mörtl	mortl.maria@uni-mate.hu	MATE-HU
56.	Marko	Marjanovic	marko.marjanovic@jcerni.rs	Jaroslav Cerni Water Institute
57.	Máté	Kardos	kardos.mate@emk.bme.hu	Budapest University of Technology and Economics
58.	Matej	Draksler	matej.draksler@geo-zs.si	Geological Survey of Slovenia
59.	Matej	Fabok	matej.fabok@vuvh.sk	Water Research Institute, Slovakia
60.	Meta	Dobnikar	meta.dobnikar@geo-zs.si	Geological Survey of Slovenia
61.	Michal	Jankulár	michal.jankular@geology.sk	SK-SGIDS
62.	Milena	Vetseva	millena_vetseva@abv.bg	GI-BAS
63.	Mojca	Dobnikar Tehovnik	mojca.dobnikar-tehovnik@gov.si	Slovenian Environment Agency
64.	Natalia	Osadcha	nosad@uhmi.org.ua	Ukrainian Hydrometeorological Institute
65.	Neda	Devic	nedad28@gmail.com	GSM
66.	Neven	Bujas	neven.bujas@voda.hr	Hrvatske vode/Croatian Waters
67.	Nikolaus	Weber	nikolaus.weber@tuwien.ac.at	TU Wien
68.	Ottavia	Zoboli	ozoboli@iwag.tuwien.ac.at	TU Wien
69.	Paul	Kinner	paul.kinner@ait.ac.at	AT-AIT
70.	Pavel	Hucko	huckopav@gmail.com	
71.	Péter	Szabó	szbpeet@gmail.com	Eötvös Loránd University
72.	Petyo	Filipov	p_philipov@geology.bas.bg	GI-BAS
73.	Prvoslav	Marjanovic	prvoslav.marjanovic@jcerni.rs	Jaroslav Cerni Water Institute
74.	Razvan Dan	Bogzianu	rabodan@yahoo.com	National Administration Romanian Waters
75.	Renata	Kaps	renata.kaps@tuwien.ac.at	TU WIen
76.	Samo	Grošelj	sgroselj@savacommission.org	International sava River Basin Commission
77.	Sándor	Baranya	baranya.sandor@emk.bme.hu	BME
78.	Snježana	Miletić	snjezana.miletic@geo-zs.si	Geological Survey of Slovenia
79.	Steffen	Kittlaus	skittlaus@iwag.tuwien.ac.at	TU Wien
80.	Stela	Ginin	stankova_stela@yahoo.com	Executive Environment Agency, Bulgaria

81.	Suzana	Erić	suzana.eric@rgf.bg.ac.rs	University of Belgrade - Faculty of Mining and Geology
82.	Szakacs	Zsolt	szakacsz@yahoo.com	Technical University of Cluj Napoca - NUC of Baia Mare
83.	Tatjana	Mitrovic	tatjana.mitrovic@jcerni.rs	Jaroslav Cerni Water Institute
84.	Teja	Čeru	teja.ceru@geo-zs.si	Geological Survey of Slovenia
85.	Toni	Nikolić	toni.nikolic@fzzg.gov.ba	Geological survey of Federation of Bosnia and Herzegovina
86.	Trifu	Cristina	cris.trifu@hidro.ro	National Institute of Hydrology and Water Manaeement
87.	Veronica Elena	Alexe	v_e_alexe@yahoo.com	Geological Institute of Romania
88.	Vesna	Meznaric	vesna.meznaric@bioinstitut.hr	Bioinstitut
89.	Vladica	Cvetković	vladica.cvetkovic@rgf.bg.ac.rs	University of Belgrade - Faculty of Mining and Geology
90.	Volodymyr	Klos	v.klos@ukrgeol.com	SE UGC
91.	Zlatka	Milakovska	zlatkam@geology.bas.bg	Geological Institute at the Bulgarian Academy of Sciences
92.	Zsófia	Kovács	zsofia.kovacs@outlook.com	General Directorate of Water Management (HU)