

APPLYING ENVIRONMENTAL GEOCHEMICAL MONITORING OF FLUVIAL SEDIMENTS USING UNIQUE AUTOMATED AND PASSIVE SAMPLING IN THE DANUBE BASIN

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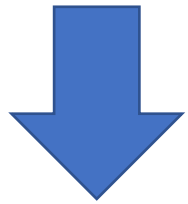
OBJECTIVES

Water Framework Directive (WFD) – Sediment quality monitoring

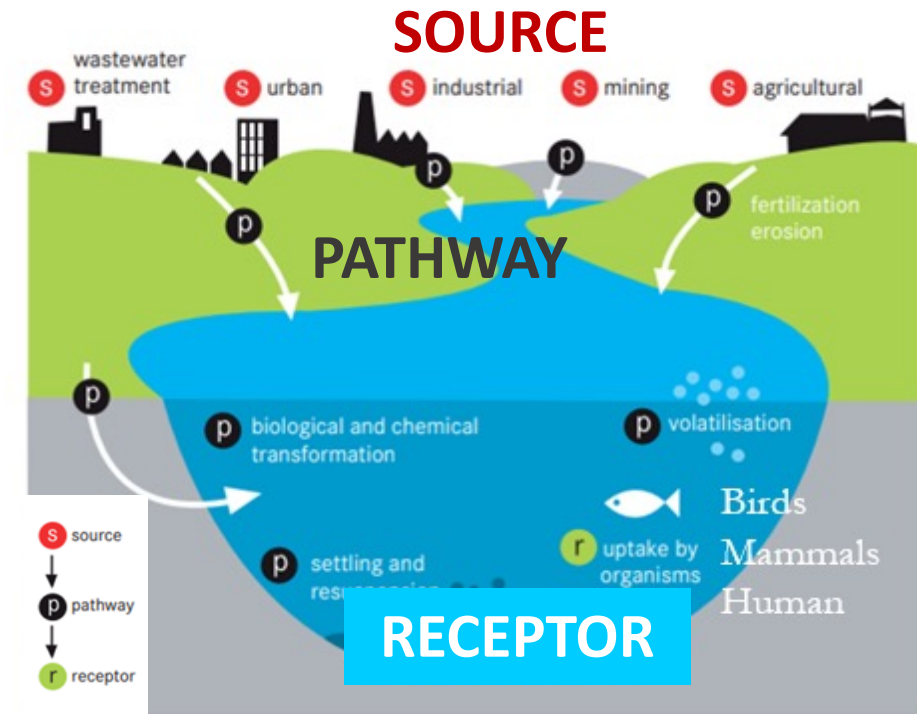
EU WFD requires: monitoring and evaluation of surface water sediment quality.

Why:

- potential sink for pollution
- potential source for pollution
- risk for biotic receptors
- natural geochemical background (toxic elements) must be defined



- SIMONA – Interreg Project
- MONITORING SITE – Drava River
- PASSIVE SAMPLING SYSTEM – Continuous monitoring
- RECOMMENDATIONS



Risk 'sources (S)-pathways (P)-receptors (R)' model [Brils et al., 2014].

SIMONA PROJECT

Sediment-quality Information, Monitoring and Assessment System

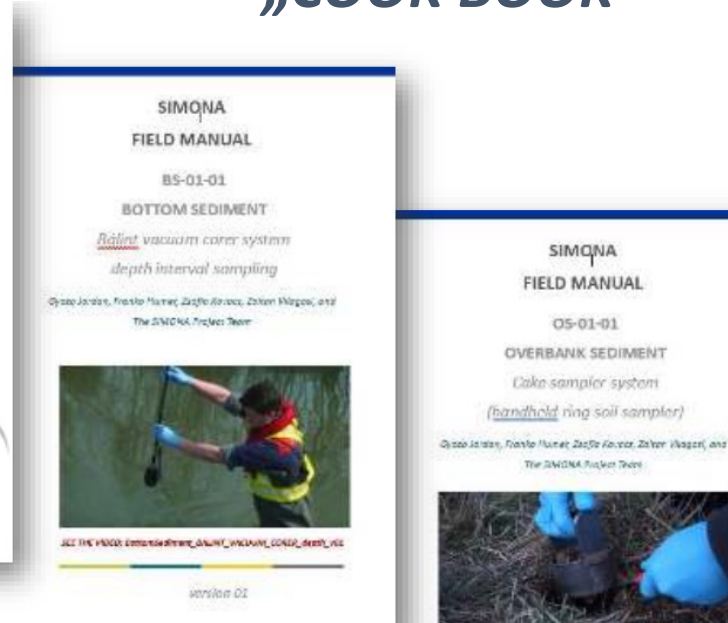
to support transnational cooperation for Danube Basin water management

- ✓ **largest** of its kind in Europe (2018-2022)
- ✓ **ready-to-deploy sediment-quality monitoring system delivered**
- ✓ **harmonized** in the River Basin Countries (13 countries)

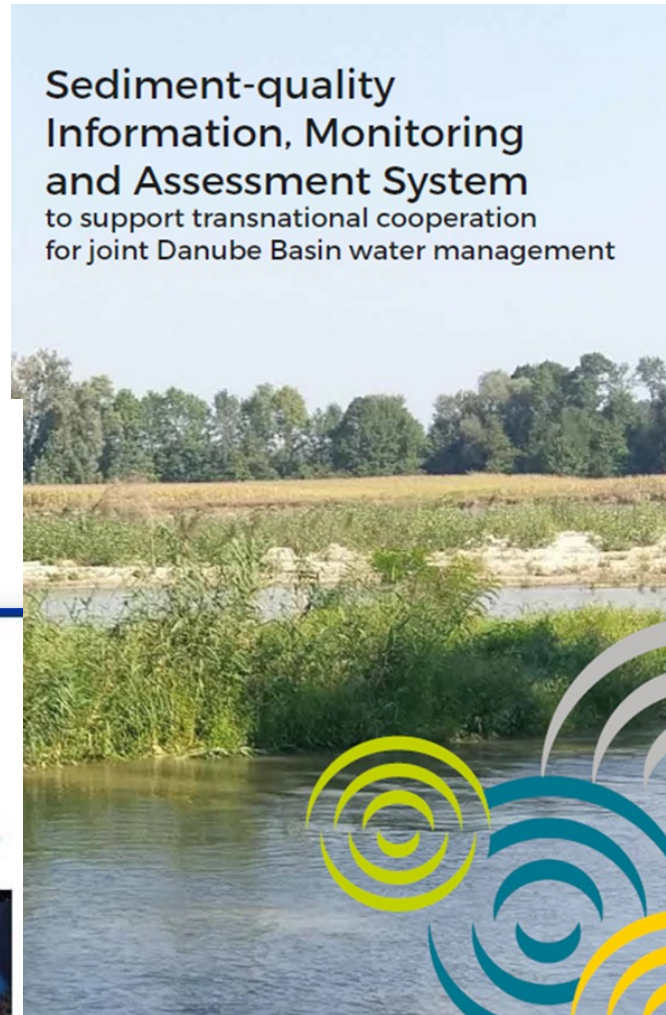


SIMONA SYSTEM:

- ✓ Sampling Method – Protocol
- ✓ Laboratory Method – Protocol
- ✓ Evaluation Method – Protocol
- ✓ IT Tool
- ✓ 3 Test Areas – Testing & Verification
- ✓ 26 Baseline Sites – Harmonization



„COOK BOOK”



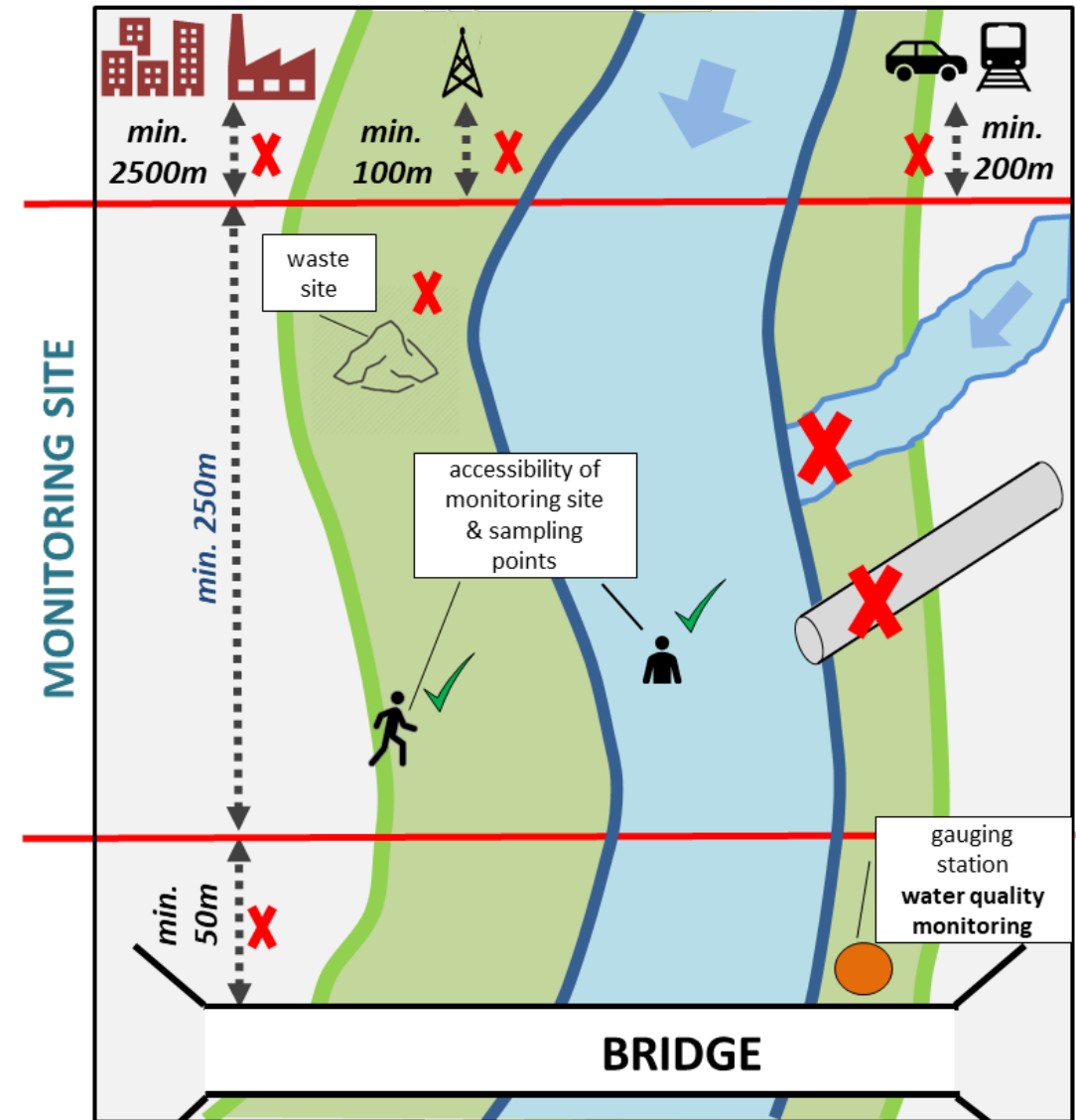
Sediment-quality Information, Monitoring and Assessment System to support transnational cooperation for joint Danube Basin water management

Aid DTP countries' daily operational work

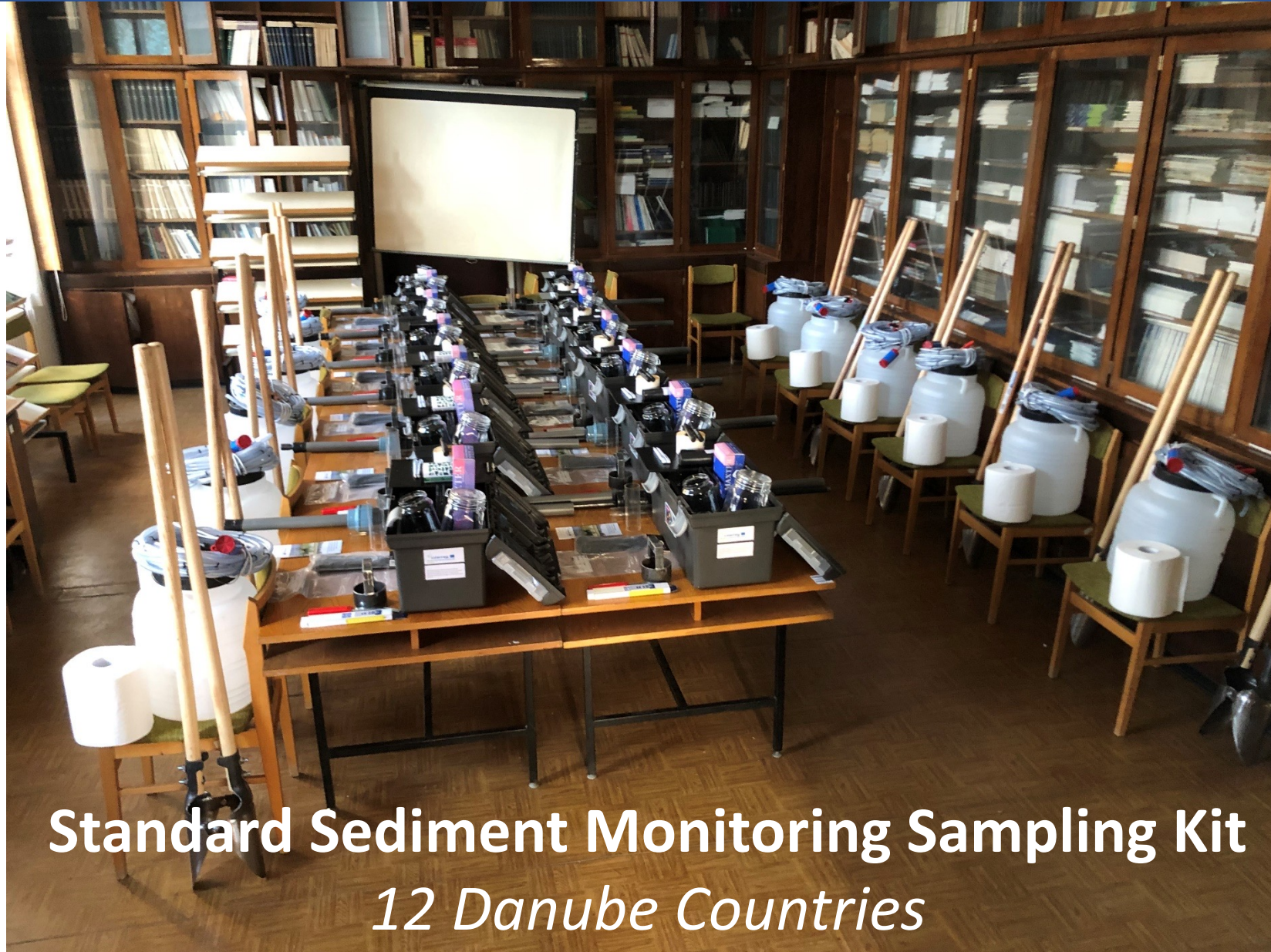
<http://www.interreg-danube.eu/approved-projects/simona>

MONITORING SITE SELECTION & SAMPLING DESIGN

1. AT NATIONAL WATER QUALITY MONITORING POINT
(preferably upstream)
2. MIN. 250M LONG
3. BOTTOM SEDIMENT, SUSPENDED SEDIMENT, OVBANK SEDIMENT SAMPLING POSSIBLE *(availability, accessibility)*
4. AVOID TRIBUTARY CONFLUENCE
5. AVOID KNOWN CONTAMINATED SITE
6. AVOID LOCAL CONTAMINATION SOURCE
 - Discharge channel or pipe
 - Waste site
 - Industry or power plant (min. distance 2500m)
 - Railway lines & major roads (min. distance 200m)
 - Electric line & pylon (min. distance 100m)
 - Bridge (min. distance 50m upstream)
 - Other sources
7. UNIFORM HYDROMORPHOLOGY



HARMONIZED – STANDARD SEDIMENT MONITORING KIT

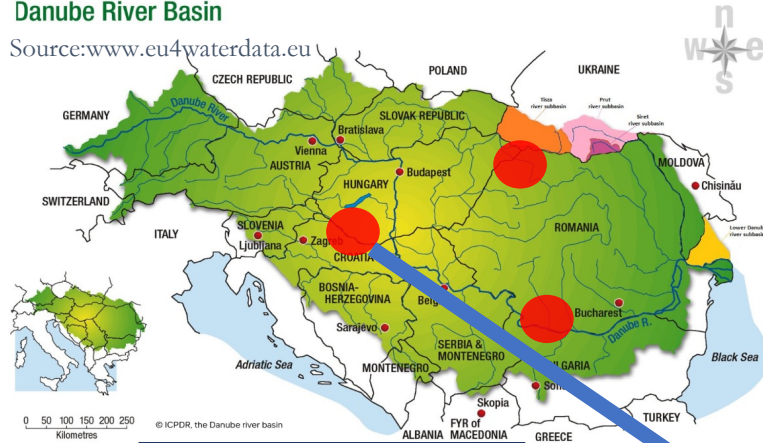


The General Directorate of
Water Management,
Budapest, Hungary

MONITORING SITE - DRAVA RIVER TEST AREA

Danube River Basin

Source: www.eu4waterdata.eu



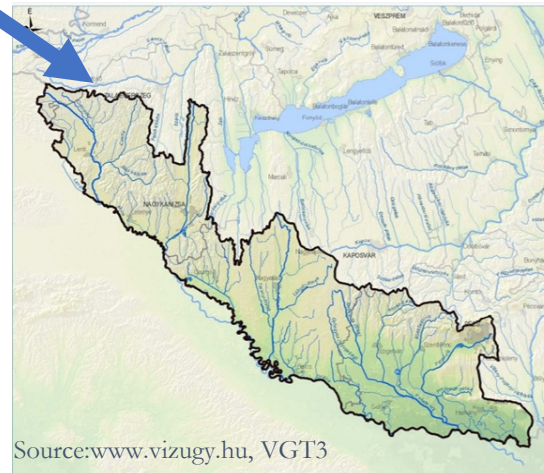
3 Test Areas

- **Drava River**
- Upper Tisa
- South Danube

Drava River

- 749 km
- **Diverse** biogeographical and sedimentation
- historical pollution: **mining and smelting industry**

DRAVA: one of the largest in Europe
(Austria, Slovenia, Croatia, Hungary)



DRAVA RIVER BASIN

OBJECTIVES

- ✓ **Continuous monitoring and data collection**
- ✓ **Easy-to-operate**
- ✓ **Reliable & comparable: representative and reproducible**
- ✓ **Cost-effective**

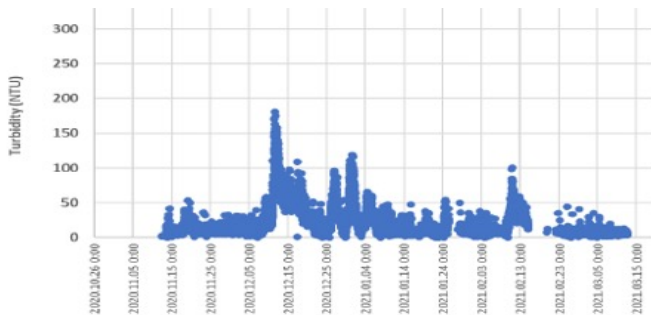
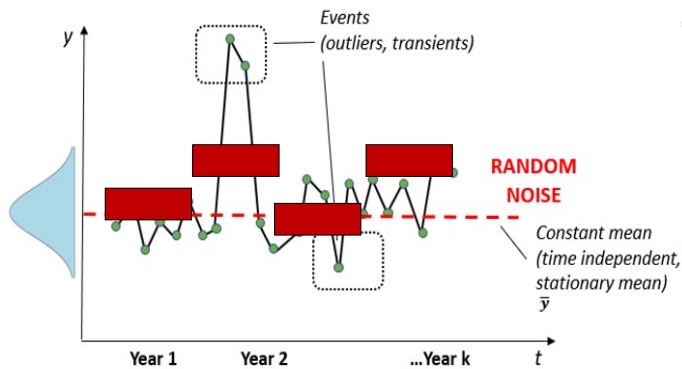


Photo: Zsófia Kovács

PASSIVE SAMPLING PLATFORM

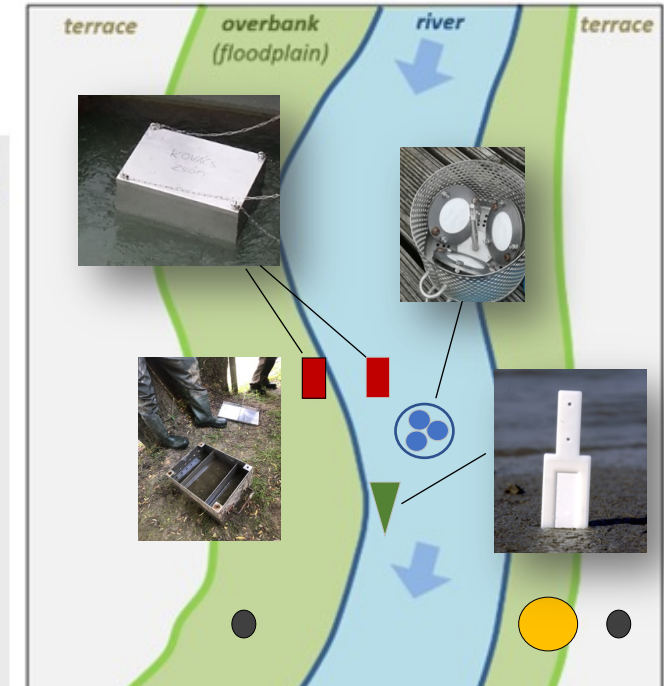
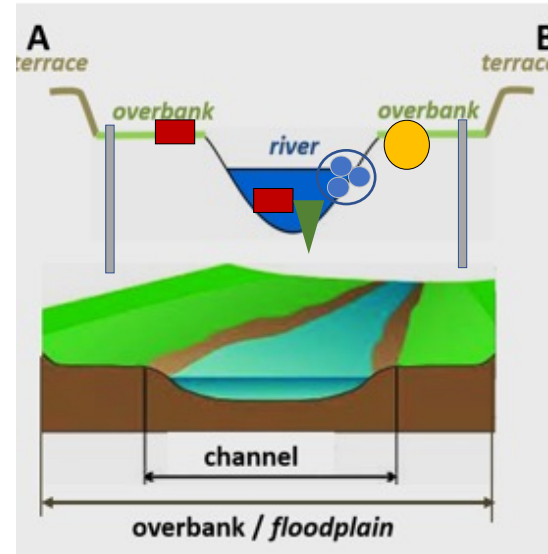
LIMITATIONS OF POINT SAMPLING (ISO standard)

- ✓ Misses contamination events – poor temporal representativity.
- ✓ Requires extensive sample preparation (dissolved vs solid-bound, etc.)



Joint Danube Survey 4: importance of suspended sediment quality monitoring!

- ✓ JDS4 sediment trap box: **time-integrated** result
- ✓ It is able to deliver important about **events** (floods)



SIMONA APPROACH:

1. **Sediment trap box**
2. Passive selective **membrane absorbents** ('artificial fish')
3. **Electric sensors** (turbidity, water chemistry)
4. Online **communication system**

PASSIVE SAMPLING PLATFORM

SIMONA SAMPLING PLATFORM:

- JDS4 standard sediment trap box - in river water
- JDS4 standard sediment trap box - on floodplain
- Passive Membrane Sampler (Metals, PAH's, Pesticides)
- Water quality monitoring sensors: pH, Redox, **Turbidity, Flow velocity**, Dissolved oxygen, Temperature, Conductivity
- Online data communication (15 minutes sampling frequency)

Verification: suspended sediment point sample into plastic water tank (30 L) every month.

Analysed: metals, PAH,'s and Pesticides.

Operation: 12 month's (4 seasons)

SURVEILLANCE (REGULAR) MONITORING

QUANTITATIVE MEASUREMENT

CONTINUOUS WATER FLOW METER AND TURBIDITY

**ONLINE SENSORS
Sampler**



**DRAVA – Barcs
STATION 11.2020**

**SEDIMENT BOX
Channel Sampler**

**PASSIVE
MEMBRANE
Sampler**



**SEDIMENT BOX
Overbank Sampler**



Photos: Zsófia Kovács



Communication box

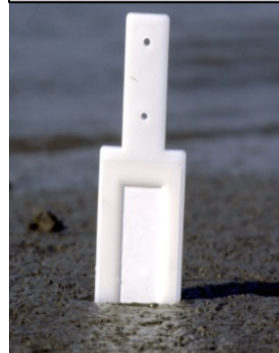
Passives Sampler

Sediment box

Sensors

Sensors:
turbidity,
velocity

**INFINIT-SINK DGT
Pore Water
Sampler**

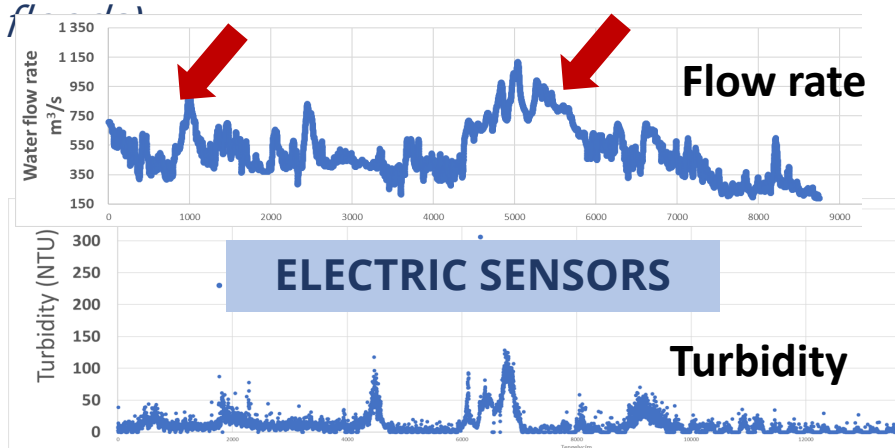


PASSIVE SAMPLING PLATFORM

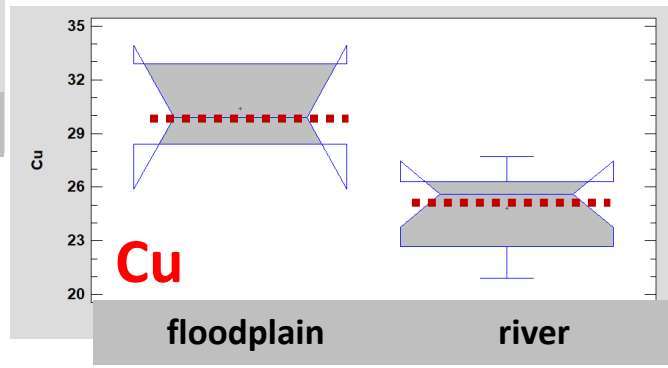
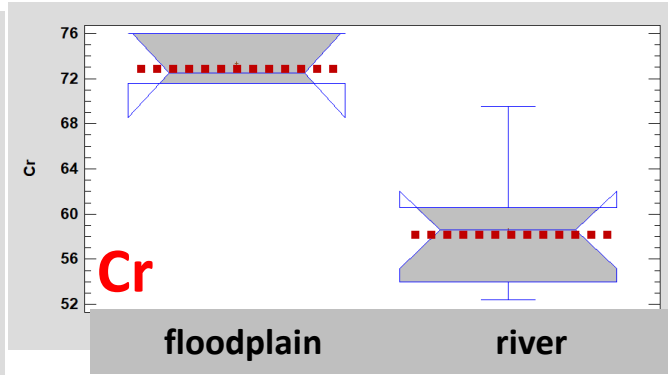
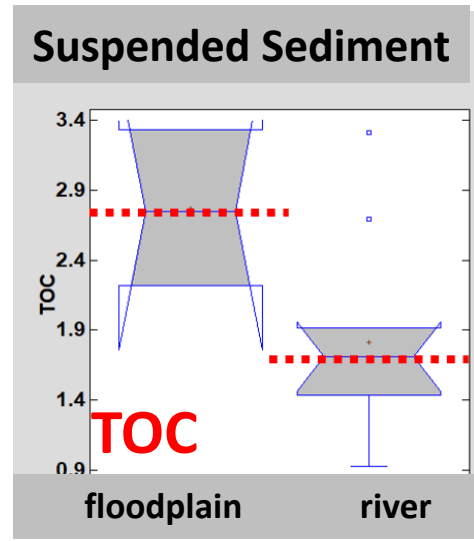


PASSIVE SAMPLING PLATFORM-RESULTS

Results: **EVENTS** (*extreme*)

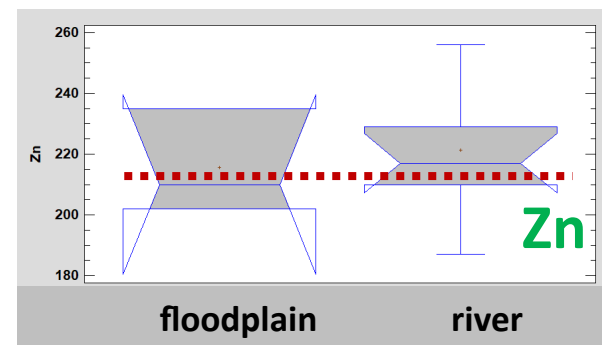
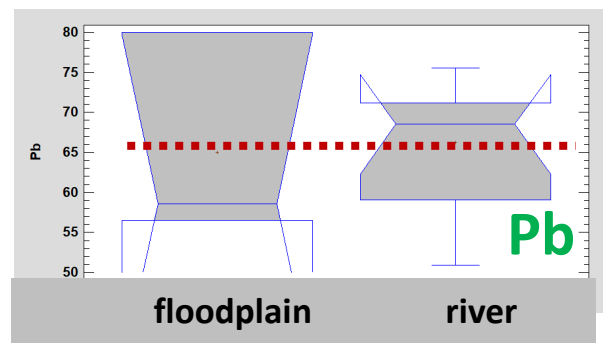
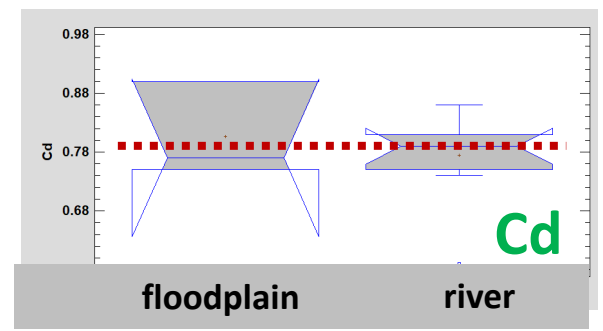


SEDIMENT TRAP BOX



Suspended sediment passive sampling system

- detected the high pollution concentration during flood events e.g. (Cr, Cu, TOC)
- detected **constant pollution levels:** natural geochemical background (?) (e.g. Cd, Pb, Zn)

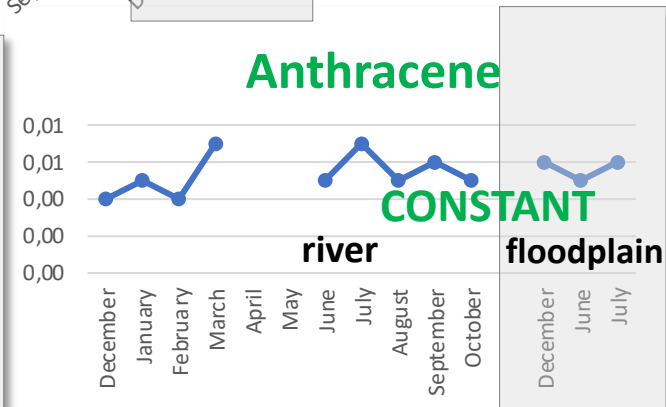
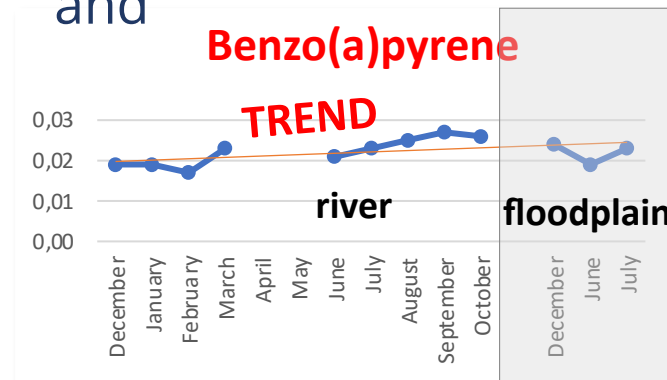
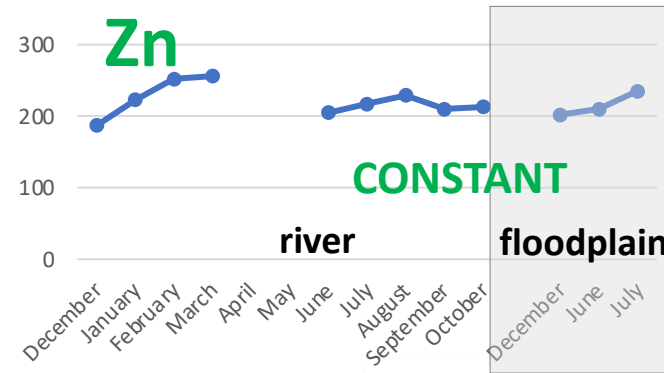
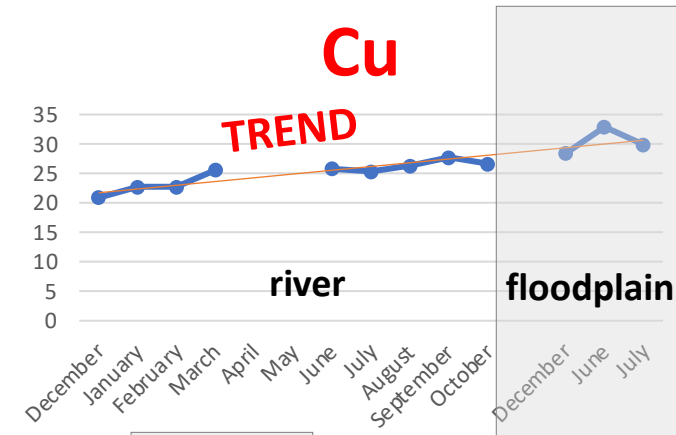
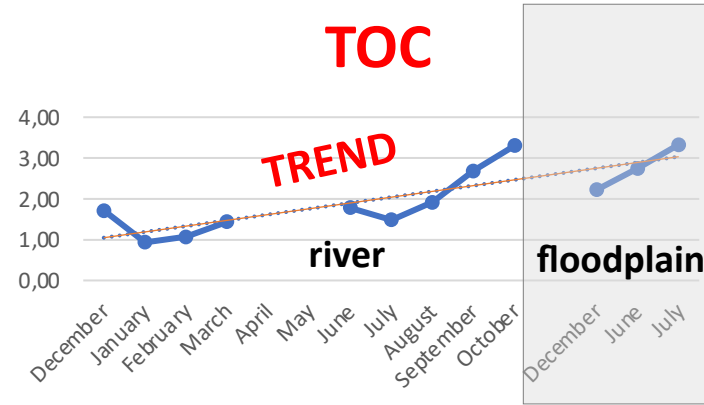


PASSIVE SAMPLING PLATFORM- RESULTS

THE RESULTS OF THE SUSPENDED SEDIMENT PASSIVE SAMPLING SYSTEM

Added value:

- **passive sampling** system identifies the quantity of the suspended sediment and pollution loads,
- **trends** that provide continuous information about water and sediment quality.



PRESENT AND FUTURE

The use of unique automated sampling techniques allows for accurate and reliable data collection, which can inform future management and protection strategies for the Danube Basin.

New concept

Integrated a quality and quantity sediment management.



Innovative sediment sampler

Prototype of automated creeping sediment sampler (national R&D project, Aqua-Terra Lab Ltd.)



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



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