Impact Of Sewage Influence on River Mura: Water Quality and GHGs Considerations

By

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River Mura: Amazon of Europe

- Location: Central Europe, Approximately 446 kilometers (277 miles).
- Countries: Originates in Austria and forming a transboundary river between Slovenia, Croatia, and Hungary.
- Characteristics: Known for its meandering course and diverse landscapes including wetlands and forests.
- Significance: Important for ecological conservation and offers opportunities for recreational activities.

Threats

- Until the late 18th century, the Lower Drava and Mura rivers flowed freely and remained untouched by human intervention.
- Over the past two centuries, extensive human activities have resulted in the loss of up to 80% of former floodplain areas and alterations to approximately 1,100 km of natural riverbanks and stretches.
- Engineering projects focused on navigation and flood protection have significantly impacted the rivers' ecological integrity, biodiversity, and natural resources.
- Key threats include channelization of river courses, extraction of gravel and sand, and the construction of hydropower dams, particularly in upstream sections, leading to habitat destruction, species endangerment, and economic repercussions.

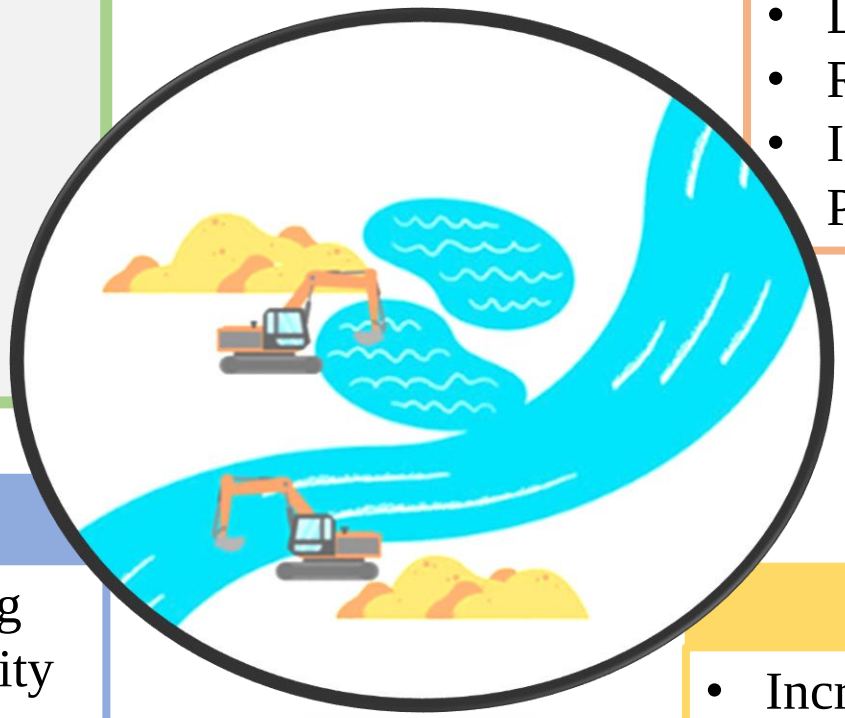
Protest for a free Mura: 2017

Biological Environment

- Habitat loss and fragmentation
- Smothered microorganism
- Reduced respiration and photosynthesis
- Reduced presence of benthic organism
- Noise pollution

Anthropogenic Environment

- Destruction of infrastructure
- Loss of agriculture land
- Reduced yield of farmers and fisheries
- Increased risk of waterborne diseases
- Poor working circumstances agricultural



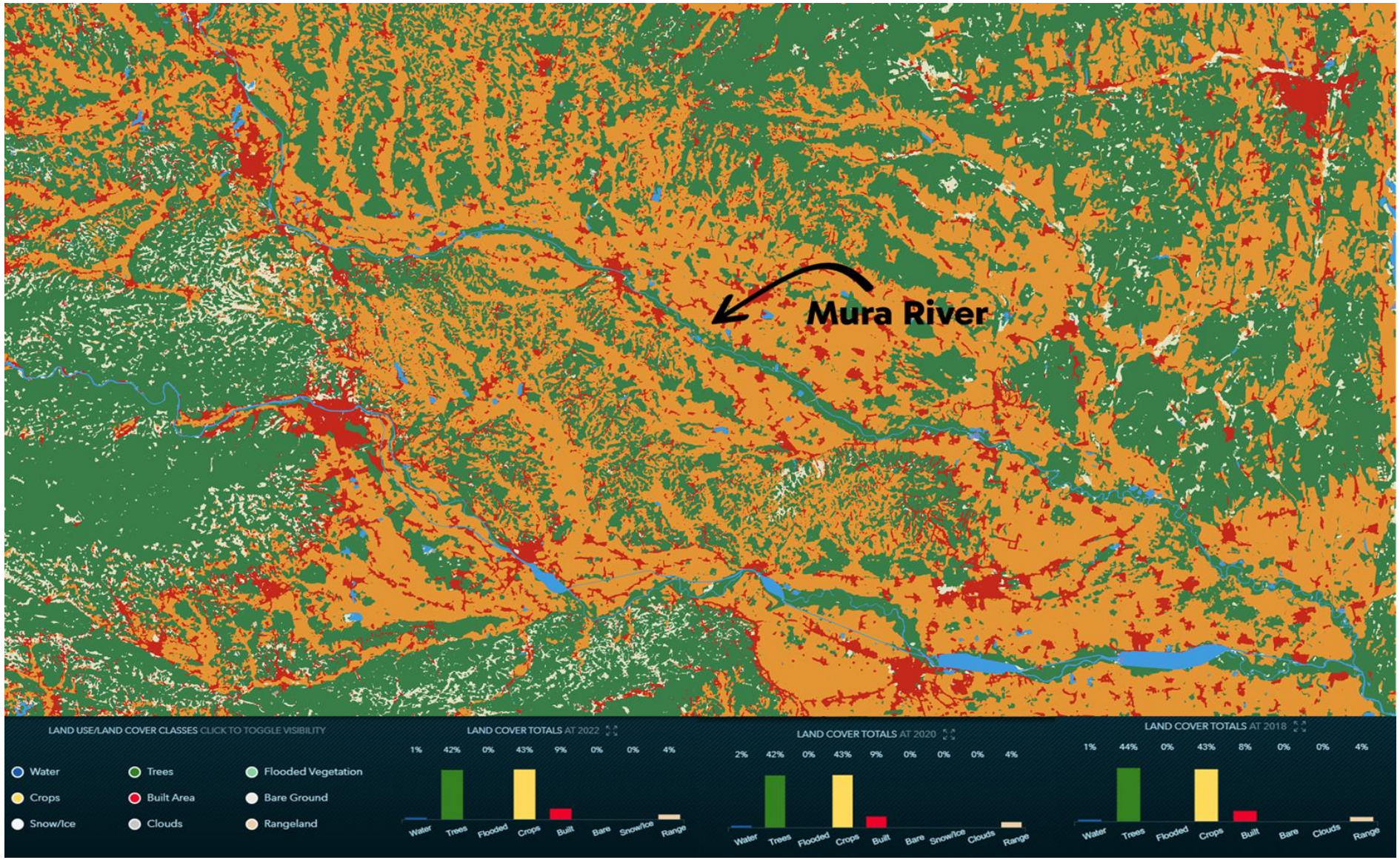
Physical Environment

- Riverbed deepening and widening
- Riverbed, -bank and slop instability
- Increased erosion
- Reduced sand replenishment
- Altered hydrological table
- Riverbed coarsening

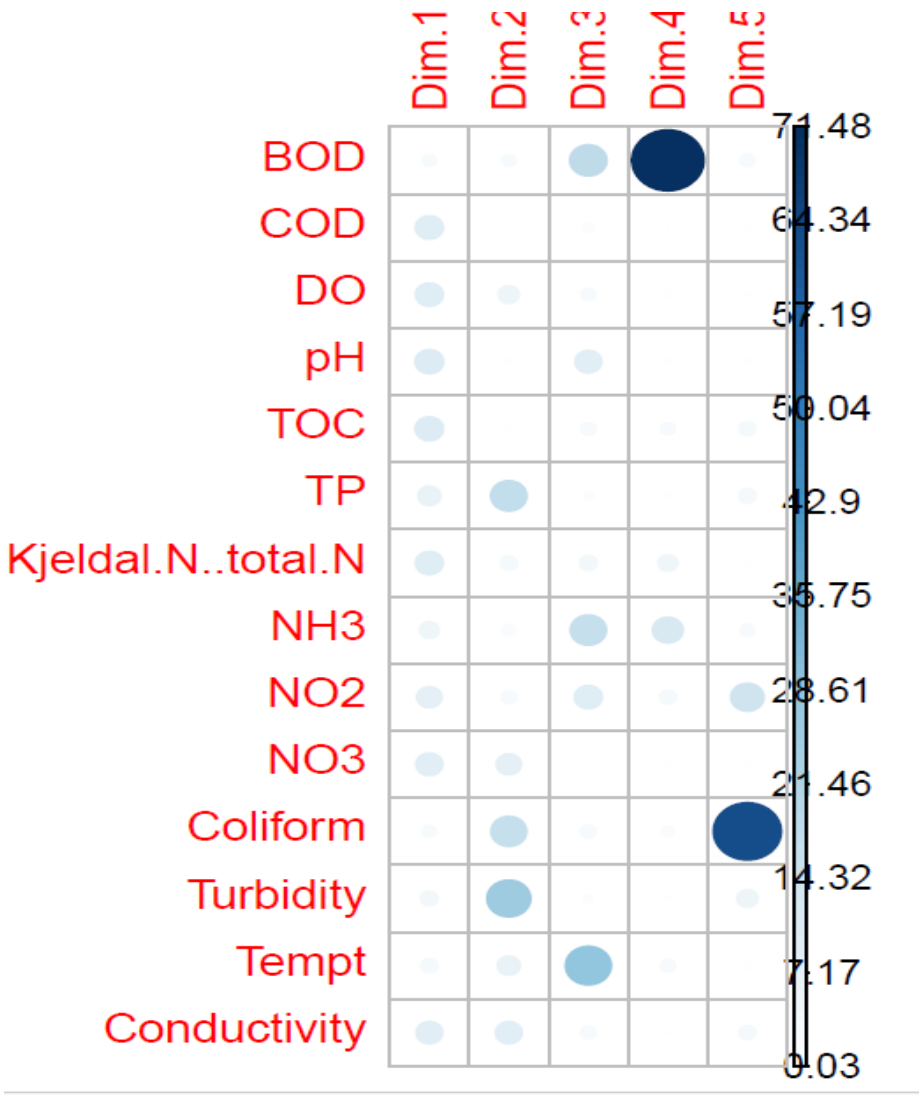
Chemical Environment

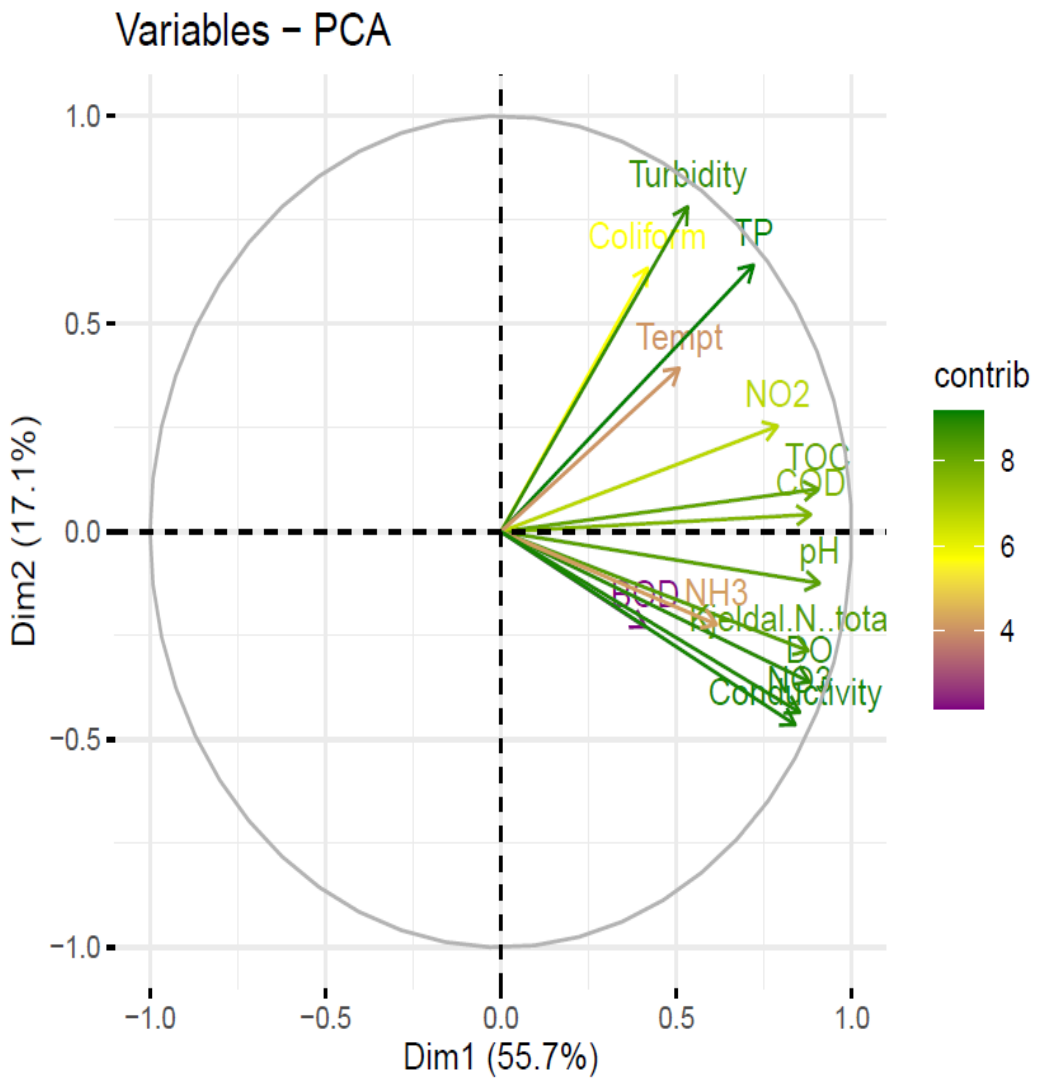
- Increased turbidity and total suspended solids
- Increased concentration of heavy metals
- Pollution of air, water, and soil.

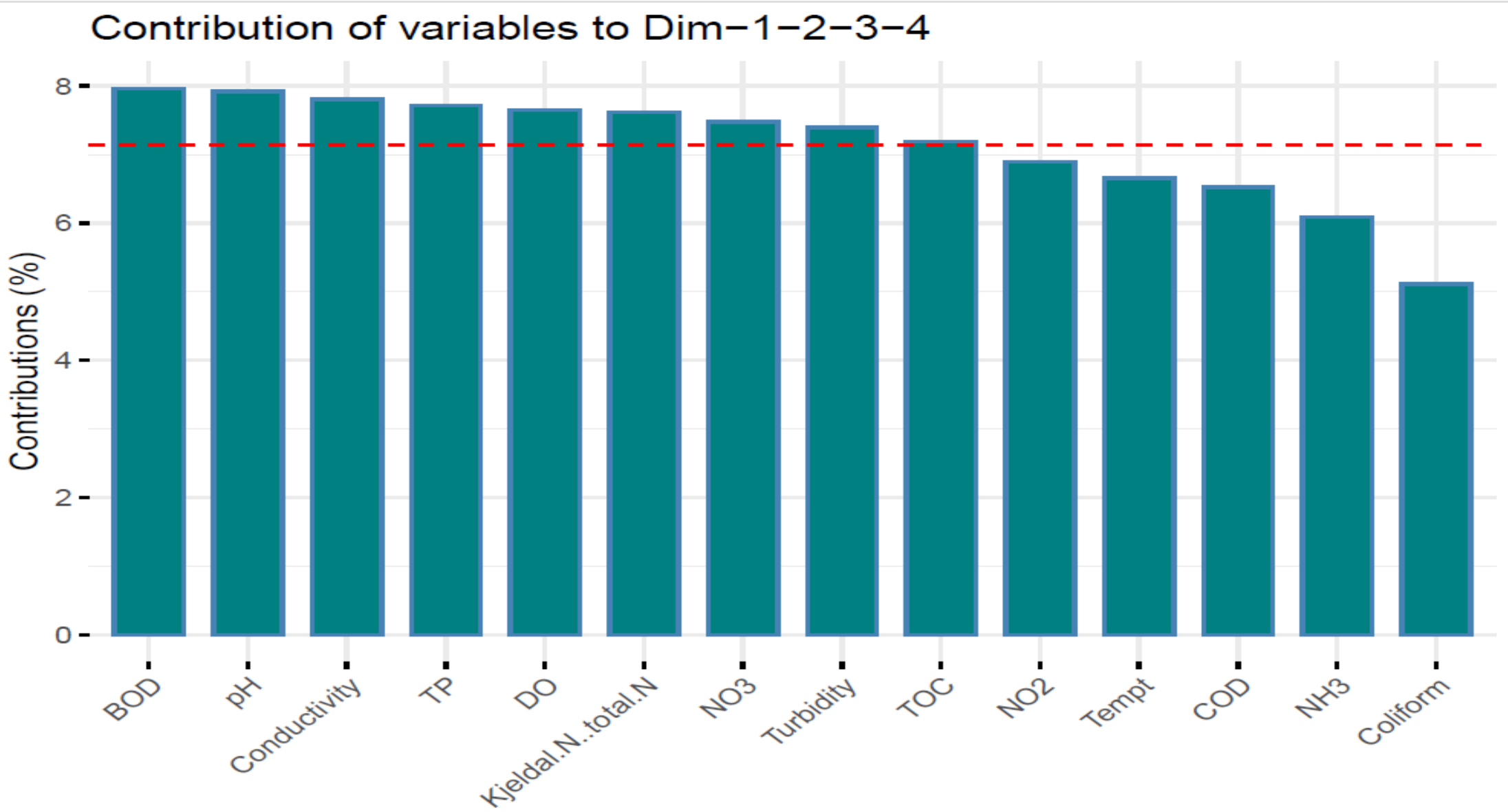
Land Use Land Cover



Yearlong Vigilance: Extensive Monitoring of River Quality






Contribution of variables to Dim−1−2−3−4
Contributions (%)
0
2
4
6
8
BOD
pH
Conductivity
TP
DO
Kjeldal.N..total.N
NO3
Turbidity
TOC
NO2
Tempt
COD
NH3
Coliform

Site 1

	BOD	COD	DO	pH	TOC	TP	Kjeldal N/ total N	NH3	NO2	NO3	Coliform	Turbidity	Tempt	Conductivity
BOD	1.00													
COD	0.89	1.00												
DO	-0.44	-0.44	1.00											
pH	-0.18	-0.20	0.39	1.00										
TOC	0.70	0.61	-0.41	-0.07	1.00									
TP	0.79	0.84	-0.52	-0.29	0.73	1.00								
Kjeldal N/ total N	0.82	0.74	-0.48	-0.08	0.78	0.82	1.00							
NH3	0.57	0.47	-0.37	-0.06	0.33	0.55	0.76	1.00						
NO2	0.19	0.20	-0.28	-0.07	0.07	0.10	0.28	0.19	1.00					
NO3	0.00	0.00	-0.13	-0.04	0.01	-0.08	0.19	-0.06	0.60	1.00				
Coliform	0.51	0.44	-0.21	0.00	0.92	0.54	0.57	0.03	-0.02	0.04	1.00			
Turbidity	0.51	0.67	-0.27	-0.28	0.25	0.58	0.32	0.22	0.11	-0.09	0.13	1.00		
Tempt	0.16	0.20	-0.53	-0.03	0.22	0.22	0.10	-0.02	0.06	-0.03	0.17	0.15	1.00	
Conductivity	0.69	0.58	-0.49	-0.27	0.62	0.74	0.84	0.72	0.36	0.19	0.39	0.27	0.15	1.00

Site 2

	BOD	COD	DO	pH	TOC	TP	Kjeldal N/ total N	NH3	NO2	NO3	Coliform	Turbidity	Tempt	Conductivity
BOD	1.00													
COD	-0.08	1.00												
DO	0.36	-0.23	1.00											
pH	-0.07	-0.19	-0.28	1.00										
TOC	0.05	0.47	-0.16	-0.07	1.00									
TP	-0.07	0.46	-0.48	-0.33	0.52	1.00								
Kjeldal N/ total N	0.35	0.06	0.68	-0.62	0.27	0.14	1.00							
NH3	0.16	0.08	0.11	-0.38	0.18	0.27	0.45	1.00						
NO2	0.15	0.27	0.03	-0.61	0.18	0.69	0.48	0.36	1.00					
NO3	0.38	-0.16	0.71	-0.42	0.17	-0.22	0.84	0.44	0.10	1.00				
Coliform	-0.05	0.38	-0.36	-0.05	0.57	0.62	0.12	0.07	0.26	-0.11	1.00			
Turbidity	-0.08	0.40	-0.48	-0.16	0.46	0.90	0.02	0.15	0.60	-0.36	0.57	1.00		
Tempt	-0.38	0.24	-0.94	0.44	0.15	0.37	-0.76	-0.27	-0.16	-0.81	0.34	0.44	1.00	
Conductivity	0.22	-0.31	0.73	-0.01	-0.12	-0.70	0.42	-0.03	-0.44	0.65	-0.23	-0.73	-0.65	1.00

	BOD	*COD*	*DO*	*pH*	*TOC*	*TP*	*Kjeldal N/ total N*	*NH3*	*NO2*	*NO3*	*Coliform*	*Turbidity*	*Tempt*	*Conductivity*
BOD	1.00													
COD	0.06	1.00												
DO	0.26	0.07	1.00											
pH	-0.19	-0.31	-0.26	1.00										
TOC	0.15	0.45	-0.14	0.00	1.00									
TP	0.03	0.43	-0.44	-0.38	0.51	1.00								
Kjeldal N/ total N	0.29	0.29	0.59	-0.53	0.13	0.13	1.00							
NH3	0.28	0.17	0.23	-0.39	0.09	0.15	0.62	1.00						
NO2	0.26	0.37	0.03	-0.54	0.20	0.71	0.53	0.44	1.00					
NO3	0.36	0.10	0.59	-0.23	0.06	-0.20	0.80	0.47	0.23	1.00				
Coliform	0.07	0.30	-0.29	-0.07	0.59	0.63	0.12	0.13	0.36	-0.10	1.00			
Turbidity	-0.03	0.33	-0.45	-0.16	0.44	0.92	0.05	0.01	0.62	-0.26	0.60	1.00		
Tempt	-0.33	-0.14	-0.89	0.45	0.02	0.27	-0.62	-0.36	-0.16	-0.62	0.23	0.36	1.00	
Conductivity	0.15	-0.02	0.68	-0.03	-0.13	-0.56	0.63	0.36	-0.15	0.79	-0.17	-0.57	-0.56	1.00

Site 3

The Water Quality Index was calculated based on *Brown et al.*, 1982 and CCME. Based on observation the water is of very poor quality

Sample Collection Site	WQI Brown et al., 1972	CCME
Site 1	15458.65	
Site 2	317.06	22.39
Site 3	273.08	

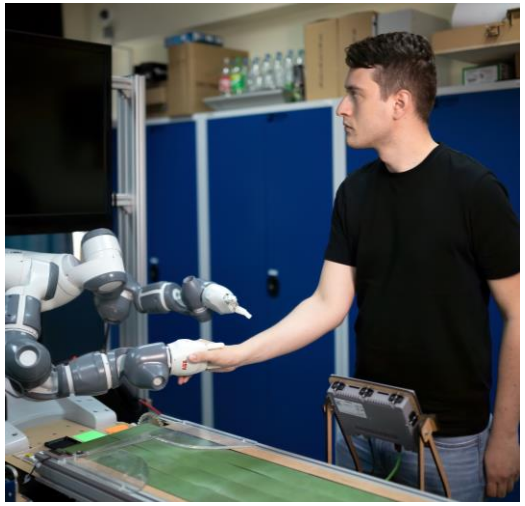
University of Pannonia

5 Faculties

5 Doctoral schools

5 University Centers and campuses

Appr. 6000 students




University Center for Circular Economy - Nagykanizsa

Small community

Friendly tone

Team game

Soós Ernő Research and Development Center

2 research groups:

- Renewable Energy Research Group

- Water Technology Research Group

  - **Economic analyses of the spread of renewable energy technologies**
    - Important area due to the unprecented spread of these technologies

    - Great significance for the assessment of policy results and future policies and measures

    - Main methods: statistical methods, regional analyses, case studies

unprecedented

Water Technology Research Group

– Main research areas

- Industrial and agricultural water and wastewater treatment
- Technological and wastewater recycling solutions in different fields (e.g. oil technologies
- Possibilities for recycling wastewater from thermal waters, irrigation water production
- Qualitative and quantitative determination of micropollutants and microplastics in waters, development of removal technologies
- Detection of COVID-19 and other gastroenterological virus hereditary material in wastewater

Water treatment technologies

- **Adsorption techniques** (physisorption, electrostatic interactions, chemisorption, ion exchange)
- **Membrane techniques** (MF, UF, NF, RO, FO)
- **Degradation, oxidation processes** (microbial, AOP – advanced oxidation process)

5 courses in English at the University Center in Nagykanizsa

1. BSc in Water Operation Engineering

- To develop students' understanding of activities involved in water and wastewater treatment
- 6 semesters, full time training
- 3 specializations:
  - Environmental analysis, instrumentation and monitoring
  - Biotechnology and innovation
  - Water quality and soil protection, waste management and remediation

2. Water and Wastewater Treatment System Operator Specialist – postgraduate course

Advanced training to engineers and specialists

2 semesters, full-time training

3. BSc in Sustainable and Circular Economy-based Tourism

- To develop a deep understanding of the operation of circular economy beyond the basic knowledge of tourism
- 8 semesters, full time training
- internship

4. MSc in Engineering Design and Development for a Circular Economy

- To learn the theories and practices related to circular water and waste management and renewable energy management
- 3 semesters, full time training
- 3 specializations:
  - Renewable energy management in a circular economy
  - Water management in a circular economy
  - Waste management in a circular economy

5. MSc in Circular Economy Management

- Ability to solve practical problems and think innovatively in order to reach circular economy
- 3 semesters, full time training

Stipendium Hungaricum scholarship

All 4 courses are available in the Stipendium Hungaricum scholarship programme for BSc, MSc and PhD students

Citizens of India are eligible for the scholarship

Covers tuition fee, dormitory fee and provides a monthly stipend

Application period: always between 15 November and 15 January

THANK YOU VERY MUCH FOR YOUR ATTENTION!