ENHANCING RIVER POLLUTION DETECTION WITH A NOVEL MODULAR WATER QUALITY MONITORING SYSTEM

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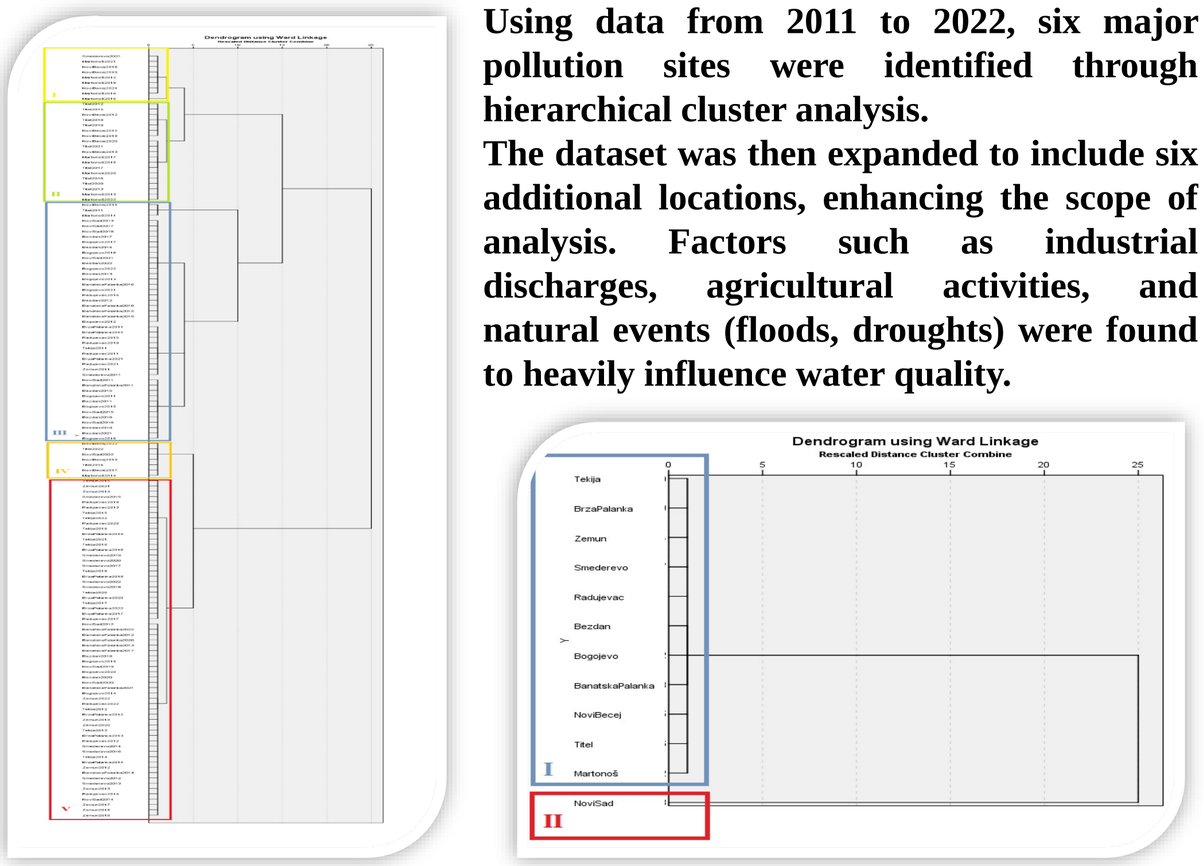
This research, under the REWARDING project, addresses the limitations of Serbia's current water quality monitoring system, particularly in pollution "hot spots" along the Danube basen in Serbia. The study proposes the installation of a modular sensor network to monitor these areas in real time, focusing on regions near Belgrade and Novi Sad. Site selection is based on hydrological and pollution data, alongside a novel methodology for identifying critical hot spots.



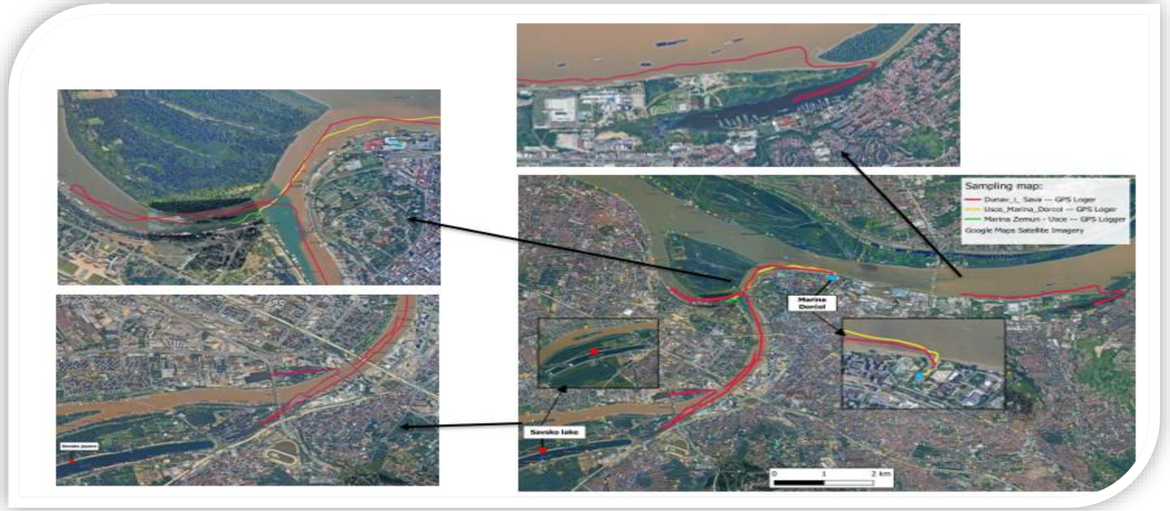
Hierarchical cluster analysis for all 12 sites period 2011-2022

Using data from 2011 to 2022, six major pollution sites were identified through hierarchical cluster analysis.

The dataset was then expanded to include six additional locations, enhancing the scope of analysis. Factors such as industrial discharges, agricultural activities, and natural events (floods, droughts) were found to heavily influence water quality.

A more frequent and prominent appearance of the Zemun locality was observed, indicating the most frequent and significant contamination in this area. Additionally, through this analysis, new and expanded lists of localities were compared by observing the overall pollution for the examined period. In this broader analysis, the Novi Sad locality emerged as the most significant, indicating a pronounced influence of fecal/industrial wastewater discharged into the Danube without any treatment.

In April 2024, a sensor system was deployed to gather real-time data from key locations on the Danube and Sava rivers. Over 20,000 measurements were collected for parameters like water temperature, pH, dissolved oxygen, and conductivity, revealing significant fluctuations.



Measurement path on Danube and Sava Rivers

Data reading

Sampling device 1

Sampling device 2

Sampling path

The results showed substantial spatial and temporal variations, particularly in conductivity and oxygen levels, likely due to pollution from untreated wastewater. This demonstrates the effectiveness of the sensor system in capturing rapid changes in water quality.

09/04/2024	Min	Max	Mean	Median
Tw (°C)	15.7	25.3	17.0	16.5
pH	8.7	10.5	9.7	9.8
O_2 (mg/l)	1.8	4.2	2.9	2.8
Conductivity (µS/cm)	223.5	1080.0	659.5	671.4

Significant fluctuations in water temperature, pH, dissolved oxygen, and conductivity measured in the Danube near Belgrade on April 9, 2024, were attributed to both natural and human-induced factors. Diurnal cycles, seasonal changes, and biological activity, such as algal photosynthesis, caused variations in temperature and oxygen levels. Pollution sources like untreated wastewater and industrial discharges further influenced pH and conductivity. Additionally, turbulence from boat movement and site-specific pollution levels contributed to the observed variability in the recorded measurements.

The project underscores the importance of adaptive, real-time water quality monitoring to manage pollution and safeguard water resources. Enhanced data collection will improve environmental strategies and support sustainable river management. Additionally, the integration of artificial intelligence is planned to optimize data analysis, enabling predictive modeling and more effective identification of pollution trends, further advancing the scope of the monitoring system.

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