Extended Abstract

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The Water Bodies and Pollution Sources

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Extended Abstract

A computerized water management system was created to assess the significance of the links between water bodies and the effects of pollution sources. The link between point loads and fundamental water quality metrics is investigated as a labeled network by modeling water bodies in a topological network. The labels are determined by the classification of the water bodies and the sources of pollution. The topology of the network may be analyzed to see how the possible pathways of the surface water network affect water quality. The retrieved data may be utilized to create a monitoring and evidence-based decision-making system. The methodological advancement is demonstrated by analyzing the physical-chemical characteristics of all surface water bodies in Hungary using emissions from industrial facilities and wastewater treatment plants. Changes in water quality are thoroughly analyzed using water quality data collected during the last ten years. The results show that the developed technique is capable of identifying crucial surface water bodies where the impact of local pollution sources is more severe. One hundred and six essential water bodies have been identified, where extra attention should be paid to improving water quality.

The Water Framework Directive, enacted in 2000, was a trailblazing approach to water protection that ensures excellent water status at the river basin level on a timeline. However, in the case of this lofty ambition, many countries are still a long way from attaining high environmental status. As a result, the monitoring and evaluation systems must be upgraded and integrated further. The last 21 years' results reflect a paradigm shift toward integrated thinking. Root cause analysis and integrated strategy management tools should concentrate on effect-based triggers. In this study, we employ data-and network science methods to conduct a comprehensive investigation of the state of surface water bodies in Hungary.

Even though the deadline for meeting the Water Framework Directive's (WFD) water policy aim was pushed back from 2015 to 2027, more than half of the world's water bodies remained in poor condition in 2019. Nutritional enrichment is one of the primary causes of this, which is why we focused on nutrient sources in our study. It should be noted that while assessing and managing diffuse pollution from agriculture is a major concern, the integration and coordination of effective strategies to combat diffuse pollution is still a work in progress. River floodplain ecosystems are particularly vulnerable and must be prioritised for restoration. Trade-offs between rheophilic and stagnophilic aquatic species, on the other hand, may impede a compromise between ecological objectives in terms of restoration. This fact also emphasises the importance of supplementing existing monitoring efforts with new types of monitoring instruments (e.g., eDNA, impact-based tools, and functional tools). Monitoring initiatives based on expertise should be revisited in light of new scientific results. One possibility is to use network science methods to identify key water bodies in water systems. In addition to the inherent trade-offs in water management, synergistic effects, such as increases in water quality generating statistically significant, non-linear changes in recreational property values, can be discovered.

MONERIS (Modelling Nutrient Emissions in River Systems), a watershed nutrient model, was used in the Hungarian portion of the Danube River Basin to investigate pollution routes. Despite being a promising method for measuring total diffuse load, further, improvement needs a survey of monitoring sites. Although this is a potential strategy for better estimating total diffuse loads, due to flow calibration, it necessitates a review of monitoring stations. The average annual evaporation rate is predicted to rise somewhat in the twenty-first century, whereas runoff is expected to fall significantly, owing to changes in urban load. The long-term effects on river basins, such as changes in flood patterns or ecological repercussions, as well as variances in national assessment systems, highlight the need for more integrated methods. Following the WFD agenda, a focus on key impacts such as climate change impact assessments and resilient ecosystem-based management of water bodies should be prioritised.

The study searches for trends in Big Data network data

representation on water quality and pollution point sources. Traditional processes simply cannot manage the increasing volume/types of data in environmental and water management. Big data is already being utilised successfully in water management; smart water metres often report water quality and use while also alerting a water provider to leaks or potential pollution. It has an impact on all of the data we already have and converts it into information that can be utilised directly to improve treatment facility management. As a result, a Big Data-based relationship between water quality and pollution sources aids in the development of water management knowledge and plans for reaching excellent ecological status following the WFD.

This study established the groundwork for a paradigm for assessing water quality based on network analysis. A detailed investigation of surface water bodies in Hungary confirmed the method's usefulness. The Water Framework Directive (WFD) has established a strict Agenda for attaining excellent ecological status, which necessitates a grasp of water quality settings as well as specific water quality improvement strategies.

The time series physical-chemical water quality parameters of Hungarian surface water bodies were integrated into a network with the pollution point sources identified by the River Basin Management Plan (RBMP), and the impact of municipal wastewater treatment plants and industrial point sources was investigated.

The findings show that using the suggested network-based autocorrelation measure, it is feasible to determine the sensitivity of water quality to nearby pollution sources, which is something that conventional water quality assessment approaches are incapable of doing.