

## Hydrological Indicators of Fen Condition Based on Groundwater Monitoring and Vegetation Classification in the Upper Biebrza Basin

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### Abstract

Fens are groundwater-dependent wetlands whose ecological condition is strongly controlled by hydrological processes, particularly groundwater level dynamics. In the Upper Biebrza Basin in northeastern Poland, fen ecosystems represent one of the most valuable wetland systems in Europe, but they are increasingly affected by land-use changes and hydrological alterations. Understanding the relationship between groundwater conditions and vegetation patterns is essential for assessing fen health and supporting effective wetland management.

This study investigates hydrological indicators of fen condition based on groundwater monitoring and vegetation classification in the Upper Biebrza Basin. Long-term groundwater level data from monitoring piezometers were analyzed to identify key hydrological indicators, including groundwater depth and temporal variability. These indicators were then compared with vegetation communities classified using field surveys and ecological indicators. The analysis aims to identify hydrological thresholds associated with different fen vegetation types and ecological conditions.

The results provide insight into the relationships between groundwater dynamics and fen vegetation patterns and contribute to the development of hydrological indicators that can support wetland conservation and water management strategies in groundwater dependent ecosystems.

### Keywords

Fen hydrology, groundwater monitoring, wetland ecosystems, hydrological indicators, Upper Biebrza Basin.