

## Abstract

The analysis of the impact of European beaver (*Castor fiber L.*) activity on water management addresses the growing need for developing innovative methodologies and effective strategies for water resource management in the context of climate change. The aim of this study was to assess the influence of beaver dams on the temporal and spatial variability of surface water resources and their quality, considering the importance of natural retention as a factor mitigating flood and drought risks. The research was conducted on natural water impoundments created by beavers within watercourses in the Polesie National Park, the Roztocze National Park, and their buffer zones. The study included both habitats influenced by beaver activity and control sites devoid of such impact. The analysis covered the assessment of hydromorphological conditions of watercourses, species diversity of macrophytes, retention capacity of beaver dams, and changes in water quality parameters. The results demonstrated that beaver activity significantly affects riverine ecosystems, contributing to an increase in macrophyte species diversity and the ecological status improvement of small rivers. Beaver dams facilitate water and nutrient retention, effectively reducing phosphate and nitrate concentrations, which positively influences surface water quality. The study also revealed negative aspects of beaver activity, such as a localized increase in ammonia concentrations downstream of dams and pollutant emissions following the destruction of dam structures. The retention capacity of beaver dams for water and pollutants was found to be highly dependent on local hydrological conditions, landscape structure, and human interference. The findings confirm that beaver dams can serve as a natural tool supporting sustainable water resource management; however, their effectiveness varies and requires further long-term research. A crucial aspect is the need to protect these structures from destructive human activities and to develop strategies that minimize the impact of anthropogenic pressure. In the face of intensifying extreme weather events and increasing environmental stress, continued research on the role of beavers in shaping river hydromorphology is essential for a deeper understanding of their influence on aquatic ecosystems and for developing effective adaptation strategies in the context of climate change.

**Keywords:** natural dams, channel retention, water quality, biodiversity