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## **Summary**

### **The effect of diversified agricultural use of soils on the development of diatoms in soil and water of the streams in the area of the Magurski National Park catchment and its buffer zone**

The area of the Podkarpackie Province is morphologically very diversified including both areas beneficial from the point of view of intensive farming and many areas with unfavourable farming conditions. An example of such area in the Low Beskid, which due to the specific morphological structure, high forest cover and low population density has low production potential. Small farms cultivate mainly winter wheat with an average yield of 20-30 dt ha<sup>-1</sup>. In recent years, an increase in livestock population grazed on many extensive meadows and pastures has also been observed. Improving the competitiveness and profitability of farms is a big challenge, especially in the buffer zone of the Magura National Park. One of the most important goals in this area is the protection of biodiversity of grassland ecosystems, which include rare in Poland fresh meadows (occurring, among others, in R2A site) and protection of all ecosystems. Therefore, land development in the river valleys of the Magura National Park buffer zone mimics the former extensive farming, including mowing, grazing or a combination of these practices.

The aim of the dissertation was to prove that the way the soil is used in the buffer zone of the Magura National Park affects their physical and chemical properties and water quality in the areas of the Magura National Park. In the beginning of the research it was assumed that: 1) diatom assemblages developing in waters and soils within agricultural catchment areas will differ from forest catchment communities and will indicate greater fertility, 2) soded soils will be less susceptible to surface runoff than arable land. Due to the very extensive nature of the crops (small area of farms, the scarcity of mineral fertilization), it was also assumed that rare and interesting taxa in terms of taxonomy will appear in the diatom communities.

Laboratory analyzes of the physical and chemical properties of soils have shown that sandy, silty and loamy formations dominate in the investigated sites. The physical and chemical properties were varied, but no clear trend towards the method of use could be established. The studied soils were characterized by high acidity, high content of organic carbon, humus, nitrogen and available magnesium and usually low content of such nutrients as phosphorus and potassium. On soils with a high proportion of clay fraction in the

granulometric composition, the content of readily dispersible clay was also indicated, which indicated high susceptibility of these soils to destruction.

The multifactor analysis, using statistical methods and the diatom index role, as well as own observations during field work, allow to conclude that soil properties result from their seminatural character. This underlines the uniqueness of this area, which after years of usage by State Farms, returns to its original state (as far as it is possible), also thanks to the establishment of the Magura National Park.

The waters of the studied streams were also characterized by very good and good chemical status as well as ecological potential. The content of nitrates underestimated the quality of water only in April 2013, after the spring thaw. The values of the other parameters were low. During fieldwork, an undoubted influence of agricultural use on the quality of water was observed, especially in the Ryjak stream catchment. At the first site, the watercourse flowed through the areas used as pastures and during the grazing period it served as a waterhole for cattle. However, these practices did not significantly deteriorate the quality of the water, which proves that it is not the way of using it, but its intensity that has an impact on the self-purification capacity of waters.

The studied habitats were characterized by a large diversity of diatom species. In six research seasons, in the years 2013–2014, a total of 182 taxa were determined on soils, while 446 taxa in waters. Among the diatoms determined in soil, *Hantzschia amphioxys*, *Humidophila contenta*, *Surirella terricola* and *Halamphora montana* developed most frequently, whereas *Achnantheidium pyrenaicum* and *A. minutissimum* in water. According to the autoecology of individual taxa, and on the basis of ecological indicators, species with a broad ecological spectrum predominated in the structure of diatom communities developing on soils, having their optimum very often in terrestrial, fertile, neutral or even alkaline habitats, but not developing in over-fertilized and acid habitats.

The statistical analysis of the investigated physical and chemical properties of soil and physicochemical waters have not shown significant dependence in most cases. The statistical analyses (cluster analysis and Design compatibility analysis DCA) showed a clear separation of soil and water habitats. The group of soil communities were loosely related sites. There was a clear distinction between positions in different seasons. However, in the group of water communities, the analysis showed a high similarity of sites. On the basis of the analyses carried out, however, it was not possible to show which factors clearly influenced the grouping of communities. Probably the formation of diatom communities is influenced by a set of various factors.

In the structure of communities in the total number of taxa, about 10% were diatoms on the Red List of Polish algae. The conducted research has shown that some species, including *Luticola acidoclinata*, *Pinnularia schoenfelderii* and *Stauroneis thermicola*, require changing of the threat category or even deletion from the group of endangered taxa, due to the numerous development in land, especially soil habitats.

Sustainable use of soils in the Low Beskids will allow to maintain the traditional agricultural character of this area, without the simultaneous threat to protected areas where rich, often unique flora and fauna occur.