

## Summary

This work includes research on the entire soil catena in which three types of phytocoenoses have formed - *Abietetum albae*, *Tilio-Carpinetum ficarietosum* and *Fraxino-Alnetum* communities. In each of them, research was carried out to show the general diversity of soil environment features. At the same time, these phytocoenoses were selected for research in order to characterize the microvariability of soil properties in detail. The aim of the research is to understand the spatial variation of measurable properties of soil in conjunction with the microrelief system conditions which create niches for existence of the undergrowth plants. An additional purpose of the conducted research is to evaluate selected phytoindication indicators in forest habitat studies. The research was carried out in the Czarna Różga Reserve, located in Przedbórz Forest District. Geomorphological factors which determine the moisture conditions of the studied soils and the remaining physicochemical properties of soils and the occurrence of vegetation play the key role in shaping soil diversity across the whole catena. The studied phytocoenoses differ in the stock of basic cations in the soil profile which is a direct effect of the interaction of water as a "donor" of dissolved mineral nutrients. The quality and quantity of soil organic matter in phytocoenoses in the entire catena is the result of geomorphological conditions and the interaction of plant cover with soil conditions. Stronger moisture in the *Tilio-Carpinetum ficarietosum* and *Fraxino-Alnetum* communities favored the development of abundant vegetation, the occurrence of trophically demanding tree species that stimulated soil biological activity and organic matter decomposition processes. The obtained results regarding ecological indicator values and biodiversity indicators confirm the possibility of their use as a tool for phytoindication of habitats differing in fertility and forest-forming possibilities. The highest situated microhabitats, transient microhabitats with periodic impact of water and wetter lowest located microhabitats covered by the study were characterized by different soil properties. The influence of microhabitats on soil properties and vegetation intensified in the tested catena according to the following order: *Abietetum albae* < *Tilio Carpinetum ficarietosum* < *Fraxino-Alnetum*. Differences in soil conditions in the described micro habitats result in the occurrence of different groups of undergrowth plants. The higher micro-habitats were characterized by the presence of plants that were less trophically demanding and resistant to acidification and less moisture. Plant groups with higher trophic and moisture requirements developed in lower locations.

**Keywords:** forest ecosystem; soil catena; microhabitats; soil properties