

Ecopedological consequences of land use in the area of Silesian Beskids

Abstract

The work covers the area of the Silesian Beskids. The focus was on the issues of changes in the landscape components of the Silesian Beskids from 1779 to the present day, based on data from maps (historical and contemporary) and field research. Particular attention was paid to changes in forest cover and its impact on soil cover. The study assessed the temporal and spatial changes in the plant landscape components of the Silesian Beskids in historical and contemporary terms, attempts were made to determine the impact of forest management in the Silesian Beskids on soil characteristics and properties, and compared the morphological and chemical characteristics of soils under beech forest communities and spruce monoculture. As a result of the research and analysis of cartographic materials, changes in the range of forest phytocoenoses were relatively accurately documented. Due to the nature of historical maps (from 1779, 1840), it was not possible to distinguish the type of forests (deciduous, coniferous), such possibilities were provided only by maps from the second half of the 20th century. The full and accurate range of the actual vegetation was determined on the basis of an orthophotomap (especially in determining the border of forest range) and direct field studies verifying the type of vegetation at the complex level, this mainly applies to forest biocoenoses. This can be considered one of the most important elements of the work. The analysis of cartographic materials from the last 240 years (1779–2020) shows clear changes, first of all, in the range of forests in individual time sections. The maximum decline in forest cover was recorded in the 1960s, the increase in forest area in the 1990s, and the second decline covers the period of the last 11 years. It is caused by forestry works related to the removal of dead spruce trees. Archival maps do not reflect short-term changes (forest areas temporarily cut down and then reforested) resulting from forest management. On the basis of historical maps, only permanent changes to the extent of forests can be determined, but it is not possible to fully assess the human impact on forests, because archival maps very often contain only information about the extent of forest areas, and not about the occurrence of specific types of forests with their characteristics. The extent of the actual vegetation, taking into account the division of forests into deciduous, mixed and coniferous, was determined on the basis of the latest orthophotomaps, and the type of vegetation - on the basis of species characteristic for communities during field verification. The text presents a detailed description of 17 soil profiles in terms of their morphological structure and physicochemical properties. The obtained results are new in terms of soil analysis. Interesting results were

obtained in the field of soil morphology and chemistry under the associations of beech trees, mixed fir-spruce forests and spruce monocultures. The conducted research shows that almost the entire studied area is covered with brown soil and its subtypes. Under natural conditions, these soils are the habitat of beech and beech-fir mountain forests throughout the Carpathians. The browning process is the dominant soil-forming process in the studied soils. The change in the species composition of stands (from beech, fir and beech to spruce) did not cause changes in the course and direction of soil formation processes. In the analyzed soil profiles, the podsoling process is not observed, which is evidenced by the lack of the level of the bottoms in the soil profile, and the local light discoloration under the humus level is mainly related to reduction processes. It was found that the introduction of spruce to the beech forest habitats leads to the formation of a transitional AE level. The negative impact of spruce monocultures is marked with different intensity depending on topographic conditions and the degree of the slope of the terrain. These changes are most often visible in soil morphology. Under the spruce monoculture in many parts of the Silesian Beskids, there is no undergrowth, the surface is covered only with spruce rainfall, which makes the soil more acidic than under beech forests. The vast majority of the spruce monoculture in the Silesian Beskids developing on brown soils is anthropogenic. The extent of brown soil can therefore be considered equivalent to the potential and past (before anthropogenic changes) range of beech forests and mixed forests with beech. The development of ski infrastructure is currently the main factor causing the destruction of surface soil levels and, as a result, acceleration of soil erosion processes. The work covers the development and formation of ecological systems in areas historically transformed by man. Similar work was done in the Carpathians, and this work fills in the gaps in this part of the Carpathians. This research is now a priority. The registration of the current state of the examined objects (on the basis of available cartographic materials, with the use of GIS) is important from the point of view of the development and shaping of ecological systems and landscape changes over time. The obtained results can be used in spatial planning and forest management. To sum up, this work is pioneering (especially in the field of ecopedology) and will also inspire further research and monitoring of forest ecosystems in the area of the Silesian Beskids.