

English Summary

Kiszka K. 2018. The complexity of landslide movements based on dendrogeomorphological research. Manuscript of the PhD thesis. Institute of Geography and Spatial Organization, Polish Academy of Science, Research Station in Szymbark, 182 pp. [76 fig., 39 tabs, 13 photos]

Key words: complex landslide activity, dendrogeomorphological method, eccentricity index, Sawicki landslide, Beskid Niski Mts.

The PhD thesis concerns the problem of landslides activity, which is one of the most important geomorphological processes in the Carpathians.

The aim of the PhD thesis is to determine the temporal and spatial complexity of landslide activity and to demonstrate the suitability of using different species of coniferous trees in the dendrogeomorphological method. The Sawicki landslide located in Beskid Niski Mts., which is one of the largest landslides in the Polish Flysch Carpathians, was selected for dendrogeomorphological analysis.

The dendrogeomorphological method and geomorphological mapping were used in the research. 1078 samples from coniferous trees (fir, spruce, larch and pine) growing on the Sawicki landslide and its immediate surroundings were taken using an increment borer in 2013-2018. The cores were taken from the upslope and downslope side of the tree stump. The width of annual tree rings were measured for each extracted core sample. The landslide activity was assessed on the basis of the eccentricity, the eccentricity index and its yearly variation. Geological and topographic maps, published data on landslides activity in the research area, precipitation data from the Research Station of Institute of Geography and Spatial Organization Polish Academy of Science in Szymbark for period 1968-2017 and from the meteorological station of Institute of Meteorology and Water Management in Krynica for period 1881-2010 were also used in the studies.

The PhD thesis consists of 14 chapters, summary and lists of references, tables, figures, photographs as well as two attachments.

The first chapter presents the main and partial objectives, as well as the outline of landslide research. The second chapter describes the current state of landslide research in the Carpathians, with particular emphasis on research using the dendrogeomorphological method.

The third chapter contains the physico-geographical characteristics of the research area, while the fourth chapter describes the applied research methods and used materials.

The fifth chapter presents a detailed geomorphological description of the Sawicki landslide, based mainly on its geomorphological sketch (scale 1: 2500). It contains also characteristics of landslide, fluvial and anthropogenic landforms, analysis of slopes exposure and inclination as well as characteristics of six morphological zones, defined on the basis of the diversity of the studied landslide relief. The sixth chapter contains the dendrogeomorphological characteristics of the studied landslide. It includes the most important parameters of the measured coniferous tree species, dendrogeomorphological indexes such as eccentricity, eccentricity index and yearly variation of eccentricity index as well as the results dendrogeomorphological measurements on reference slope.

Chapter seven presents the thermal and precipitation conditions during the measurement period, whereas the eighth chapter presents the periods of Sawicki landslide activity, determined on the basis of dendrogeomorphological analysis, in relation to the entire studied landslide, research sites and research sub-sites. The ninth chapter discusses all the years of landslide activation in the Szymbark area, noted in the relevant literature, while the tenth chapter contains a detailed analysis of the displacement dynamics within the Sawicki landslide.

In the chapter eleven, the years of activity of the Sawicki landslide, determined based on the dendrogeomorphological method, were compared with the years of landslide movements in Szymbark area reported in the literature of the subject. In the twelfth chapter an analysis of the relation between periods of the landslide activity and atmospheric precipitation was analyzed, while in the thirteenth chapter the usefulness of particular coniferous trees species for dendrogeomorphology was evaluated. Chapter fourteenth contains conclusions.

The result of research shows that the Sawicki landslide is characterized by varied temporal and spatial complexity of landslide activity. The dynamics of displacements within the research sites and research sub-sites, including various fragments of landslides, and movements of colluvial packages is spatially mosaic and chaotic in time. Mass movements covering almost the entire surface of the landslide occurred in the years 1913-1914 and 1974-1975, while in the years 1888, 1906-1907, 1916, 1918, 1929, 1965, 1973, 1980, 1983-1985, 1997 landslide activity was recorded only in its particular parts. The largest variation in the dynamics of landslide movements is characteristic for the period 1970-1985. It was also found that in the initial stage of formation of the landslide tongue, the colluviums movement is disordered. During further downhill movement, the direction of displacement became

organized. Periods of Sawicki landslide activity refers to extremely humid years (62%) and humid years (48%). They are consistent with the years of landslides activity in Szymbark area, reported in the relevant literature. The most suitable coniferous trees species to dendrogeomorphological analysis are spruce, larch and fir. Despite its limitations, the dendrogeomorphological method is a useful tool in landslide activity research.