



Timberline at Mt. Babia Góra as a reflection of the different rates of slope processes

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Geomorphologists have recently been shifting their focus increasingly to the timberline seen as a boundary of two differently functioning mountain geoecosystems. There are two types of timberline, i.e. climatic and empirical. The variable altitude of the latter depends to the greatest extent on rates of slope processes, but also on the local climate and human activity. The climatic timberline is determined by certain annual isotherms (2°C at Mt. Babia Góra). Timberline itself is defined as the boundary of a continuous forest, above which it becomes sparser (and ends at a forest line) and further still there are only isolate dwarf tress (bound by a treeline). The Babia Góra massif (1725 m a.s.l.), where the research is conducted, is an asymmetrical ridge with a precipitous northern slope and a gentler southern slope. On the northern slope the timberline is shaped by snow avalanches and the block cover creep, as well as, but less frequently, by landslides and debris flows. Herding has played a role in the determination of the current timberline. Most of the highest section of the northern slope has never been used for herding, but the entire southern slope, including its summit section, has seen sheep and cattle herding, which has produced numerous and large forest clearings that reach up to the timberline. Even now, 60 years after the establishment of the Babia Góra National Park and a related forest expansion, the pastoral frontier around the former clearings, now overgrown with trees, is still visible and can be even 100 m lower than the natural timberline in adjacent sections of the slope. This fact suggests a need for a particularly careful approach to timberline analysis on the southern slope of Mt. Babia Góra. The authors measured the intensity of geomorphological processes influencing the timberline at Mt. Babia Góra by determining the distance, by which the empirical timberline (measured using GPS) was lower than the climatic timberline, which was identified on average at 1380 m a.s.l. This approach is a new contribution to the body of research on this massif. The results confirm general patterns of timberlines, such as these found in the Tatra Mts and Karkonosze Mts, whereby it tends to be higher on slopes that are gentler, exposed to the south, upwind or convex and that it is lower a.s.l. below gullies, paths of avalanches, mobile slopes covered by rock rubble and below former herding clearings affected by snow avalanches. Another new contribution to the science of natural influences on the timberline includes findings about a landslide impact. Landslides developing above the timberline have been found to send large volumes of rubble into forests, while landslides developing below the timberline continue to edge upward thus gradually eliminating the forest and exposing much longer sections of slopes to avalanches. The shape of the slope and the rate of slope processes at Mt. Babia Góra combine to produce timberline altitude differences up to 400 m.