



Monitoring environmental changes of the timber line and timber line ecotone in the Swiss Alps

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One of the most important causes for the current changes of timber lines are increasing temperature over the past years. Important research issues are the complex environmental changes associated with increasing temperatures influencing geomorphologic landscape systems on different temporal scales.

Timber lines are formed by many different factors, like: climate (temperature, annual rain fall), geology, geo morph dynamic processes, such as: landslides (snow and soil), mud flow, solifluction, rock slide, erosion, vegetation developments (succession) and anthrop-zoogenic interactions. These factors lead to changes in the landscape system. It is therefore important to understand the system and its reaction to changes. Influencing factors may appear continuous or at short intervals and lead to the certain forms of the timber line as well as the timber line ecotone.

In this work the altitude of the timber line, tree and shrub limit has been compared with given dates from 1920 in the area of Lauterbrunnen, Berner Oberland. The results have shown an average increase of the timber line, tree and shrub line by 30-50 m in selected areas: Mürren, Männlichen and Wengen as well as changes in the forest, shrub and grassland surface of about 12 percent. Main changes came in through anthrop-zoogenic interactions like grazing, fertilizing, hiking or skiing, but also several geo morph dynamic processes led to changes in the flow of the timber line, released by plant succession, that formed different shapes of boundaries, which were

demonstrated with GIS.

Geomorphic responses to Holocene environmental change show that timber lines demonstrate over long term observation simplicity, because the main influence factor is the temperature for its development. However over short term intervals many different factors besides the temperature influence the timber lines and therefore should be regarded as complex landscape systems.