The Influence of vegetation on processes of shallow soil erosion in subalpine catchment areas in Western Austria

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Problem

Shallow soil erosion processes have been increasing within the last decades in the high montane and subalpine altitudinal zone of Western Austria. Explanations for the progression of eroded areas in the 2nd half of the 20th century have been the subject of various research projects.

This research project is based on an interdisciplinary, multi-scale approach and applies for a better understanding of the process catenae of the dynamics of shallow soil erosion processes in different areas of the subalpine zone in Western Austria. The focus of this poster is restricted to one catchment area and highlights the influence of different plant parameters on shallow soil erosion processes.

Aim

The aim of this poster is to figure out the role of the vegetation related to the development of erosion processes. Information about the predominant vegetation has been collected to assess their influence on shallow soil erosion processes. However, not only vegetation itself but also other parameters, such as hydrology, geology and geomorphology, have been considered but the results are not included in this poster.

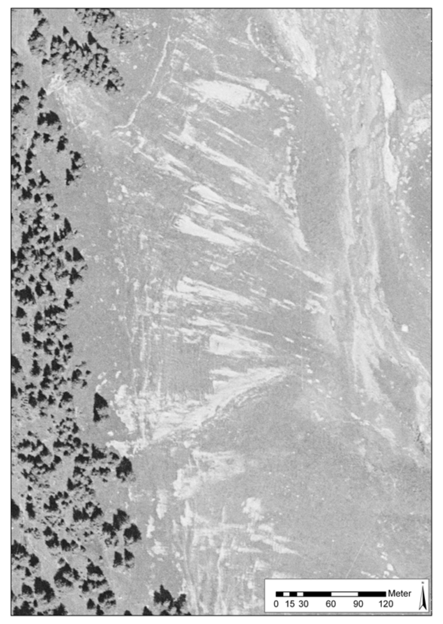

Figure 1: Detail of the orthophoto in the 50s.

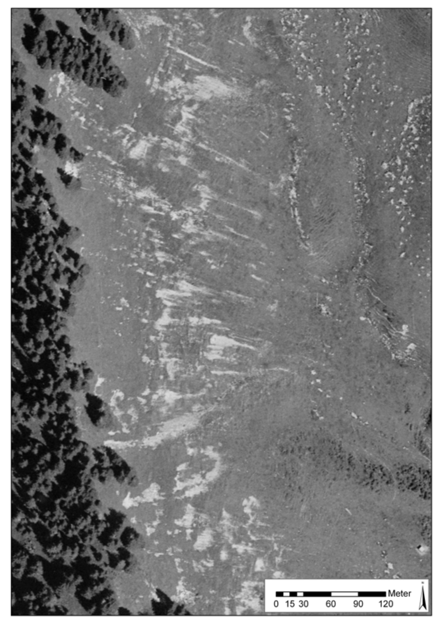

Figure 2: Detail of the orthophoto in the 70s.

Figure 3: Detail of the orthophoto in 2006.

Research Areas

The research area restricted in this poster is the Thüringerberg in Vorarlberg, Austria, marked with a yellow spot.

Figure 4: Map of Austria with the location of the research area (http://www.ginkgomaps.com).

Thüringerberg is located in the lithographic flysch unit in the subalpine zone (ca. 1600 - 1900 m a.s.l.) in Vorarlberg, in Western Austria. Its vegetation is strongly characterized by agricultural activities of local farmers, mainly alpine pasturing.

Methodology

At first, aerial pictures (see Figure 1-3) have been analysed, among others to evaluate the historical dynamis of process areas induced by shallow soil erosion processes. These aerial pictures were also used as a base for the fieldwork.
Three areas of interest were defined (see Figure 5). Within these selected areas about 914 process polygons were recorded and analysed during the field work.

Figure 5 shows the location of the three selected areas in the research area Thüringerberg.

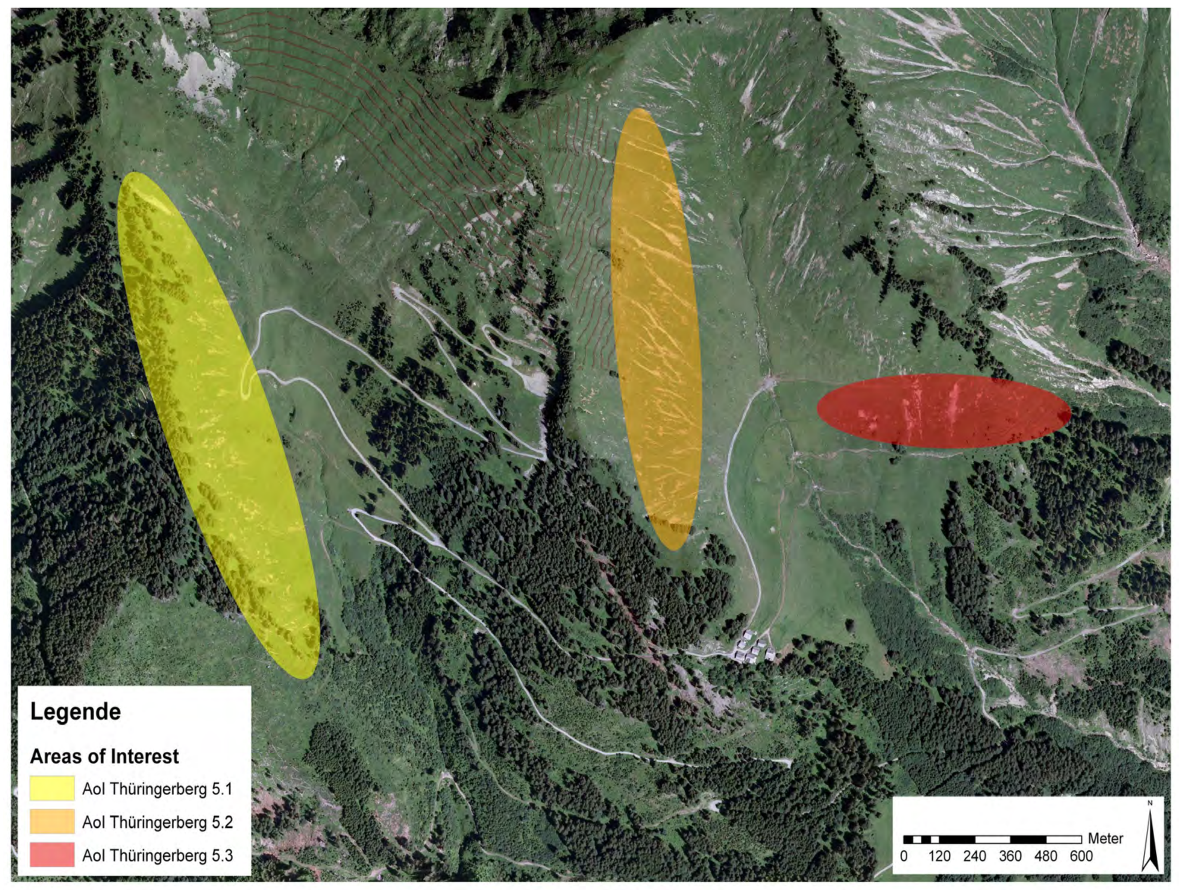

Figure 5: Orthophoto of the area Thüringerberg with the three areas of interest.

- aerial pictures have been attended to get the basis for the field work
- vegetation data has been recorded around every single soil erosion process polygon (above, sideways, below and inside)
- the observed vegetation parameters are: species, height, frequency, distribution, coverage and dominance
- several frequency analysis (27) have been performed between the process areas and around some defined processes
- plant communities and different vegetation groups were categorised
- Ellenberg indicator values for nitrogen and moisture of the occurring plants have been assigned
- correlations with important terrain parameters like: aspect, angle of the slope, and processtyp

Results and Discussion

Communities and groups of plants

The vegetation of the areas of interest at Thüringerberg is strongly characterized by agricultural activities of local farmers, mainly alpine pasturing. Generally, the vegetation can be classified in three different types of plant-groups: dry grasslands, pioneers, and higher perennial herbs. The grassland is dominated by the plant community Caricetum ferrugineae. Additionally, other forms of plant communities such as Seslerio-Semperviretum, Polygono-Trisetion, defective plant community with Agrostis stolonifera, and defective plant community with Dactylis glomerata can be found.

Ellenberg Indicator values

The indicator values for moisture in all areas of interest are quite homogeneous. However, a comparison of the situation above and below shows, that the process plots above are partly a little more dry (see Figure 6 and Figure 7).
Inside the process polygons the values are marginally lower. The reason probably is the low plant coverage insinde the process, so that the soil is drying very quickly.

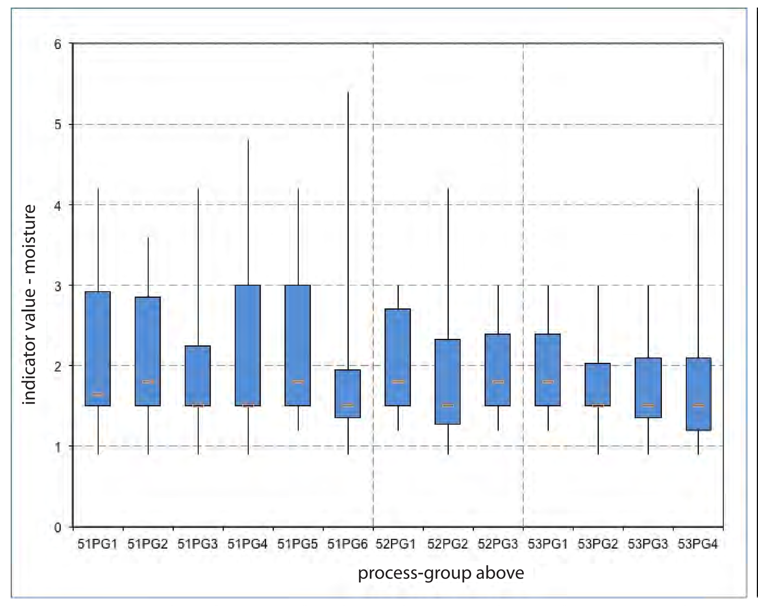

Figure 6: Boxplot-diagram for the indicator values of moisture above.

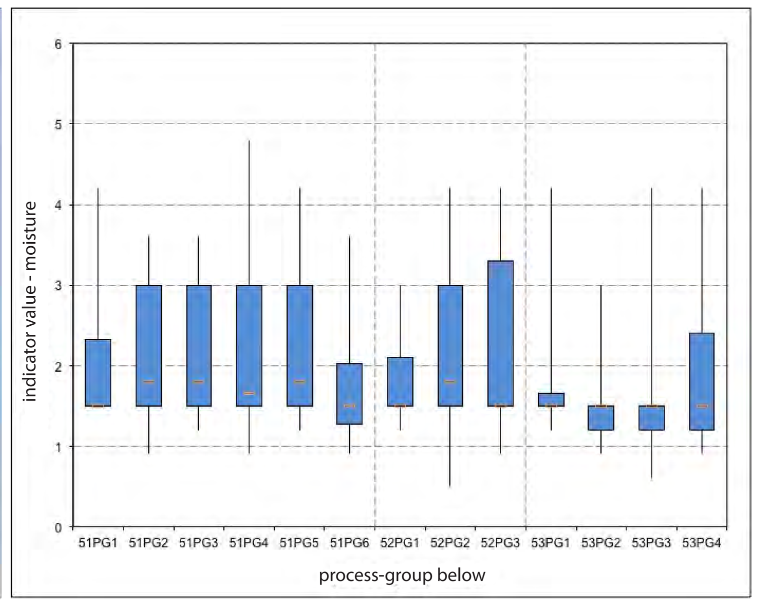

Figure 7: Boxplot-diagram for the indicator values of moisture below.

Correlations

Figure 8 and Figure 9 show the dynamics of the vegetation growth, on the one hand, compared to the aspect and, on the other hand, compared to the angle of the slope. Regarding the aspects and the dynamics of the growth, it can bee shown sparely and average vegetated process areas are appearing mainly on southeast oriented slopes. More eastern oriented plots tend to be more vegetated. This could be a hintof a better resettlement with a higer radiation oft he afternoon sun. When comparing the angle of the slope and the dynamics of the growth, it can be observed that most of the process areas are located in the angle from 25° up to 35°. However, most complete vegetated processes are located in lower angles of the slopes.

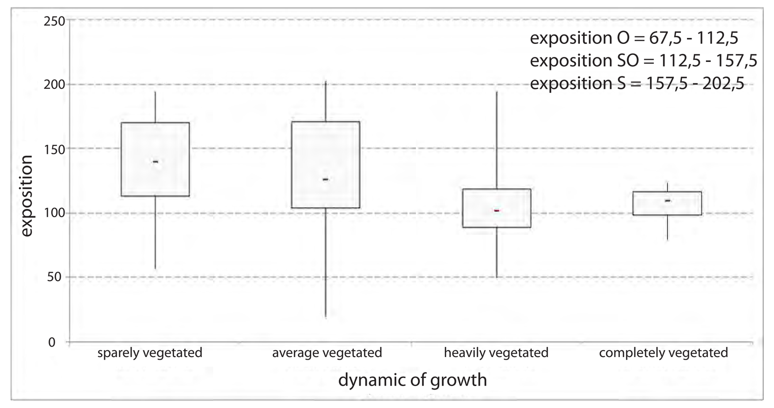

Figure 8: Boxplot-diagram for aspect and dynamics of growth.

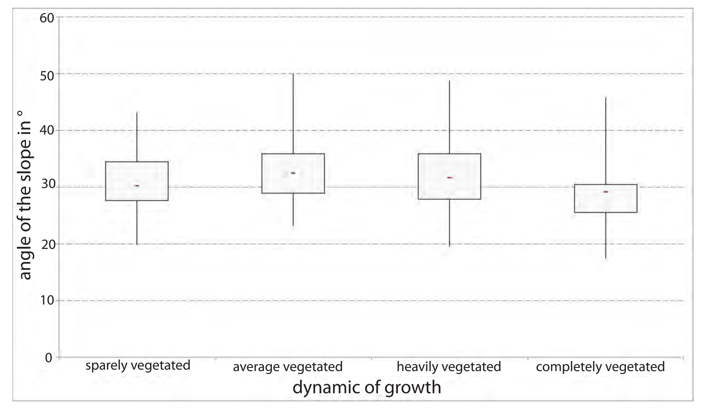

Figure 9: Boxplot-diagram for angle and dynamics of growth.

In Figure 10 various plant-groups are displayed. Furthermore, the dynamic of growth in the processes is marked in different green-tones, exemplary for one area of interest. Between the process plots there are consistently higher perennial herbs, which are regularly cut off by the local farmers. Lastly, it is also noticeable that most of the identified process areas are already strongly overgrown.

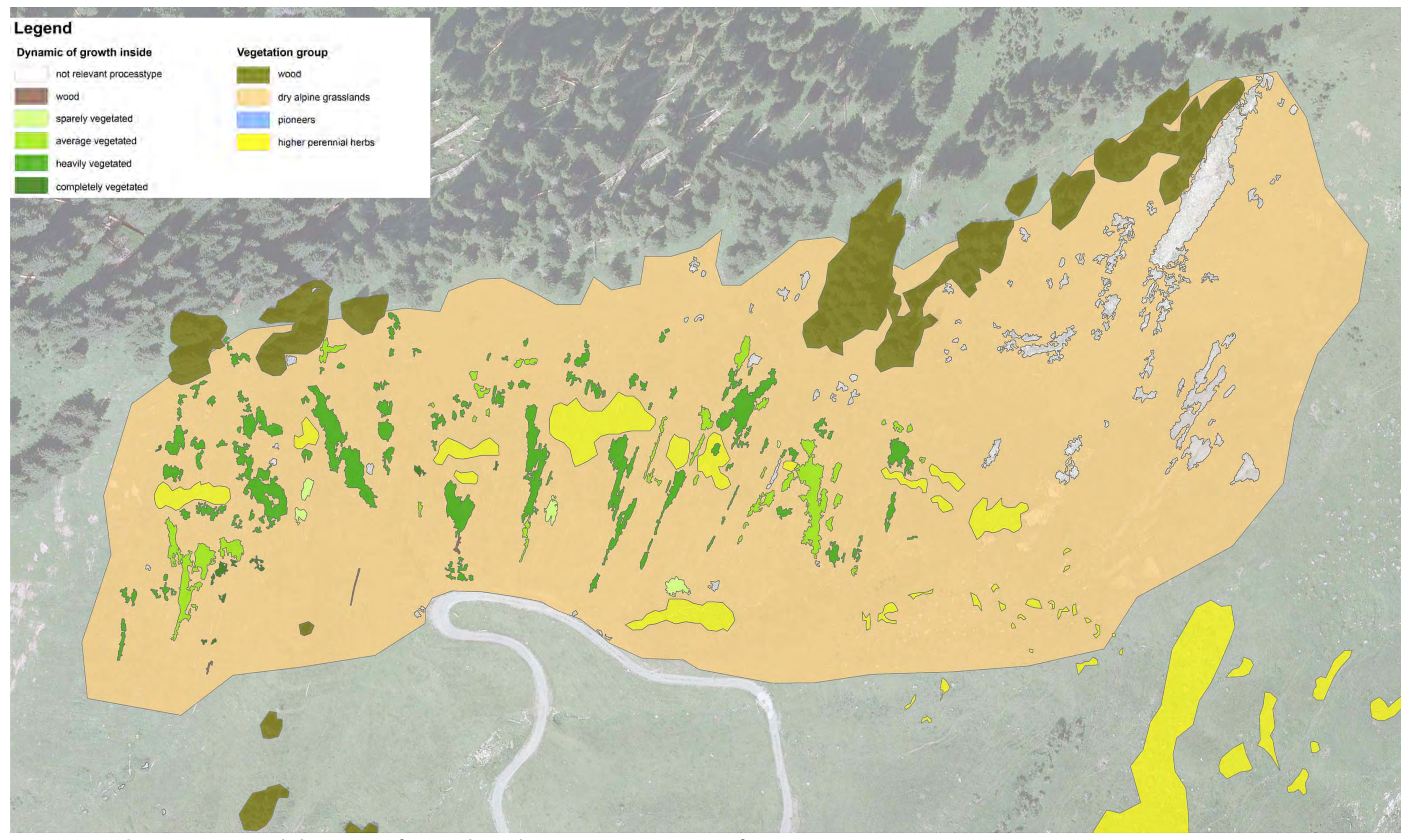

Figure 10: Plant-groups and dynamic of growth in the processes in area of interest 5.1.

Conclusion

It could be shown, that the resettlement and the dynamic of growth are related to terrain parameters, both aspect and angle of slope. Moisture values can give a hint on material elution or accumulation at the process plots. The coverage ratio in comparison with analysis of historical areal images point to a very distinct dynamic of shallow soil erosion and recovering.

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