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Patterns of Wilderness – en route to compiling an inventory of the national processes in Gesäuse National Park (Ennstaler Alps)

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Abstract

In this paper, the authors examine the composition, patterns and succession of vegetation in four different ecosystems in Gesäuse National Park (Styria, Austria), that are characterised by certain disturbance regimes. The basic methodology for compiling an overall inventory of the region's natural processes is to be established in an attempt to describe the systems in terms of their spatial and temporal patterns using structograms and dynamograms. The detailed analysis will highlight the extent to which floodings, avalanches and mudflows contribute to local biodiversity. This confirms the importance of consequently protecting the natural processes in a manner consistent with an IUCN category II national park.

Key words

Wilderness, natural processes, succession, vegetation dynamics, vegetation patterns, national park research, nature conservation

Introduction

Natural processes play a crucial role in natural science definitions and descriptions of wilderness. As shown by JUNGMEIER et al. (2016), the Gesäuse National Park, which was set up in 2002, is particularly predisposed to natural process research. Natural processes should continue undisturbed in the core zone (currently accounting for 83 percent of the area). The Gesäuse mountains are characterised by high relief intensities. This causes a large number of gravitational dynamic processes such as avalanches, mudslides and rock falls. 'Wild water – steep rock' are slogans that are associated with Gesäuse National Park. Therefore, national park research also focuses on inventory compilation (STANGL 2011) and monitoring these areas (KLIPP & SUEN 2011, HALLER et al. 2013).

The investigation of natural processes in Gesäuse National Park can be traced back to the studies conducted by EGGER (1996). The syndynamic ecosystem concept developed by this author also provides the basis for this study. In the course of the investigations, four areas characterised by disturbance dynamics in Gesäuse National Park were to be documented to provide an answer to the following questions:

- How can natural processes be described and compared in a systematic manner (method development)?
- How can the significance of these processes be assessed from the perspective of biodiversity, natural protection and national park management (analysis)?
- What conclusions can be drawn to deal with natural processes relating to the European wilderness discussion (discussion)?

Methods

Vegetation mapping was based on a total of 47 plot studies in plant communities, 42 of which were carried out along 6 transect lines overall. A further 5 recordings were documented slightly outside the transect lines. Vegetation mapping was supported by high-resolution aerial photographs, which were taken with the Hexakopter E.C.O.pteryx. The UAV (unmanned aerial vehicle, commonly known as 'drone') aerial photograph material provided a unique portrayal of the small-scale patterns of vegetation (Fig. 1, gravel bars alongside and within the river Enns).

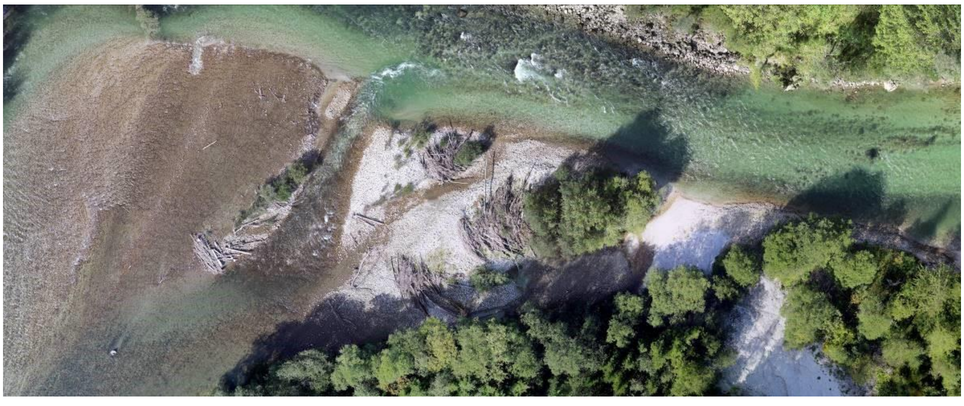

Figure 1: The aerial photograph was taken with a UAV, it shows one of the study sites at river Enns. Bed-load dynamics and flooding are crucial factors for zonation of vegetation in this area; E.C.O.pteryx/C. Hecke

The synsystematic nomenclature with brief descriptions in terms of ecological parameters and species follows GRABHERR & MUCINA (1993) and MUCINA et al. (1993). The preparation of natural processes stems from EGGER (1996). In the structograms, the spatial structure of the respective natural process is portrayed as abstracted patterns of the corresponding vegetation units. To analyse the temporal structure of a natural process, the (mostly obvious) temporal pattern of the process was generated from the spatial sample as a sequence of various vegetation units and illustrated accordingly in the dynamograms. The species in the individual vegetation units were counted in order to analyse biodiversity. An analysis of the plant life-forms according to GRIME (1979) and an analysis of indicator values according to ELLENBERG (1986) complete the picture of the respective natural process. Details on land survey methods can be gleaned from Jungmeier et al. (2016) and details on the respective land surveys per se from JUNGMEIER et al. (2014, 2015) and HECKE & JUNGMEIER (2017).

Results

Since 2014, four natural processes have been selected as part of the research project for detailed studies of disturbance dynamics. In the uninhabited regions of Johnsbach, just above the confluence of the Kainzenalblgraben in the Johnsbach, certain debris dynamics and floods determine the development and zoning of the vegetation. Disturbances are episodic and broadly reflect natural succession in a variety of ways, depending on intensity. A similar situation can be seen with the dynamic gravel bars along the Enns. In sections of the Enns that are free from river control structures, in areas such as Finstergraben and Räucherlboden, the natural processes are largely determined by debris dynamics and floods. The disturbance regime is comparable to that of Johnsbach. In the Kühgraben debris channel, water is also the defining system factor. However, the ditch is water-bearing only after heavy rainfall. There is a significant relocation of weathered material, essentially Dachstein limestone. Episodic erosion and deposits have formed patterns of stable and unstable debris fields, varying in age, which determine the way in which vegetation develops. In the Kalktal avalanche area, the ditches and channels under the Tamischbachturm are determined by avalanche events and the related disturbance dynamics. The avalanches are periodic but vary in intensity.

The spatial extent and zoning of the various natural processes are depicted in a structogram as shown in Fig. 2, citing the example of Enns. Taking Enns River once again as an example, the temporal component of disturbance dynamics is shown in the dynamogram in Fig. 3. The vegetation can be divided into different development stages arising essentially from an interplay of succession and disturbances.

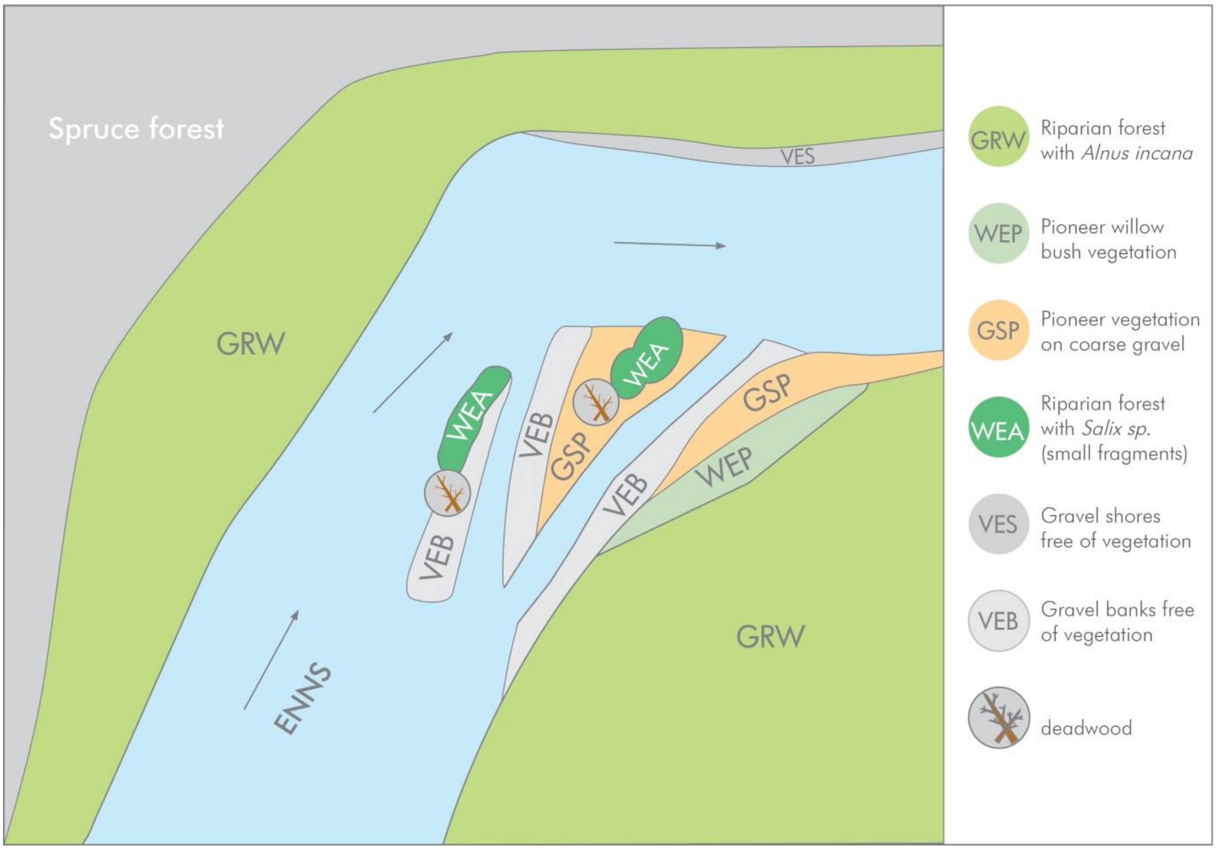

Figure 2: Structogram of dynamic habitats at study site river Enns. The chart illustrates the zonation of vegetation communities alongside river Enns; E.C.O./M. Fercher

Based on the structograms, the individual processes investigated can now be analysed comparatively. To this end, vegetation surveys are used to reach conclusions on the distribution of plant life-forms, number of species and site conditions in the respective processes. For instance, Fig. 4 shows the distribution of light-loving species according to an analysis of Ellenberg's indicator values in the disturbance systems. More detailed results are provided in the reports of JUNGMEIER et al. (2014, 2015 and 2016) and HECKE & JUNGMEIER (2017).

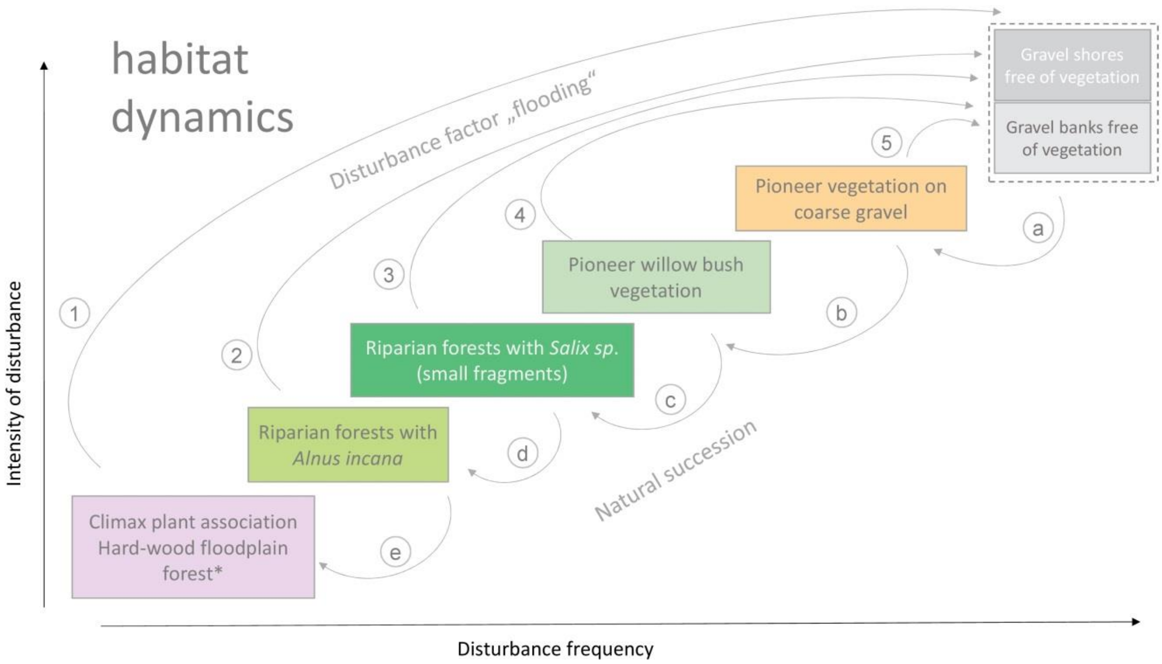

Figure 3: Dynamogram of dynamic habitats at study site river Enns. The chart illustrates how the temporal pattern of vegetation development is affected by disturbance dynamics and succession; E.C.O./C.Hecke

Discussion/Conclusion

An examination of selected natural processes reveals the complex spatial and temporal patterns which emerge through episodic and periodic disturbances. These are characterised by natural succession to the climax society and opposing disturbance regimens. The analysis shows that niches are formed in the resulting small-scale differentiation of habitats, leading to a significant increase in species. Only plant species were specifically studied but it can be assumed that this diversity is evident in animal species to a significant, if not greater, extent. Thus these natural process samples that characterise 'wilderness' are crucial factors in high biodiversity.
The applied method is used to test a procedure that allows natural processes to be detected and compared. Using this approach, the natural processes of an area, in this case the Gesäuse National Park, can be systematically recorded and will lead to a complete inventory. As regards the dynamics in largely disturbance-free climax plant communities, survey and presentation methods must be adapted. Based on corresponding surveys, a typology can be generated for the processes and the whole inventory *per se*. It is to be hoped that this inventory approach can be continued.

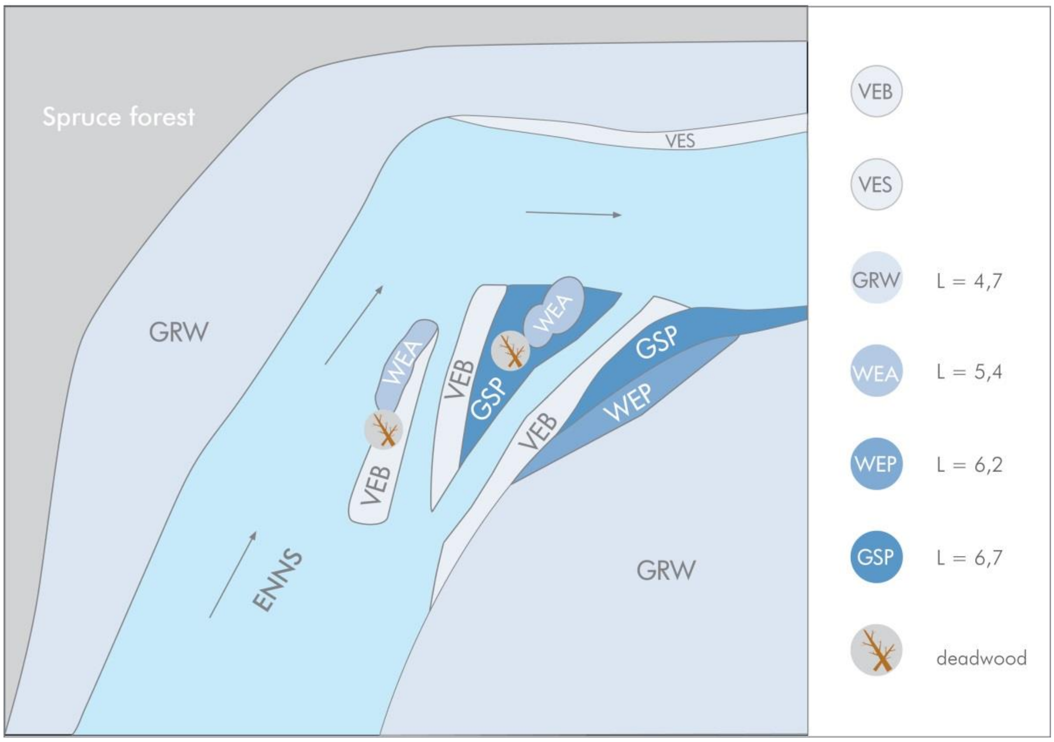

Figure 4: The structogram shows the average light values of the vegetation units according to the analysis of Ellenberg's indicator values. The scale is a 9-point scale representing a plant species preference for light intensity (1=deep shade, 5=semi-shade, 9=full light); E.C.O./M. Fercher

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