Submitted Abstract

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Abstract

Due to climate change and the associated glacier retreat, proglacial systems undergo considerable changes. The patterns of proglacial ecosystem dynamics and the adjustment towards non-glacial conditions are highly depending on time since deglaciation, initial site conditions and geomorphic disturbances. Although, several authors emphasize that an interdisciplinary approach is indispensable to develop a holistic understanding of primary succession, investigations that integrate multiple autogenic and allogenic factors are rare.

In the proglacial area of Fürkele-, Zufall-, and Langenferner (Martell Valley/ Eastern Italian Alps), the impact of various geomorphological, climatic, and edaphic parameters on vegetation cover, plant species number, and plant species composition was investigated. A total of 65 plots of 5×2 m was installed to perform vegetation analysis. Community weighted means of the Landolt indicator values (Landolt et al. 2010) were calculated for each plot. Following the geoscientific concept of spheres the effect of atmosphere (temperature, solar radiation, snow free growing degree days), cryosphere (glacier extent, distance to glacier, snow cover duration, snow free freeze thaw days), hydrosphere (topographic wetness index, precipitation), relief-/lithosphere (elevation, inclination, curvature, stream power index, landforms), pedosphere (Landolt indicator values for nutrients, soil organic matter, pH; Landolt et al. 2010; referenced using in situ soil data), and anthroposphere (grazing/trampling) on vegetation cover, species richness, and plant communities were quantified via general additive models.

Patterns in primary succession were highly related to autogenic factors and (micro-)topographic factors. Particularly, temperature variability, controlled by elevation and variability of solar radiation correlated strongly with the spatial patterns of vegetation cover. In addition, the deposition of fine material had a positive effect on it. The species richness was also positively influenced by better nutrient availability, improved water supply, and geomorphic disturbances. The number of species was thereby significantly associated to different landforms, and thus to variations in substrate and process activity.