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Geoconservation mapping using digital geomorphological maps in Vorarlberg, Austria

A.C. Seijmonsbergen (1), M.G.G. De Jong (2), L.W.S. de Graaff (2), and N.S. Anders (1)

(1) University of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics, Computational Geo-Ecology, Amsterdam, The Netherlands. A.C.Seijmonsbergen@uva.nl, N.S.Anders@uva.nl, (2) Research Foundation for Alpine and Subalpine Environments (RFASE), The Netherlands. mdejong@susures.nl, leo.w.s.degraaff@hetnet.nl

Geomorphological inventories are being made in the State of Vorarlberg (Austria) since the mid-1950s by the University of Amsterdam. Starting as an academic training fieldwork for undergraduate geomorphology students, PhD students and staff members soon recognized the research potential of the unique alpine landscape. In particular, landforms and deposits of the ice-marginal environment and pollen records preserved in peat provide valuable proxies for climate reconstruction and give detailed insight in the former growth and decay of the Rhine glacier network and of local glaciers, and assist in reconstructing landscape development in general. A project was started in 2007 to prepare community wide inventory maps of potential geoconservation areas, based on digital geomorphological mapping in a Geographical Information System (GIS). A stepwise protocol was designed for the identification of potential geoconservation areas in the landscape, comprising: 1. Preparing digital geomorphological maps, using a morphogenetic classification scheme 2. Assigning values for selected geoconservation assessment criteria to types of geomorphological features 3. Ranking the criteria assessment values into three categories of potential geoconservation value, and 4. Storing, visualizing and describing the geoconservation data. Four major traits are used in the weighting and ranking protocol (steps 2 and 3): scientific relevance, frequency of occurrence, disturbance, and environmental vulnerability. The process of assigning values and of ranking the landforms and deposits has been automated in GIS. For the evaluation of disturbance we use digital infrastructure layers in GIS which can be intersected with the potential geoconservation areas to determine the level of disturbance. The proposed method is demonstrated for the municipality of Lech, a well-known winter skiing resort. To illustrate the loss of high-rank potential geoconservation areas due to human influence over the last 50 years, we used digital multi-temporal panchromatic ortho-rectified air-photos from the nineteen fifties, seventies and nineties to detect changes in land use and infrastructure. The disturbance criterion – linked to infrastructure – influences the weighting and ranking of potential geoconservation areas, which makes it possible to monitor and calculate the loss of high-rank potential geoconservation areas over time. It also allows visualization of potential geoconservation loss in future scenarios. The method used here enables us to: 1. identify and delineate potential geoconservation areas systematically using geomorphological information and 2. make a ranking in terms of significance using well-defined weighting and ranking criteria in a GIS and 3. quantify past and projected loss of geoconservation areas due to expanding infrastructure.