

Publication

A model-based reconstruction of Holocene treeline dynamics in the Central Swiss Alps

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)**ID** 4488097**Author(s)** Heiri, C.; Bugmann, H.; Tinner, W.; Heiri, O.; Lischke, H.**Author(s) at UniBasel** [Heiri, Oliver](#) ;**Year** 2006**Title** A model-based reconstruction of Holocene treeline dynamics in the Central Swiss Alps**Journal** Journal of Ecology**Volume** 94**Number** 1**Pages / Article-Number** 206-216**Keywords** climate change; European Alps; FORCLIM; forest succession model; Holocene; macrofossils; palaeobotany; pollen data; treeline dynamics; vegetation response

1 We used the forest succession model FORCLIM simulate Holocene treeline dynamics along an elevational transect in the Central European Alps, in order to explore the extent and cause of changes in treeline altitude and composition. 2 A temperature reconstruction independent of vegetation proxies was used to drive the model, and the simulation results were compared with Holocene pollen and macrofossil records from a nearby site close to the present-day treeline. 3 The simulation results yielded treeline fluctuations of about ± 100 m (2375-2600 m a.s.l.), confirming earlier palaeoecological studies and quantitatively corroborating the interpretation of most palaeoecologists that decadal- to centennial-scale Holocene fluctuations of pollen and plant macrofossil frequencies reflect treeline shifts rather than productivity changes alone. 4 The simulated changes in species composition and treeline position show general agreement with palaeobotanical data between 11 000 and 4500 calibrated radiocarbon years BP. In the late Holocene, however, palaeobotanical evidence indicates a distinct lowering of the treeline, while simulation projected continuous forest cover up to an altitude of 2400 m a.s.l. 5 Our results indicate that changes in temperature alone can account for changes in treeline elevation for the first half of the Holocene. The discrepancy between simulation results and palaeobotanical records since 4500 cal. BP supports the hypothesis of a strong human influence on the Alpine treeline during the late Holocene. 6 Combining palaeoecological methods with vegetation modelling can disentangle climatic effects and early human impacts on long-term vegetation dynamics. Forest succession models may not only help palaeoecologists to achieve a better understanding of the factors driving past vegetation changes, but their validation with long-term empirical data is also an important step towards applying these models to the assessment of future vegetation dynamics in a changing climate.

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