

## **Vegetation dynamics and plant species distribution under changing climates**

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Quaternary climate variability strongly affected ecosystems and vegetation. Climatic oscillations became more moderate during the Holocene, and vegetation reorganizations in response to climate eventually shifted from the biome to the community level during the past 11500 years. Superimposed on climate variability, land use significantly altered European vegetation structure and composition during the mid and late Holocene. Anthropogenic alterations of vegetation during the past 8000 years included contractions and extensions of ranges and realized niches of species. Such paleo-ecological information can be used to infer measures to preserve future biodiversity and ecosystem services under global change conditions. The combination of paleoecological evidence with dynamic vegetation modeling allows investigating spatially explicit transient stages of past and future vegetation shifts under global change conditions. Specifically, dynamic modelling projections may be used to investigate open paleoecological questions or to plan paleo-validated climate-impact mitigation strategies at local to regional scales.