

# BACKLAND: spatially explicit and high resolution pollen-based BACKward LANDscape reconstructions.

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## Abstract

Studying the interactions between humans, landscapes and biodiversity is necessary for the sustainable management of socio-ecosystems and requires long-term reconstructions of past landscapes, improving the integration of slow ecological processes. The main source of information on past vegetation is fossil pollen, but pollen data are biased by inter-taxonomic differential production and dispersal. The Landscape Reconstruction Algorithm (LRA) approach is today the most widely used to correct pollen data for these biases and also allows to identify the spatial extent of the local vegetation reconstruction zone via the Relevant Source Area of Pollen (RSAP). While LRA estimates have already been integrated into certain past land-cover mapping approaches, none have been designed to allow the diachronic reconstruction of the land-cover mosaic of a landscape over the long term combining the following points: the direct integration of LRA estimates as a source of variability in the composition and distribution of pollen taxa, without resorting to multiple scenarios, and the integration of spatiotemporal autocorrelation in the taxa distribution between two periods. In this study, we propose an innovative approach for Backward Landscape reconstruction (BACKLAND), combining these previous points and estimating past landscapes within a set of RSAPs. Based on three stages using parsimonious assumptions and easy-to-implement probabilistic and statistical tools, the implementation of this approach requires LRA estimates of sites with overlapping RSAPs, botanical data, a Digital Elevation Model and two recent land-cover maps. Developed and tested on a small study area within the mountain landscape of the Bassiès valley (French Pyrenees), BACKLAND achieved the reconstruction of a past land-cover map representing eight land-cover types at a spatial resolution of 20m with a good level of accuracy. We showed in this study the originality of this approach and discussed its potential for palaeoenvironmental studies, historical ecology and the management of socio-ecosystems.

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