POLLENOMICS: Decoding the Farming History of Europe Using Advanced Statistics to Combine Ancient DNA with Paleo-Pollen Data

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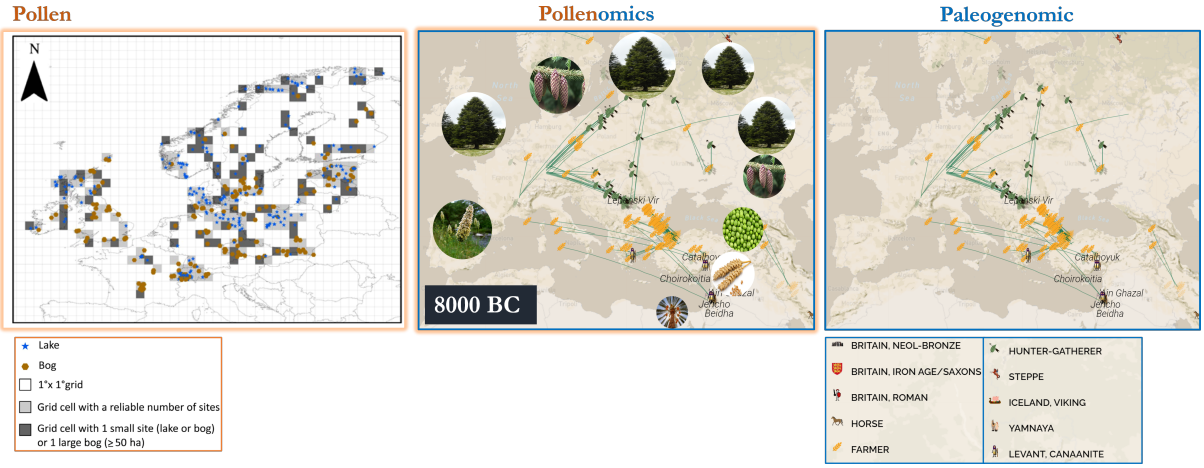

Pollenomics: Integrating pollen and paleogenomic data to infer spatiotemporal human migrations.

Keywords: Land use and land cover change, Paleo-Pollen REVEALS reconstruction, ancient DNA, Bayesian hierarchical modelling

Abstract:

This study uniquely combines advanced continental-scale data from two distinct sources: pollen-based past land cover (paleoecology) and ancient DNA (aDNA), developing a novel statistical model for spatiotemporal reconstructions of past land use across Europe. This groundbreaking approach integrates paleo-pollen and aDNA data, providing unprecedented insights into the environmental impacts of Holocene human migration and subsistence practices.

Employing Supervised Machine Learning algorithms, the study identifies geographic-specific mutations in over 20,000 European Holocene aDNA samples to trace human migration patterns. Bayesian models are utilized for constructing probability maps of land-cover types from pollen data, to be compared with migration patterns from aDNA data. In addition, aDNA data serves as a proxy for human habitation, differentiating anthropogenic and natural land cover changes from paleo-pollen land cover reconstructions. This will be accomplished using a hierarchical statistical model that combines Gaussian Markov random fields and point process models. The study also integrates the LPJ-GUESS model to assess the impact of land use and land cover change (LULCC) on vegetation and carbon pools.

Key outcomes include combined pollen- and aDNA-based LULCC datasets, a consensus map of European agriculture spread, and insights into human-land interactions. The study marks a major advancement in understanding human-environmental dynamics over millennia.

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