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Reconstructing and quantifying human impact in contrasting environments: a palynological and statistical approach

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Reconstructing and quantifying human impact is an important step to understand human-environment interactions in the past. To fully understand the role of human impact in altering the environment during the Holocene, detailed reconstructions of the vegetation changes and quantitative measures of human impact on the landscape are needed. Statistical analysis of pollen data has recently been used to characterize vegetation changes and to extract semi-quantitative data on human impact. In this study, multivariate statistical analysis (cluster analysis and non-metric multidimensional scaling (NMDS)) of pollen data was used to reconstruct human induced land use changes in two contrasting environments: central Belgium and SW Turkey. For each region, pollen data from different study sites were integrated. The data from central Belgium shows the gradually increasing human impact from the Bronze Age onwards (ca. 3900 cal a BP), except for a temporary halt between 1900-1600 cal a BP, coupled with the Migration Period in Europe. Statistical analysis of pollen data from SW Turkey provides new integrated information on changing human impact through time in the Sagalassos territory, and shows that human impact was most intense during the Hellenistic and Roman Period (ca. 2200-1750 cal a BP) and decreased and changed in nature afterwards. In addition, regional vegetation estimates using the REVEALS model were made for each study site and were compared with the outcome of the statistical analysis of the pollen data. It shows that for some cases the statistical approach can be a more easily applicable alternative for the REVEALS model.
Overall, the presented examples from two contrasting environments shows that cluster analysis and NMDS are useful tools to provide semi-quantitative insights in the temporal and spatial vegetation changes related to increasing human impact. Moreover, the technique can be used to compare and integrate pollen datasets from different study sites within one region. Our study extensively discuss and illustrate the possibilities and limitations of statistical analysis of pollen data to quantify human induced land use changes.