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New approach to quantitative reconstruction of past vegetation inferred from fossil pollen – implications for applications within climate research

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A new approach to quantitative reconstruction of past vegetation inferred from fossil pollen is presented. This approach was named the Landscape Reconstruction Algorithm (LRA) (Sugita 2006 a and b, submitted). It is based on the use of models of the pollen-vegetation relationship and of pollen dispersal and deposition. The approach is based on the validation of two major hypotheses: (1) Large basins (lakes and bogs of over ca. 100 ha) are characterized by pollen assemblages that do not vary significantly between sites for a particular time and in a specific vegetation region, and (2) Small basins (lakes and bogs of 0.5 to ca. 5ha) are characterized by pollen assemblages that may differ significantly between sites for a particular time and in a specific vegetation region, i.e. the small sites register within-region differences in vegetation at the local scale. These hypotheses have been validated both by simulated and empirical data. These characteristics of pollen dispersal and deposition imply that it is possible to reconstruct past plant abundance in percentage cover of various taxa or groups of taxa with much greater accuracy than possible earlier, both at the very large regional scale (100x100 km^2) and at the local scale (1x1km^2), using a combination of fossil pollen assemblages from large and small basins. The application of the LRA implies that estimates of pollen productivity and fall speed of pollen are available for the key taxa of the region under study. Such parameters are available for southern Sweden and several other European regions, or in the process to be produced. The LRA will be described in details and illustrated by examples. First results of land-cover reconstructions for Scandinavia will be presented. The ability to reconstruct past vegetation abundance in percentage cover at both continental-subcontinental and local scales provide enormous

potentials for application in a number of research fields, e.g. for testing vegetation and climate models in the past and testing hypotheses such as those of Ruddiman (Anderson et al. 2005, submitted). Examples of applications within climate research will be discussed and illustrated.

References

Anderson, N. J., BugmannH., Dearing, J.A. and Gaillard, M.J. 2005 (submitted): Linking models and palaeoenvironmental data: understanding the past and the future. Submitted to TREE.

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