Geophysical Research Abstracts
Vol. 18, EGU2016-6169, 2016
EGU General Assembly 2016

Quantitative land-cover change in space and time over the last 11 000 years in the Baltic Sea catchment area and Norway – implications for studies on vegetation-climate interactions and land-use as a forcing of climate change

Anna-Kari Trondman (1), Marie-José Gaillard (1), Anne Birgitte Nielsen (1,2), Sugita Shinya (3), Birks John (4), Bjune Anne (5), Kangur Mihkel (3), Lagerås Per (6), Latalowa Malgorzata (7), Lindbladh Matts (8), Poska Anneli (2), and Veski Siim (9)

(1) Department of Biology and Environmental Science, Linnaeus University, Kalmar, Sweden (anna-kari.trondman@lnu.se), (2) Department of Physical Geography and Ecosystem Science, Lund University, Sweden, (3) Institute of Ecology, Tallinn University, Tallinn, Estonia , (4) Department of Biology and Bjerknes Centre for Climate Research, University of Bergen, Bergen, Norway, (5) Uni Research Climate & Bjerknes Centre for Climate Research, Bergen, Norway, (6) National Historical Museums, Lund, Sweden, (7) Laboratory of Palaeoecology and Archaeobotany, Department of Plant Ecology, University of Gdańsk, Gdańsk, Poland , (8) Southern Swedish Forest Research Centre, Swedish University of Agricultural Sciences, Alnarp, Sweden , (9) Institute of Geology, Tallinn University of Technology, Tallinn, Estonia

Quantification of the effect of human-induced land-cover change (land-use) on climate in the past is still a subject of debate. Although we know that both biogeochemical and biogeophysical processes between the land surface and the atmosphere due to anthropogenic land-cover change lead to significant effects on climate, we still know little on the net effect of both types of processes. For instance climate modelling studies have shown that the extent of deforestation in Europe between 6k and 0.2k - as proposed by the KK scenarios of Anthropogenic Land Cover Change (ALCC) of Kaplan et al (2009) - has either warming or cooling biogeophysical effects on the geographical location (Strandberg et al., 2014). Further progress in our understanding of the effects of land-use change on climate greatly depends on the availability of reliable, empirical data on past land-use changes in quantitative terms. We present here pollen-based estimates of regional vegetation cover over the Holocene in the catchment of the Baltic Sea and in Norway. The regional abundance of individual plant species, genus, and groups of taxa were estimated at a 0.5k - to 0.1k – calender year time resolution using 339 pollen records and the REVEALS model (Sugita, 2007). Although there are very large differences between pollen percentages and REVEALS estimates of plant cover in terms of percentage values, the general trends in relative changes of the large landscape units (coniferous trees, deciduous trees, and open land) over time are comparable between the two. However, the ages obtained for the establishment of all tree taxa using a "REVEALS estimate threshold" of 1% are almost all older (by 0.5k years or more) than the ages inferred earlier from pollen percentages, and the times of maximum abundances of the tree taxa, as well as the relationships trees/openland and coniferous/deciduous are different between pollen percentages and plant cover. The pollen-based REVEALS cover of open land confirms the earlier observation that REVEALS estimates of landscape openness are generally much higher than the percentages of pollen types indicative of open land. The two major and fastest increases in landscape openness occurred from i) c. 1.5k (in most of the study region) and ii) c. 0.5k (in the entire study region). The time of highest landscape openness in the entire study region was between 0.5k and 0.2k, with maxima of c. 50 to 90% in the temperate zone, and c. 40% in the hemiboreal zone. Before 1.5k, landscape openness was largest in the temperate and hemiboreal zones of the study region (20-30% around 5k and 35-60% around 3k). Therefore, human-induced deforestation was already significant in Mid Holocene. The effect on climate of the successive land-use changes (deforestations) between 5k and 0.2k are not known and worth studying.

References: Kaplan JO et al. (2009) Quaternary Science Reviews 28(27-28): 3016-3034. doi: 10.1016/j.quascirev.2009.09.028; Strandberg G et al. (2014) Clim. Past 10: 661-680. doi:10.5194/cp-10-661-2014; Sugita S (2007) The Holocene, 17(2): 229–241. doi:10.1177/0959683607075837