

Importance of climate, forest fires and human population size on the long-term boreal forest dynamics in Northern Europe

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Palaeoecological data provides valuable information for understanding the processes behind the past changes in forest composition, and hence can provide important knowledge regarding the potential effects of future changes in climate on boreal vegetation. Furthermore, it is essential to consider both regional and local factors in order to better understand the processes behind the boreal forest dynamics.

The relative importance of climate, forest fires and human population size on long-term boreal forest composition were statistically investigated at regional and local scales in Fennoscandia. Statistical method variation partitioning was employed to assess the relative importance of these three variables. Fossil pollen data reflecting long-term boreal forest composition, at both regional (lake records) and local (small hollow records) scales from Russia, Finland and Sweden, were used as response matrix. Climate, generated from a climate model and oxygen isotope data, past forest fires generated from sedimentary charcoal data and human population size derived from radiocarbon dated archaeological findings were used as potential drivers of long-term boreal vegetation.

Though the results clearly demonstrate that climate is the main driver of long-term vegetation changes at the regional scale, the role of climate notably is smaller at local scale and the influence of local site specific factors increases. However, the relative importance of forest fires on long-term changes in boreal forest composition remain generally low both at regional and local scale. The relatively low importance of both climate and forest fires on the variation in long-term boreal forest composition at local scale demonstrates the complexity of factors affecting stand-scale forest dynamics. In general, the relative importance of human population size on long-term changes in boreal vegetation was low. However, this was the first time that this type of human population size data was statistically applied to explain the long-term changes in boreal forest composition. The low explained variation may be due to the fact that the population record is based on archaeological and historical data and is an average estimate for the whole study region and therefore might reflect population data from a different regional scale than our palaeoecological data.