Geophysical Research Abstracts
Vol. 20, EGU2018-14760, 2018
EGU General Assembly 2018

Ecological history of four headwater catchments by anthracological analyses of kiln sites in the northern Vosges

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The northern Vosges is a hilly sandstone area in North-East of France which has undergone profound economic and social changes due to decreasing industrial and agricultural activities during the last century. This changes have led to land abandonment and the landscape is now dominated by forests that are managed for timber production. Since the Late Middle Ages until the Modern Age, it is well known that local historical glass and metal industries have repeatedly used large amount of woods. Such wood consumption has probably influenced local forest dynamics, with potential effects on the current state of the local ecosystems. This appears even easier to postulate when observing the large number of historical kilns that subsist today in the landscape. They constitute small-scale anthropogenic archives that might provide useful insights about the past wood charcoal production.
Therefore, we performed anthracological and dendroanthracological analyses on these archives to evaluate the historical composition of the forest at a local scale. Four small catchments were investigated and each kiln was geolocalized. A total of 266 kiln sites were found and 124 of them were sampled, collecting 100 charcoal pieces per kiln. Overall more than 12 000 charcoal pieces were analyzed by identifying the species and the diameter of the wood from which it comes. About 10 radiocarbon dates were done to estimate the periods of charcoal kilns exploitation.
Although the charcoal production was already known in the northern Vosges, our first results show the very high spatial density of kiln sites which mainly date from the XVII and XVIII centuries. Identification of charcoal pieces revealed high densities of Fagus and Quercus with variable densities of Betula, Carpinus, Pinus and, more rarely, Tilia and Alnus. In comparison with the current forest species distribution it is interesting to note that, just like today, forest ecosystems were dominated by Fagus and Quercus and that Betula was well represented. In contrast, we notice that Pinus is the only conifer we rarely found, whereas this species is actually widespread. Carpinus also seem to be more present in the past.
Our results suggest that historical charcoal production may have impacted both forest dynamic and indirectly headwater streams functioning by changing both the quality and quantity of litter inputs to aquatic ecosystem. Now, a challenging question has merged: to what extent such past activity still continues to affect both terrestrial and aquatic ecosystems? To investigate this question anthracological data will be coupled to actual forest survey data, soil physico-chemical properties on kiln sites as well as biotic and abiotic characteristics of stream ecosystems will be assessed. Gathering this interdisciplinary data is a great opportunity to study the potential effects of past on the actual functioning of ecosystems, even after several decades or centuries.