The needs for high spatiotemporal resolution to define forest ecological references

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Résumé

Past forest references play an important role in the understanding of ongoing and future forest changes. As initial, pristine, pre-disturbance, less degraded forests, etc., the ecological references allow to undertake comparative analyses with present and future forest states, on various scales of time and space. Therefore, working on the forest transition, to identify forest ecological references remains of first interest. However, classically, these ecological references are identified on long temporal scales (i.e., "before the anthropogenic impact becomes significant") and on large spatial scales (i.e., landscape and above). Such spatiotemporal resolution no longer appears to be adapted to the needs for knowledge and the stakes of forest management, particularly considering the ecological transition implying needs for sustainable management, biological conservation, or ecological restoration.
Indeed, it appears that reference states "before the anthropogenic impact becomes significant" are not relevant to understand the ongoing changes, or at least not if these reference states are considered as an absolute, fixed, reference state. When considering that human exterminated the populations of large herbivores in Europe during the Paleolithic, which were key parameters of natural forest dynamics, we can consider that reference states "before the anthropogenic impact becomes significant" are not suitable targets. It also appears that reference states defined on large spatial scales can induce the "smoothing" of local heterogeneity, at the scale of forest stations, and can therefore induce the loss of information. These variations are important since it is at the local scale (i.e., the forest plots) that forest management, and therefore the transition, is carried out.
To illustrate the needs and interests to define forest ecological references with higher spatiotemporal accuracy we present paleoecological works relying on pedoanthracological analysis in the forests of Sainte Baume, in the south of France, and of the Plateau Lorrain, in the north-east of France. The pedoanthracology is a paleoecological method using the signals from macroscopic charcoal pieces buried in soils, locally, after fire events, and preserved in-situ (i.e., at catchment scale) possibly during millennia. Their quantitative and qualitative analyses permit to reconstruct the composition of past forests and their dynamics. The studies presented here illustrate the importance to work in high spatiotemporal scales to identify forest ecological references. We show, notably, that paleoecological data in high spatiotemporal resolution make possible to identify intra-forest disturbances and post-disturbances resilience, as well as patterns of diversity of forest tree species which differ depending on the considered spatial scale. We also point-out the importance to define past forest references in a chronologically "continuous" paleoecological trajectory, over long time, up to current dynamics.

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