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# Impacts of land use changes on biodiversity. An example from forests

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**Summary**

Land use changes are a prominent feature of this world. Forests and woodlands have been and still are replaced with farmland and built-up areas. Humans do not seem to think about the reversibility of these changes! Forest clearance, actually going on at an alarming rate in the developing countries, exerts a profound effect on biodiversity. Particularly in the developing countries of Latin America and Asia, many taxa are driven to extinction even before they have been described. In Europe, the change from forest to other land use forms has a long history starting from Neolithic times. In Flanders, forest has not been more stable than any other form of land use, yielding large spatial changes between e.g. the late 18$^{th}$ century (maps of Count de Ferraris) and the 20$^{th}$ century landscape.

In this presentation, we focus on the effects that land use changes from forest to farmland, and back, have on the diversity and composition of forest plant species. Therefore, we made a comparison between ancient and recent forests. The former are considered a legacy of the past ('past-natural forests'). Both are showing the effects of management and habitat continuity. The change from forest to farmland would be less problematic if re-afforestation resulted after a relatively short time in fully developed forest stands comparable to the ancient forests. The (re)colonisation of recent forests by forest plant species was also studied. Over the last decade, EU afforestation incentives yielded more than 0.5 million ha of newly established deciduous forest in western Europe.

A land use change from forest to farmland is a dramatic change in habitat, and the main ecological difference is the enormous increase in light intensity, but also soils may be altered to a considerable extent. The consequence for biodiversity is an almost complete loss of forest species. However, forest clearance following by grazing may have less profound effects on forest species than a change to arable land. In the latter, it is impossible for forest plant species to survive farming, as regular disturbance through ploughing inevitably destroys all forest species populations. If grazing follows forest clearance, some forest plant species may survive, depending on the grazing intensity, the survival of scrubs and manuring. So forest land use changes result in the first place in habitat destruction and the loss of forest species. If we compare forest plant species composition between ancient and recent forest stands, we can conclude that a considerable number of plant species are limited to the ancient forest (in a review of the literature on NW Europe, we found that about 132 forest plant species almost exclusively occur in ancient forests, i.e. 34% of the forest plant species of deciduous forests). On a local scale, e.g. an area between Leuven, Diest and Tienen (80 km$^2$) with 241 forest patches, we observed that 51 of the 103 forest plant species found (i.e. 49.5%) significantly showed an aggregation with ancient forest patches. The remainder also occurred in recent forest stands; they survived the non-forest land use and/or they recolonised the stands after afforestation. The difficulties in colonisation are the spatial characteristics of the newly established forest stands (isolation, shape and area), imposing dispersal limitation, and the duration and intensity of the farmland use, leading to changes in habitat characteristics influencing recruitment probability. Colonisation rates of ancient forest plant species from ancient to adjacent recent forest stands ranged from less than 0.05 to 1.15 m per year. When the new forest stand was situated further than 200 m from the ancient forest stand, then the probability of occurrence of many forest plant species almost dropped to zero.

Apart from habitat destruction, forest fragmentation thus affects both the intra-patch survival of forest plant species and the colonisation of newly afforestated stands. The former is mainly driven by edge effects and their penetration into the forest core habitat. We can conclude that forest plant species migration -essential to cope with global climate change- is far too low to allow for a northward shift in range!

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