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## **The EU project RECIPE: understanding and managing peatland restoration.**

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RECIPE – Reconciling commercial exploitation of peat with biodiversity in peatland ecosystems – compared peatland regeneration at five cut-over sites: Finland, Scotland, Switzerland and two in France. Our aim was to compare the vegetation, microbiology, soil chemistry, carbon (C) dynamics and socio-economic aspects and make some general observations and recommendations.

Cut-over mires have been used for a large range of activities and as a consequence the peatland regeneration potential is very much site dependent. Some activities have strongly modified the structure and the functioning of the ecosystem, especially in terms of biodiversity and C-sequestration.

It is generally assumed that the restoration of a *Sphagnum* cover suffices to restore the C-sequestration function. Indeed, we have seen the reestablishment of C sink function in both *Sphagnum*-dominated and *Eriophorum*-dominated cutover bog within 20 years. However this is not always the case. Secondary cutover bogs may function as C sinks, but usually not in the very early stages. Furthermore, the C-sequestration function may peak at an intermediate stage and then lessen.

It is often stated that methane emissions could be reduced by keeping water tables so low that most of the CH<sub>4</sub> is oxidised to CO<sub>2</sub> before entering the atmosphere. In contrast, plant carbon sequestration is known to reach an optimum at high water levels. Thus, there is a trade off between these two variables but so far the effect on the peatland's total C budget has not been studied in detail. Results from Finland imply that water levels as low as -20 cm below the surface are enough for maintaining a carbon sink. However, since methane is 21 times stronger as a greenhouse gas compared to CO<sub>2</sub>, very high water levels, ranging from -10 to -6 cm, are needed for a net cooling effect.

These considerations indicate that peatland managers need ongoing monitoring of the C sequestration status of restored sites (if this is one aim of restoration). One cannot assume that the presence of *Sphagnum*, or even the accumulation of a new peat layer, is necessarily indicative of C accumulation as any C fixed may be balanced by C mineralisation from deeper horizons. However, once the new acrotelm has reached 20–30 cms we can be reasonably confident of net accumulation.

Changes in microbial communities across the regeneration sequences are related to differences in organic matter properties and the presence of certain plants. These results confirm the important role

of labile carbon in determining the activity of the microbial communities. Microbial biomass dynamics over the 55 year chronosequence (considering all RECIPE sites) illustrated the poor conditions during bare peat recolonization. We observed a lag time of ca. 10 years in the early stages of succession. Vegetation colonization and increasing plant diversity have positive effects on the development of the microbial pools, which significantly increase at the intermediate stages (from 10 to ca. 40 years after abandonment). These results suggest that microorganisms and peat organic matter properties can be used as bioindicators for ecosystem regeneration and ecosystem function.

The project has highlighted that across Europe there are very varying attitudes to the exploitation, conservation and rehabilitation of peatlands. In many areas, exploitation continues to be a source of a valuable raw commodity and of income for rural communities. However, the tendency to conserve and rehabilitate rather than exploit varies inversely with the absolute area of peatland within each region though other cultural values also play a role and there is increasing pressure in many regions to promote peatland conservation.