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Promoting ecological engineering for restoration of biodiversity in temperate forests

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Abstract

Historically, Temperate Forest managers have both used civil engineering and biological engineering to restore mountains and dunes. In each particular cases, they have applied ecological principles to optimize one function: flood regulation or counteract soil erosion. In these cases, ecosystem functions reflect the capability of the ecosystem to provide functions of value to humans.

Some others forest practitioners used biological interactions and biotic controls to manage uneven-aged stands especially in mountain forests. First of all, this so-called "close-to-nature" sylviculture based on ecological principles aimed to optimize productivity (e.g. organic matter turn-over) not biodiversity. This First Act just required the knowledge and control of both coarse biological and physical processes at local scale.

But, the challenges inherent to solve multi-scale environmental changes are crucial today. The study and practice of environmental assessment increasingly recognize the importance of scale and cross-scale dynamics in understanding and addressing global environmental change in order to improve the role of biodiversity.

Examples taken in biological invasions like *Prunus serotina*, in conservation biology like the shift in altitude of many herbaceous plants in the northern part of Europe illustrate it. The problem is that the consequences of interventions on forest ecosystem dynamics are not known.

In order to achieve this crucial issues, modelling approaches in systems dynamics are developed. Spatial modelling is rapidly becoming a key component offering a consistent, repeatable, affordable and ecologically explicit method. We developed such model at a landscape level using biological traits associated with huge environmental databases in order to optimize several ecosystems services. Some examples to mitigate the impact of climate change in temperate forest were assessed.

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