A Mathematical Model to Investigate the Impact of Climate Change on Forest Ecosystems and a Strategy for Its Regeneration

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Abstract : In recent years, scientific research has paid particular attention to the link between the balance of forest ecosystems and climate change in an international context of global warming that threatens the health of biodiversity as well as the functioning and progress of our societies. Forest ecosystems play an essential role in biodiversity and human well-being. Their conservation and protection are therefore unavoidable issues and will become major challenges in the near future.

In this presentation, we model the impact of climate change on forest ecosystems and their regeneration. In particular, this study explores the dynamics of tree mortality in a warming world, as well as the global effect of temperature on forests through the use of a penalty function. We examine a solution proposed to save forests : the active regeneration of forest ecosystems. This work highlights two recently studied principles : (i) the increase of temperature plays a major role in tree mortality, and (ii) the introduction of an enriching species into the forest (ecosystem regeneration) can promote the regeneration of endemic species, which in turn contributes to ecosystem restoration. By understanding these dynamics, we can develop more effective conservation strategies to enhance forest resilience in the face of climate change. Our model is based on a system of ordinary differential equations. We perform a stability and bifurcation analysis in order to study a possible successful regeneration of the forest ecosystem.

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