RESILIENT FORESTS

Christian Messier

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Canada has 347 million hectares of forest. That's 35% of Canada's land mass and 9% of the world's forest ecosystems! For thousands of years, forests have shown extraordinary resilience in adapting and renewing themselves, sometimes under extreme conditions. This resilience is a veritable "insurance policy" against the loss of value and functionality of forests, as emphasized by the International Convention on Biological Diversity (CBD) adopted at the Rio Earth Summit in 1997. But to preserve this resilience in the face of increasing threats to its sustainability, it is vital to protect or restore forest biodiversity by revolutionizing management approaches and focusing on arboreal diversity. This is the mission set by Christian Messier, researcher at UQO and Scientific Director of the Institut des sciences de la forêt tempérée (ISFORT).

From an ecological economy perspective, the forest is a major provider of essential services. In addition to providing significant wealth, they help preserve and purify our water resources and trap large quantities of carbon. It is their resilience - their ability to withstand external pressures and quickly return to their original state after being disturbed - that has enabled forests to survive over the centuries. Because it relies on biodiversity at multiple scales, the resilience of forests is increasingly compromised by human intervention and climate change.

Christian Messier holds the Canada Research Chair in Forest Resilience to Global Change at UQO, and has been actively working on forest resilience for over 10 years. He is co-investigator of an international network of experimental forests (IDENT), where several tree species have been grown in closely spaced rows over half-hectare (100 m x 100 m) areas, in order to observe the various factors influencing a forest's ecosystem, such as soil decomposition, the bacteria that thrive there, the insects that settle there, and the trees' response to the climate changes. Christian Messier co-supervises six such experimental forests in Quebec, Ontario, Minnesota (USA), Sardinia (Italy) and Germany. The results of his work have already been published in some thirty articles in leading journals such as Nature.

"Traditional forestry, which is over 300 years old, has always focused on harvesting and reforesting trees that are economically profitable. In the long run, this has greatly simplified them, and some forests suffer as a result. It's harder for them to survive droughts, diseases or invasions by insect pests. Thanks to the experimental forests, we can test different management strategies in a closed circuit, based on the afforestation of 2 to 10 tree species, sometimes with foreign species alongside native species. After nearly 10 years of experimentation, we have found that these strategies, which capitalize on the interconnectivity potential of tree species, greatly improve the resilience of our forests.

Forests are complex and dynamic systems, but it remains difficult to predict exactly how they will react in the long term to new threats generated by climate change, among other things. Christian Messier also explores the concept of forest functional connectivity. By combining the functional characteristics (i.e. biological attributes that play an important role in the functioning of the tree) of each tree species and the natural connectivity of forests in complex networks (via seed dispersal) that promote diversity, it is possible to intervene by managing forests in such a way as to immunize them against present and future stresses.

"I like to say that what we want is to inoculate our forests against global change. By experimenting on a 500,000-hectare wooded area in the Bois-Francs region of central Quebec, we have built mathematical models to evaluate, over a 30-year period, how we can manage these forests as effectively as possible to significantly increase the diversity of tree species to maximize the forest's resilience to the various disturbances ahead. We know that enriching forests with species with complementary biological attributes enhances the immunity of the forest ecosystem, as it promotes better resource utilization and greater complexity of interactions. This can be achieved by acting on the natural regeneration capacity of forests, seed dispersal capacity and by promoting reforestation with targeted species. This type of analysis can enable us to prevent the consequences of a possible drought and act to increase the forest's capacity to defend itself against the arrival of certain insect pests that might threaten a particular species".