International Union of Forest Research Organizations
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IUFRO SPOTLIGHT

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IUFRO Spotlight *also aims to present activities such as sessions at major IUFRO congresses or the work of IUFRO Task Forces with a focus on emerging key issues that are of great interest to policy makers and groups inside and outside the forest sector, and contribute to international processes and activities. The* ***IUFRO Spotlight*** *findings will be distributed in a periodic series of emails as well as blog postings.*

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Variety could be the spice of life – for forests

An increasing number of studies demonstrate that mixed forests can deliver many ecosystem services at a higher level than pure forests.

Today, however, less than 0.1% of plantation forests worldwide are made of mixed tree species. And, by the end of this century there is the potential for about 20% of the world's forest area to be represented by planted forests.

"More efforts should be made to develop new mixed, planted forests," said Dr. Hervé Jactel of the French National Institute for Agricultural Research. He is one of the authors of a new review, ***Tree Diversity Drives Forest Stand Resistance to Natural Disturbances***, which reviews the relationships between tree diversity and stand resistance to natural disturbances, and explores the ecological mechanisms behind the observed relationships.



Autumn leaves in a mixed-species forest of France. Photo by Damien Bonal, one of the co-authors of the review

"Forest ecosystems are frequently exposed to natural disturbances such as fires, windstorms and pest outbreaks that shape forest structure and drive their dynamics," said Dr. Jactel, who is also coordinator of the IUFRO Task Force on the Contribution of Biodiversity to Ecosystem Services in Managed Forests.

"Disturbances are essential for forest succession and biodiversity, however, biotic and abiotic hazards may have a negative impact on forest health and compromise the provision of ecosystem goods and services," he said.

The review notes that the multiple hazards that threaten forests not only increase concurrently but also interact and potentially synergize.

Examples of this can be found where more intense droughts trigger more frequent or more severe fires as well as outbreaks of forest insects and epidemics of forest pathogens due to the increased susceptibility of drought-stressed trees.

One generic approach for increasing forest resistance to multiple damaging agents that has been discussed in the literature is increasing tree species richness at the stand level. There is growing evidence that mixed forests could be beneficial for a broad range of ecosystem functions and services, he said.

Mixed forests appear to be more resistant than monocultures to small mammalian herbivores, soilborne fungal diseases and specialized insect herbivores. Mixing broadleaves with conifers also increases the resistance to fire and windstorms when compared to pure conifer stands. However, mixed forests may be more affected by drought – depending on the species in the mixture.

This suggests that mixed forests are more resistant to natural disturbances that are relatively small-scale and selective in their effect. However, Dr. Jactel said, benefits provided by mixtures are less evident for larger-scale disturbances.

"Associational resistance" describes the greater resistance of plants against herbivores when surrounded by plants of different species. For example, if tree "A" is in an area mixed in with other trees of species B or C that are unpalatable to the various mammals and insects that normally attack tree "A", then tree "A" is less likely to be attacked.

"We propose to extend this framework to resistance against numerous biotic and abiotic stressors. Associational resistance can thus be regarded as an emerging property of assemblages of several tree species resulting in less damage by natural disturbances, particularly when associated species have contrasting functional characteristics" Dr. Jactel said.

Many more observational and experimental studies are needed to better ascertain the generality of patterns of forest diversity–resistance relationships proposed here and better decipher the underlying mechanisms, Dr. Jactel said.

But what the review shows, he added, "is the urgent need to develop new forest management strategies that increase forest resistance to multiple risks, both for socioeconomic and ecological reasons."

Jactel, H., Bauhus, J., Boberg, J., Bonal, D., Castagneyrol, B., Gardiner, B., Gonzalez-Olabarria, J-.R., Koricheva, J., Meurisse, N., Brockerhoff, E. G. (2017). Tree Diversity Drives Forest Stand Resistance to Natural Disturbances. Current Forestry Reports, September 2017, Volume 3, Issue 3, pp 223–243
https://link.springer.com/article/10.1007/s40725-017-0064-1

Task Force website: https://www.iufro.org/science/task-forces/biodiversity/

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