

'Protection too small, pressure too high' for tree species globally, study finds

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Emergent Dipterocarp tree in Sumatra, Indonesia. Dipterocarps are among the largest trees in lowland tropical rainforests in Southeast Asia. Photo by Rhett A. Butler / Mongabay

- *Researchers looked at the distributions of more than 46,000 tree species around the world and found that more than 13% have no protection. For all species examined, at least half of their distribution lacks protection.*
- *Further, almost 15% of all species are exposed to high or very high human pressure and 68% to moderate pressure.*
- *The study goes beyond this assessment to explore which areas need to be protected worldwide to provide maximum benefit for tree diversity.*
- *Researchers found that the existing plan that would most effectively protect tree diversity is The Global 200, a list of ecoregions identified as priorities for conservation by WWF.*

Trees play a critical role in supporting life on Earth, and over the past few years, everyone from governments to companies to celebrities has been talking about tree planting as a solution to climate change and a boon to biodiversity. But, according to recent research, we could also do a much better job of protecting the trees that already exist.

Researchers looked at the distributions of 46,752 tree species around the world and found that more than 13% of all species examined (6,377 species) have no protection at all and have a limited distribution, making them vulnerable to disturbance, disaster and disease. They published their findings in a [recent study in the *Proceedings of the National Academy of Sciences*](#).



The flowers of *Magnolia canandean*. Only [60 of these trees are known in the wild](#). They inhabit Ecuador's Canandé Reserve in the Chocó, where scientists and locals are working to help conserve the rainforest. Photo courtesy of Álvaro Pérez.

For all species examined, at least half of their distribution lacks protection. The researchers determined this by breaking down the range of each species into blocks of 110 by 110 kilometers (68 by 68 miles), and found that, on average, 50.2% of any given tree species' distribution falls inside blocks that have no protected areas.

“[This study] highlights really a need to have more focus on tree diversity [and for] for much, much more conservation and restoration effort than we currently are seeing,” study co-author Jens-Christian Svenning, a professor of biology at Aarhus University in Denmark, told Mongabay. “There’s a lot of interest in trees and tree planting right now, but not so much the diversity of trees.”

To calculate the geographical distribution of each species, the scientists combined five large databases, each documenting millions of registrations of tree locations. These distributions were overlaid with the [World Database on Protected Areas](#) and maps of how human activities affect nature (known as the [Human Modification Map](#)).

From this, they drew up a pressure index, which showed that almost 15% of all species are exposed to high or very high human pressure, and 68% to moderate pressure. This leaves only 17% of the species not under pressure from human activities.



Novo Aripuanã, Amazonas state. Greenpeace Brazil flew over the southern Amazonas and northern Rondônia states in Brazil to monitor deforestation and forest fires in the Amazon in July 2022. © Christian Braga / Greenpeace

“[The researchers] present a fascinating and original assessment,” Erle Ellis a professor of geography and environmental systems at the University of Maryland, who was not involved in the study, told Mongabay. “They find that most of these species are under significant human

pressures from land use for agriculture, timber, fuel gathering, pollution, species invasions and other threats to their survival and reproduction. This is a very significant concern.”

“[These findings] illustrate that the overall level of protection is too small and the degree of human pressure is too high for [a] large proportion of biodiversity,” Svenning said. “In this case for a keystone group, trees, which have fundamental importance for many other organism groups.”



More than [one-third of global oak species are at risk of extinction](#). This southern live oak (Quercus virginiana) in the Washington Oaks park in Florida, US is listed as least concern on the IUCN Red List. Photo by oliver.dodd via Flickr (CC BY 2.0)

The study goes beyond this assessment to explore which areas need to be protected worldwide to provide maximum benefit for tree diversity.

“By compiling millions of registrations collected by researchers and citizens across the world and shared in open databases, we can calculate where it’s most important to preserve and restore natural areas in order to effectively protect biodiversity,” co-author Josep M. Serra-Diaz, who was previously affiliated with Aarhus University, and who is now an associate professor at AgroParisTech in France, said in a statement.

“We did this by calculating the most suitable locations of potential protection areas if we are to safeguard tree species diversity, not only with regard to the coverage of species, but also with regard to their evolutionary and functional differences,” said lead author Wen-Yong Guo, who started the work at Aarhus University, but is now affiliated with East China Normal University in Shanghai.

The researchers compared their analyses with several existing conservation plans. They found that the existing plan that would most effectively protect tree diversity is [The Global 200](#), a list of ecoregions identified as priorities for conservation of plant and animal biodiversity by WWF.

Svenning said he hopes these findings can help to inform conservation priorities. The U.N. Strategic Plan for Biodiversity 2011-2020, for instance, aimed to protect 17% of land areas, lakes and watercourses. This goal was not met, but new frameworks, such as the post-2020 global biodiversity framework ([post-2020 GBF](#)) build upon these goals.

The world map shows the extent to which current protected areas (PAs) and the top priority areas for the targets for 17 % and 50 % protection is being pressured by human activities (HMI = Human Modification Index). We see, for example, that the Amazon has many areas where trees are only slightly pressed. We also see that in many current protected areas there is a relatively high pressure from human activities; this is especially true in East Asia. Image by Wen-Yong Guo via Gao et al 2022.

“But taking a broad-brush approach or just designating the most convenient areas, for example, uninhabited tundra and desert areas, will not have the desired effect,” Svenning said.

Strategically selecting 17% of land so that it maximizes biodiversity protection could mean that, on average, a tree species will have protected areas in 66% of the landscapes in which it is found, instead of the current 50%.

“In order to achieve this” Svenning said, “we have to look at the distribution of all species across the world, and establish protected areas so that they cover the species and their biological functions and evolutionary differences in the best possible way.”

Citation:

Guo, W. Y., Serra-Diaz, J. M., Schrod, F., Eiserhardt, W. L., Maitner, B. S., Merow, C., ... Svenning, J. C. (2022). High exposure of global tree diversity to human pressure. *Proceedings of the National Academy of Sciences*, 119(25), e2026733119. doi:[10.1073/pnas.2026733119](https://doi.org/10.1073/pnas.2026733119).

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