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Restore fragmented forests to help them recover

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A helping hand goes a long way, especially for fragmented and disturbed forests. According to a recent study published in *Ecosphere*, removing weeds and planting native trees in such patches can help forests recover in numerous ways (including increasing their carbon storage or sequestration levels) than when compared to just protecting them. However, there's a critical caveat: though such restoration is important, it is no substitute for undisturbed, naturally intact forests, as the study found.

Undisturbed forests are few in the tropics due to increasing deforestation and human-caused degradation of forest tracts. Impacts include species declines (of not only large mammals and birds, but insects and even soil bacteria) as well as the release of ancient, stored carbon. When forests are logged, carbon stored in wood and other biomass above the ground over millions of years is lost to the atmosphere. This aggravates ongoing climate change. Though forest protection, a "passive" strategy, wherein existing forest patches are afforded protection from deforestation and other disturbances, helps, numerous countries are now taking additional steps to mitigate deforestation-linked climate change. This includes active restoration, the process of removing weeds and planting native, often nursery-raised tree species to help forests recover faster.

For instance, the Bonn Challenge initiated in 2011 – a global effort endorsed by more than 100 governments (including India), NGOs and private enterprises – aims to restore 150 million hectares of the world's deforested and degraded land by 2020. India has committed to restoring 21 million hectares by 2030 as per this challenge. This is expected to help realise several international commitments including the Aichi Biodiversity Targets. One of the targets delineates that "ecosystem resilience and the contribution of biodiversity to carbon stocks" is

enhanced by 2020, through “conservation and restoration, including restoration of at least 15 percent of degraded ecosystems…”. In a recent assessment of the feasibility of restoration in tropical rainforests worldwide, India also emerged as one of the five countries (joining the ranks of Brazil, Indonesia, Madagascar and Colombia) with the largest restoration hotspots, the prioritisation of which are crucial for successful forest recovery.

A rainforest fragment and in the Anamalai Hills. Areas close to the road towards the bottom-left of the image were restored during 2002-03. Photo by Kalyan Varma.

Yet, how effective is active restoration? And how do ongoing active restoration efforts compare to just providing a forest protection and letting it recover by itself?

To answer these questions, a team of scientists including Anand M. Osuri of The Earth Institute, Columbia University and the Nature Conservation Foundation‘s (NCF) Divya Mudappa and T.R. Shankar Raman turned to Tamil Nadu’s Valparai plateau. Owing to deforestation, the plateau’s once contiguous rainforest is now a mix of protected forests and private plantations, predominantly coffee and tea. These plantations are also home to about 45 remnant rainforest patches, ranging from 1 to 1,300 hectares in area. While the plantation companies protect some of these patches from deforestation and disturbance (they’re being “passively” restored), Mudappa and Raman have been actively restoring some sites within these degraded patches with help from the plantation companies and the Tamil Nadu Forest Department by removing weeds and planting nursery-raised tree saplings. Osuri and his colleagues chose 25 pairs of such fragments (adjacent to each other and comparable in area,

topography and other factors) that were actively and passively restored for between seven to 15 years, to study several aspects of forest quality. In small plots within each fragment, they quantified 11 indicators of forest structure, including the expanses of tree canopies, species diversity and numbers of adult trees and saplings, and above-ground carbon levels. They also studied the same metrics in nearby contiguous, protected forests and used these as a benchmark to compare the actively- and passively-restored forest patches.

Active over passive?

The team recorded a total of 150 tree species (3,146 individual trees) from all their study plots. Benchmark forests alone contained 1,116 individual trees belonging to 97 species. Actively restored sites, however, were home to 99 tree species, while passively-restored ones housed only 79. In terms of saplings regenerating naturally on the forest floor, benchmark forests recorded the highest numbers and species (1,467 individuals of 81 species), followed by actively restored sites (1,081 individuals of 62 species). Passively restored sites showed the least numbers and species of regenerating saplings: 536 individuals of just 37 species.

Active restoration helped these degraded forest patches recover not just in tree numbers (69 percent) and species (49 percent) but also canopy cover (82 percent). Tree species that are unlikely to colonise isolated and degraded patches on their own without the help of seed dispersers – such as the wild nutmeg *Myristica dactyloides* and *dhoopa* tree *Canarium strictum* – increased in numbers in these actively restored patches. The numbers of naturally regenerating saplings also recovered by 51 percent. Even above-ground carbon storage levels (obtained from measurements of tree height and diameter, and information on their wood densities) recovered in these sites by 47 percent.

The team also chose the actively- and passively-restored pairs of forest sites at differing distances from the nearest benchmark forest, to see how the effects of restoration varied with increasing isolation from these protected areas. Interestingly, they found that more isolated, actively restored sites recovered better in terms of several metrics including canopy cover and tree numbers than passively restored sites did. Basically, the more isolated forest patches were, the more they benefited from active restoration for they were unlikely to recover on their own.

One of the more well-recognised factors that could explain this trend is the lack of seed dispersal, says Osuri, the lead author of the study and currently with the NCF. “Studies show that large fruit-eating animals, which act as seed dispersers for many rainforest tree species, are less likely to visit and disperse seeds into the more isolated areas,” he says.

This finding – that active interventions of clearing weeds and planting trees are particularly useful in fragmented landscapes where there are various factors preventing these sites from bouncing back naturally – is a crucial take-home of the study, apart from how it shows that

active restoration can help a forest recover and increase its carbon storage potential, adds Osuri.

Frugivores like the Malabar Grey Hornbill – seen carrying a *Persea macarantha* fruit – disperse the seeds of many rainforest tree species. Rainforest restoration can help overcome losses of natural seed dispersal resulting from the declines of hornbills and other large frugivores in fragmented and disturbed forests. Photo by Abhishek Gopal.

Implications for policy

According to co-author Mudappa, these findings also carry an important message for restoration policy in India and elsewhere.

“Government policies allow afforestation or restoration to be used as a method of compensating for the destruction of mature natural forests,” she said in a press release. “However, it is wrong to assume that planted forests – even ones planted with diverse native species – can truly replace the unique biological wealth, climate regulating potential, and other ecological values of existing natural forests.”

In their study, for instance, benchmark forests trumped active and passively-restored sites in most metrics including higher sapling regeneration on the forest floor.

“This study is timely as India and many other countries strive to meet large restoration pledges during the U.N. Decade on Ecosystem Restoration (2021-2030),” wrote independent scientist and restoration ecologist J. Leighton Reid, Assistant Professor at the School of Plant and Environmental Sciences, Virginia Tech, United States, in an email to Mongabay-India. “We

need more field studies like this one to be able to match damaged ecosystems to the best possible restoration strategies.

If the initial decisions of choosing which patches to restore had been made randomly (versus how degraded rainforest patches were specifically chosen for restoration in the 2000s), the effect of active restoration probably would have been stronger, he commented.

This case study also clearly demonstrates that conserving intact habitat should be the number one priority, he added.

“Ecological restoration can help replenish carbon stocks and conserve some species, but we never get back everything that we lose when an ecosystem is destroyed. This paper shows that is as true in the Western Ghats as it is anywhere else.”

A degraded rainforest fragment in the Anamalai Hills with a canopy of non-native Eucalyptus trees with invasive weeds removed in preparation for restoration planting in 2004

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