Do we really need to plant a trillion trees? Tree islands are an ecologically and economically sound strategy for tropical forest recovery

In their new research, Karen Holl, Leighton Reid and colleagues compare the use of tree islands to other strategies for tropical forest restoration. Here they share their findings, including ecological and economic benefits, as well as lessons to carry forward.

A video summary of the research is also available in English and Spanish.

A version of this blog was originally shared by Natural History of Ecological Restoration.

It seems that everybody from business people to politicians and even YouTubers, is proposing that we should plant millions, billions, or even trillions of trees. They cite a host of reasons, such as storing carbon, conserving biodiversity, and providing income. These efforts should be done carefully and with a long-term commitment to ensure that the trees survive and to prevent unintended negative consequences, such as destroying native grasslands, reducing water supply in arid areas, or diverting attention from efforts to reduce greenhouse gas emissions.

Another important question is whether we really need to plant that many trees to restore forest. In a new paper in *Journal of Applied Ecology*, we summarise some the lessons we have learnt about a different approach.

Over 15 years ago, we set up an experiment in southern Costa Rica to test whether planting small patches or 'islands' of trees could speed up forest recovery for a lower cost than typical tree plantations. The idea is to plant small groups of trees that attract birds and bats, which disperse most tropical forest tree seeds. The tree canopy also shades out light-demanding grasses that can outcompete tree seedlings. As a result, over time these tree islands spread as they grow and facilitate the establishment of a lot more trees.

Compared to tree plantations, the tree island approach has two major benefits. First, it better simulates the patchiness of natural forest recovery. Second, it costs much less than planting rows and rows of trees.

In our experiment, we planted tree islands that covered about 20% of a 50 × 50 m plot of former cattle pasture. We compared that to plots where no trees were planted (natural recovery) and to the more intensive and more typical restoration strategy of planting trees in rows throughout the plot (plantation). We repeated this set-up at 15 sites in 2004-2006.

Over the past 15 years, we have monitored the recovery of vegetation, litterfall, nutrient cycling, epiphytes, birds, bats, arthropods, and more. Our data reveal a few key lessons about how to restore tropical forests more ecologically and economically.

First, our data show that planting tree islands is as effective as bigger tree plantations, despite cutting costs by around two-thirds. Compared to plantations, tree islands have similar recovery of nutrient cycling, tree seedling recruitment, and visitation by fruit-eating animals. Both tree islands and

plantations speed up tropical forest recovery compared to letting the forest recover on its own. After 15 years, cover of trees and shrubs in the island planting plots has increased from 20% to over 90%.

Second, we have found that larger tree islands are more effective than smaller islands in enhancing the establishment of fauna and flora, as larger tree islands attract more birds and shade out competitive grasses.

Third, while tree islands cost less than plantations, some landowners won't use the tree island approach because the land looks 'messier' than orderly tree plantations. Some people prefer to plant lots of trees that are valuable for timber or fruit, rather than having the diverse suite of species that are typical of a tropical forest. So, the tree island planting strategy will be more suitable in cases where the goal is to restore forest.

Our results and those of others show that the tree island planting approach holds promise as a cost-effective forest restoration strategy in cases where there are seed sources nearby to colonise and animals to disperse them, and where the spread of tree islands is not likely to be slowed by fire or invasive species. But we need more long-term studies to judge whether tree islands will be effective in other tropical forest ecosystems and to test other questions, like how the particular tree species used affect forest recovery, or what is the best distance to leave between tree islands.

More broadly, our study shows that tropical forests can recover some species quickly but it will take many decades, or longer, for forests to fully recover. So, preserving existing rainforests is critical to conserving biodiversity and the services that intact forests provide to people.

Yes, carefully planned tree planting can help accelerate tropical forest recovery. But, in many cases we don't need to plant trees everywhere. Rather we should use restoration strategies that encourage trees to plant themselves.

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