

Protected areas save mangroves, reduce carbon emissions

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Protected areas not only keep significant swaths of Indonesia's shrinking mangrove habitats intact, but also prevent emissions of carbon dioxide that would have been released had these mangroves been cleared, according to a study in the journal *Ecological Economics*.

Published online, the analysis examined the success of [protected areas](#) between 2000 and 2010, finding that their use has avoided the loss of 14,000 hectares of mangrove habitat.

"This is not a small number," said Daniela Miteva, a postdoctoral researcher at The Nature Conservancy and a Duke University alumna. "Protected areas have reduced the rate of mangrove loss by about 28 percent in Indonesia, which has the world's largest area of [mangroves](#)."

Mangroves are dense forests of trees and shrubs that grow in brackish, low-lying coastal areas in the tropics and subtropics. The study is the first rigorous large-scale evaluation of the effectiveness of protected areas in reducing mangrove loss and [carbon dioxide](#) emissions, using a detailed country-wide data set of social, economic, climatic, geographic, biophysical and environmental indicators.

"We found that by keeping more mangroves intact we avoided release of approximately 13 million metric tons of carbon dioxide into the atmosphere," said Brian Murray, co-author and director of the Environmental Economics Program at Duke's Nicholas Institute for Environmental Policy Solutions. "That's equivalent to taking 344,000

vehicles off the road each year."

This carbon dioxide is released mainly through the disturbance of carbon stored in sediment layers beneath mangroves, referred to as "blue carbon." When the water around mangroves is drained or they are destroyed, the [sediment layers](#) below begin to oxidize. Once this soil, which can be many meters deep, is exposed to air or ocean water, it releases carbon dioxide.

"Our study suggests that the mangrove conservation in Indonesia generated approximately \$540 million in social welfare benefits from avoided climate change damages," said Subhrendu Pattanayak, professor of public policy and environmental economics at Duke's Sanford School of Public Policy and the Nicholas School of the Environment.

"Our study is one the few rigorous and careful attempts to see if conservation policies work," Pattanayak said. "We find that while designated protected marine areas do the job, there is no evidence that certain other, less-specific forms of species protection stalled the loss of mangroves, suggesting we need a new approach that distinguishes between types of protected areas. A one-size fits all solution is a poor policy."

More information: Miteva, Daniela A., Murray, Brian C., Pattanayak, Subhrendu K., "Do Protected Areas Reduce Blue Carbon Emissions? A Quasi-Experimental Evaluation of Mangroves in Indonesia," *Ecological Economics* (2015), [DOI: 10.1016/j.ecolecon.2015.08.005](https://doi.org/10.1016/j.ecolecon.2015.08.005)

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