Super high-resolution carbon estimates for endangered Madagascar

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By combining airborne laser technology, satellite mapping, and ground-based plot surveys, a team of researchers has produced the first large-scale, high-resolution estimates of carbon stocks in remote and fragile Madagascar. The group has shown that it is possible to map carbon stocks in rugged geographic regions and that this type of carbon monitoring can be successfully employed to support conservation and climate-change mitigation under the United Nations initiative on Reduced Emissions from Deforestation and Degradation (REDD).

Madagascar has unique flora and fauna found nowhere else on Earth, but habitat destruction has transformed its tropical forests, leaving a patchwork of different landscapes. The rugged and remote terrain has made it very difficult to measure vegetation carbon content via traditional plot sample methods. Plots alone are impracticable for large sample sizes and often do not account for the great degree of landscape variability.

The team, made up of scientists from the Carnegie Institution's Department of Global Ecology, GoodPlanet Foundation, and the World Wide Fund (WWF) for Nature used the Carnegie Airborne Observatory (CAO) to develop high-resolution estimates of carbon stored above ground across a wide range of ecological conditions. Their goal was to understand both human and environmental controls that shape the carbon landscape. The work is published in February 14, 2012, issue of Carbon Balance *and Management*.

"We found that humid mountain forests had the highest carbon densities, while there was less carbon in dry forests and in the lowlands with more human activity," explained lead author Greg Asner at Carnegie. "Despite widespread human activity, we found that large-scale natural controls over carbon stocks were heavily driven by the type of terrain and vegetation cover."

The researchers looked at two areas, one in the north and the other in the south, totaling 9,160 square miles (2,372,680 hectares)—an area about the size of Vermont. In both regions the carbon stocks reached their highest levels at mid-elevation. Deforestation and forest degradation greatly reduced standing carbon stocks. The scientists also found that carbon stocks in some areas containing secondary forest regrowth varied tremendously, but were consistently lower than in old-growth forests.

"Madagascar provides an excellent example of the challenges we face in mapping carbon in most tropical regions," remarked Asner. "These results show that we can obtain verifiable carbon assessments in remote tropical regions, which will be a boon not only to science and conservation, but to potential carbon-offset programs."

Co-author Romuald Vaudry of the GoodPlanet Foundation said that "the partnership between GoodPlanet, WWF, and Carnegie is of utmost importance for the REDD+ projects being developed in Madagascar with the support of Air France. Our results will help to ensure the conservation of Madagascar's exceptional biodiversity, and will help to improve living conditions for local peoples."

Provided by Carnegie Institution

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