

Higher density means world forests are capturing more carbon

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Forests in many regions are becoming larger carbon sinks thanks to higher density, US and European researchers say in a new report. In Europe and North America, increased density significantly raised carbon storage despite little or no expansion of forest area, according to the study, led by Aapo Rautiainen of the University of Helsinki, Finland, and published by the online, open-access journal *PLoS One*. These photos from the same spot in Finland, taken in 1893 (l) and in 1997 (r) show that while the forest area is the same, the trees are larger in the later photo. Credit: I.K. Inha (1893) and K.A. Ennola (1997)

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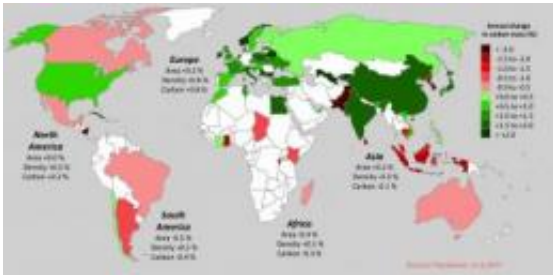
Even in the South American nations studied, more density helped maintain regional [carbon](#) levels in the face of deforestation.

The researchers analyzed information from 68 nations, which together account for 72 percent of the world's forested land and 68 percent of reported carbon mass. They conclude that managing forests for timber growth and density offers a way to increase stored carbon, even with little or no expansion of forest area.

"In 2004 emissions and removals of carbon dioxide from land use, land-use change and forestry comprised about one fifth of total emissions. Tempering the fifth by slowing or reversing the loss of carbon in forests would be a worthwhile mitigation. The great role of density means that not only conservation of forest area but also managing denser, healthier forests can mitigate [carbon emission](#)," says Rautiainen.

Co-author Paul E. Waggoner, a forestry expert with Connecticut's Agricultural Experiment Station, says remote sensing by satellites of the world's forest area brings access to remote places and a uniform method. "However, to speak of carbon, we must look beyond measurements of area and apply forestry methods traditionally used to measure timber volumes."

"Forests are like cities – they can grow both by spreading and by becoming denser," says co-author Iddo Wernick of The Rockefeller University's Program for the Human Environment.



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The authors say most regions and almost all temperate nations have stopped losing forest and the study's findings constitute a new signal of what co-author Jesse Ausubel of Rockefeller calls "The Great Reversal" under way in global forests after centuries of loss and decline.

"Opportunities to absorb carbon and restore the world's forests can come through increasing density or area or both."

To examine how changing forest area and density affect timber volume and carbon, the study team first focused on the United States, where the U.S. Forest Service has conducted a continuing inventory of forest area, timberland area and growing stock since 1953.

They found that while U.S. timberland area grew only 1 percent between 1953 and 2007, the combined national volume of growing stock increased by an impressive 51 percent. National forest density increased

substantially.

For an international perspective, the research team examined the 2010 Global Forest Resources Assessment compiled by the UN Food and Agriculture Organization (FAO), which provides consistent figures for the years 1990 to 2010.

The data reveal uncorrelated changes of forest area and density. Countries in Africa and South America, which lost about 10 percent of their forest area over the two decades, lost somewhat less carbon, indicating a small rise in forest density.

In Asia during the second decade of the study period, density rose in 10 of the region's 21 countries. Indonesia's major loss of density and sequestered carbon, however, offset any gain in carbon storage in other Asian nations.

Europe, like the U.S., demonstrated substantial density gains, adding carbon well in excess of the estimated carbon absorbed by the larger forested area.

Says study co-author Pekka Kauppi, of the University of Helsinki, Finland, "With so much bad news available on World Environment Day, we are pleased to report that, of 68 nations studied, forest area is expanding in 45 and density is also increasing in 45. Changing area and density combined had a positive impact on the carbon stock in 51 countries."

Provided by Rockefeller University

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