



# The Forest Identity

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## *End of Deforestation in View? Experts Advance New Way to Size Up Global Forest Resources*

*“Growing Stock” Expanding in Most Forested Nations, even with Modest Prosperity;  
Fears of a “Skinhead Earth” Not Borne Out by Data, Researchers Find*

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An increasing number of countries and regions are transitioning from deforestation to afforestation, raising hopes for a turning point for the world as a whole, according to researchers advancing a more sophisticated approach to measuring forest cover.

The novel approach looks beyond simply how much of a nation’s area is covered by trees and considers the volume of timber, biomass, and captured carbon within the area. It produces an encouraging picture of Earth’s forest situation and may change the way governments size up their woodland resources in future.

Devised by six distinguished international academic and non-governmental experts in forestry science and economics, the “Forest Identity” considers both area and the density of trees per hectare to determine the volume of a country’s “growing stock”: trees large enough to be considered timber. The formula also quantifies the biomass and atmospheric carbon stored in world forests and will help track those forest characteristics over time.

Applying the formula to UN-collected data released last year, the researchers find that, amid widespread concerns about deforestation, growing stock has in fact expanded over the past 15 years in 22 of the world's 50 countries with most forest. In countries where per capita Gross Domestic Product exceeds US \$4,600 (roughly equal to the GDP of Chile), richer is greener. In about half of the most forested countries biomass and carbon also expanded. Earlier work showed that by the 1980s wooded areas in all major temperate and boreal forests were expanding.

Forest area and biomass are still being lost in such important countries as Brazil and Indonesia but an increasing number of nations show gains. The forests of Earth's two most populated nations no longer increase atmospheric carbon concentration: China's forests are expanding; India's have reached equilibrium – changes due in large part to urban migration, agricultural yield increases and reforestation policies.

The paper, peer-reviewed by the US journal Proceedings of the National Academy of Sciences, was created by six experts from diverse academic disciplines (forestry, environmental technology, ecology, geography, resource economics, and agronomy) in China, Finland, Scotland, and the USA who, following independent lines of thinking, came to agree that forest transition on a major scale is underway and have now collectively demonstrated it.

The new way of measuring forests reflects the comprehensiveness of new FAO studies, a new consistency of measurement protocols and reliable ways of translating area, volume, and tons across countries.

Among the 50 nations studied, forest area in percentage terms shrank fastest from 1990 to 2005 in Nigeria and the Philippines, and expanded fastest in Viet Nam, Spain and China.

Growing stock fell fastest in Indonesia, Nigeria and the Philippines, and increased fastest in the Ukraine and Spain.

In absolute terms, Indonesia and Brazil experienced the greatest losses of both forested square kilometers and cubic meters of growing stock; China and the USA achieved the greatest gains.

“The Forest Identity separates nations into classes of expanding and shrinking forest that clarify the causes of changing forest expanse, timber, biomass, and carbon,” says

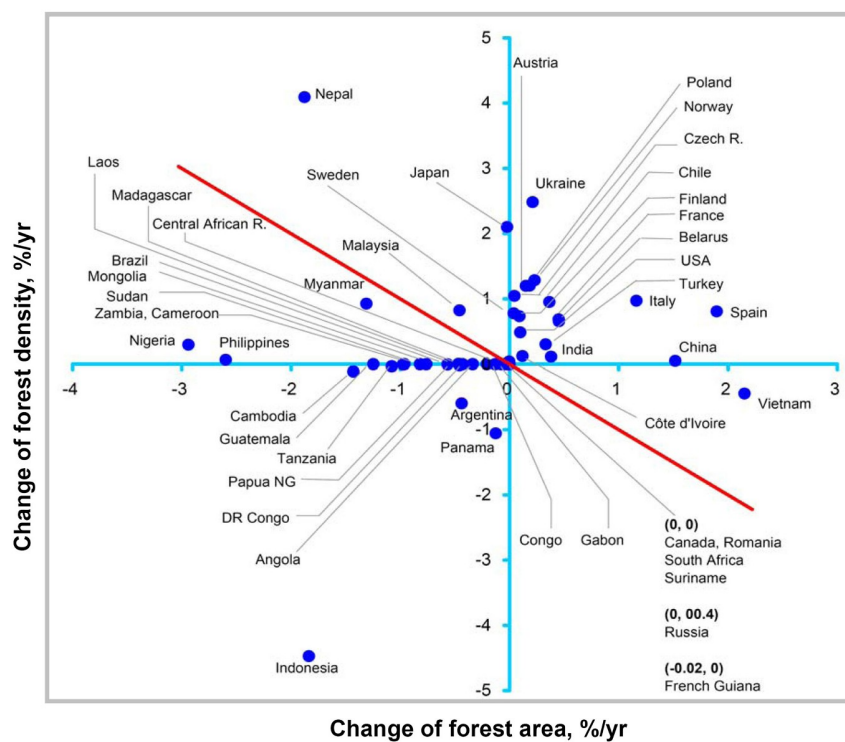
lead author, Pekka E. Kauppi of the University of Helsinki, Finland. The co-authors are Jesse H. Ausubel, Rockefeller University, USA; Jingyun Fang, Peking University, Beijing, China; Alexander Mather, University of Aberdeen, Scotland; Roger A. Sedjo, Resources for the Future, USA; and Paul E. Waggoner, The Connecticut Agricultural Experiment Station, USA.

Says Mr. Ausubel, an environmental scientist: “Earth suffered an epidemic of deforestation. Now humans may help spread an epidemic of forest restoration.”

### Changes in growing stock, 1990 to 2005

Using data from the Global Forest Resources Assessment of 2005, published by the UN Food and Agriculture Organization, the researchers plot on a graph the shift from 1990 to 2005 in the forest density and area of 50 countries to reveal the change in their respective growing stock.

*Charting forest changes, 1990 to 2005, in the world's 50 most forested nations. Forest area expanded in nations right of the vertical line; tree density expanded in nations above the horizontal line. Nations above the diagonal line gained growing stock.*



(Please see: [http://photos1.blogger.com/blogger/7041/2254/1600/Forest ID graph.jpg](http://photos1.blogger.com/blogger/7041/2254/1600/Forest_ID_graph.jpg))

The authors say Japan’s forest cover area is virtually unchanged since World War II (22.2 million hectares in 1947 vs. 23.7 million hectares today). However the density of its forests has risen, producing an average 1.6% annual increase in the volume of growing stock.

“China has experienced falling forest density in many parts of the country since 1949, but its area of forested land has steadily risen,” notes ecologist Dr. Fang of Beijing. “The net result: an increase in China’s growing stock, biomass, and carbon sequestration.”

The graph shows Indonesia down roughly 2% per year in forested area and down 4% in density. At the other end of the spectrum is Spain, which increased its forested area by 2% per year and its density by almost 1%.

With one exception, the growing stock grew from 1990 to 2005 in the 50 most forested nations with more than about \$4,600 GDP per capita. In the exception, Canada improbably reported identical area and growing stock in 1990 and 2005.

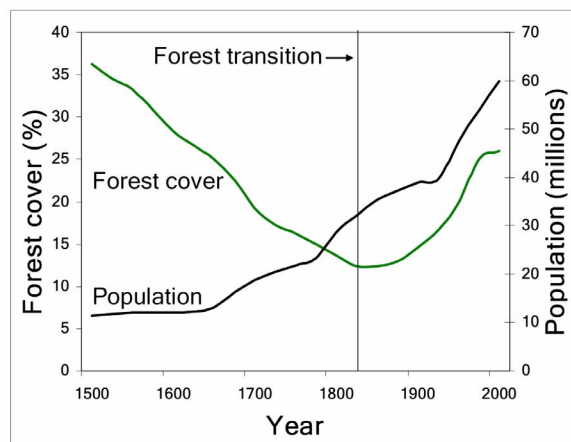
Evidently, prosperity and measures such as good governance that raise income need not shrink forests, according to the paper.

### Forest “transitions”

While forest density data are relatively new, forest area data spanning 200 years show several places worldwide have shifted from net deforestation to net reforestation – the “ forest transition.”

“Forest transitions,” says geographer and historian Dr. Mather, who coined the term, “occurred between 1810 and 1930 from the lowlands of Denmark to the mountains of Switzerland, and from the highlands of Scotland to Russia.”

In France, where forest cover over time is especially well-documented, forest area expanded



*Trends in French forest area and population*

by one-third after that nation's transition circa 1830 until 1960 – and by a further 25% from 1960 to 2005.

In the USA, meanwhile, the forests of industrial and urbanized Massachusetts, Pennsylvania, Ohio, and Illinois have expanded by more than half since their respective transitions in the 1800s. In Connecticut, where the first USA transition occurred, forests covered about 30% of the state in 1860 and 60% in 2002.

While forest resources are stable or increasing in countries where per capita GDP exceeds US \$4,600, the results in India and China (both of which fall short of this income level) show the importance and impact of government policies.

In China, reforestation and afforestation efforts have led to an increase in forest area from 96 million to 143 million hectares from the late 1970s to the early 2000s.

Other Asian countries that have made the transition include South Korea and Viet Nam. Taken as a whole, the Asian continent recently experienced forest transition, having lost 792,000 hectares of forest between 1990 and 2000 but gaining just over 1 million hectares between 2000 and 2005.

The authors foresee still more nations achieving forest transitions within three decades.

### **Forest transition at a global level**

When forest transition occurs at a global level depends largely on Brazil and Indonesia, where huge areas of tropical forests are rapidly being cut and cleared. Encouragingly, in many other tropical areas forests are re-growing. Studies in Central America show tree cover in El Salvador grew by about one-fifth from 1992 to 2001. Forests are also recovering fast in the Dominican Republic, in harsh contrast to deforested Haiti on the same Caribbean island.

Says Dr. Kauppi: “The main obstacles to forest transition are fast-growing poor populations who burn wood to cook, sell it for quick cash, and clear forest for crops. Harvesting biomass for fuel also forestalls the restoration of land to nature. Through paper recycling and a growing reliance on electronic communication, people help the transition by lessening demand for wood products.”

## **Anticipating impacts of expanding global trade**

The authors note that it's possible to sustain a large commercial harvest and expand "growing stock" at the same time.

Says economist Dr. Sedjo: "The USA gained growing stock during 1990 to 2005 while harvesting much round wood and some fuel. China did likewise. On the other hand, Indonesia and Brazil lost much growing stock without harvesting as much timber as either the USA or China."

The authors also predict the share of industrial wood production in forest plantations will grow from an estimated one-third today to half by 2025 and three-quarters by 2050.

"Plantations and the trade to make them effective reduce the impact of industrial pressures on the expanse of natural forests, which may be rich in soil carbon and biodiversity," adds Dr. Sedjo.

## **Implications for climate change**

In addition to the measurement of forest area and growing stock, the researchers offer a formula to calculate atmospheric carbon being stored incrementally in the trees of a given area, knowledge critical for mitigating climate change.

Says Dr. Waggoner: "A rapid forest transition at a global scale would mean that atmospheric CO<sub>2</sub> might not rise as fast as many fear."

As well, forest transitions are good news for wildlife like tigers and moose whose forest habitat has been decimated by human activity.

## **Skinhead Earth?**

Earlier research showed farmers have so successfully learned to extract more crop from a given area that land needed for agriculture is shrinking, even as people become more numerous and eat better. In many countries forests have begun to enlarge, as farmers spare land and foresters also shift from extensive to intensive strategies.

Says Mr. Ausubel: “This great reversal in land use could stop the styling of a Skinhead Earth and begin a great restoration of the landscape by 2050, expanding the global forest by 10 percent – about 300 million hectares, the area of India.”

“Without depopulation or impoverishment, increasing numbers of countries are experiencing transitions in forest area and density,” adds Dr. Kauppi. “While complacency would be misplaced, our insights provide grounds for optimism about the prospects for returning forests.”

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