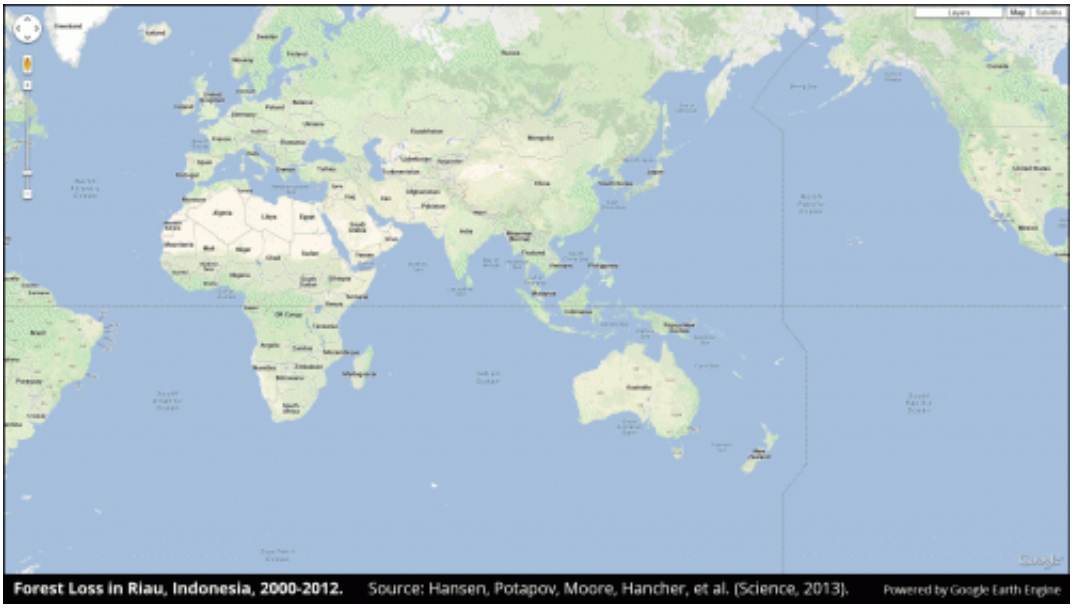
First detailed map of global forest change created

November 14 2013



Forest loss in Sumatra's Riau province, Indonesia, 2000-2012. Credit: Hansen, Potapov, Moore, Hancher et al., 2013

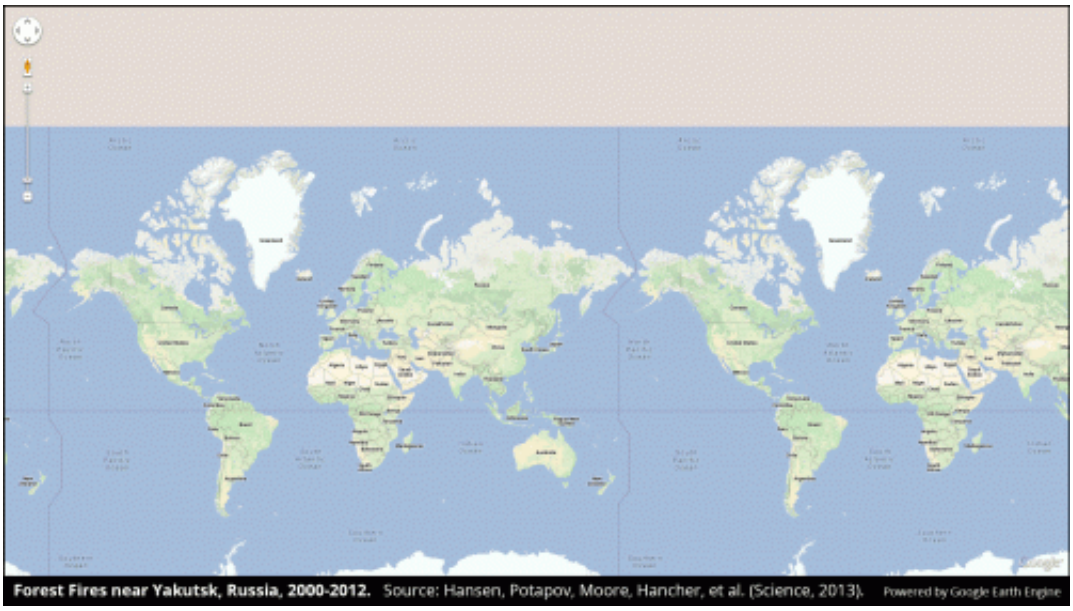
A University of Maryland-led, multi-organizational team has created the first high-resolution global map of forest extent, loss and gain. This resource greatly improves the ability to understand human and naturally-induced forest changes and the local to global implications of these changes on environmental, economic and other natural and societal systems, members of the team say.

In a new study, the team of 15 university, Google and government researchers reports a global loss of 2.3 million square kilometers (888,000 square miles) of forest between 2000 and 2012 and a gain of 800,000 square kilometers (309,000 square miles) of new forest.

Their study, published online on November 14 in the journal *Science*, documents the new database, including a number of key findings on global forest change. For example, the tropics were the only climate domain to exhibit a trend, with forest loss increasing by 2,101 square kilometers (811 square miles) per year. Brazil's well-documented reduction in deforestation during the last decade was more than offset by increasing forest loss in Indonesia, Malaysia, Paraguay, Bolivia, Zambia, Angola and elsewhere.

"This is the first map of forest change that is globally consistent and locally relevant," says University of Maryland Professor of Geographical Sciences Matthew Hansen, team leader and corresponding author on the *Science* paper.

"Losses or gains in forest cover shape many important aspects of an ecosystem including, climate regulation, carbon storage, biodiversity and water supplies, but until now there has not been a way to get detailed, accurate, satellite-based and readily available data on forest cover change from local to global scales," Hansen says.



Forest Fires near Yakutsk, Russia, 2000-2012. Credit: Hansen, Potapov, Moore, Hancher et al., 2013

To build this first of its kind forest mapping resource, Hansen, UMD Research Associate Professor Petr Potapov and five other UMD geographical science researchers drew on the decades-long UMD experience in the use of satellite data to measure changes in forest and other types of land cover. Landsat 7 data from 1999 through 2012 were obtained from a freely available archive at the United States Geological Survey's center for Earth Resources Observation and Science (EROS). More than 650,000 Landsat images were processed to derive the final characterization of forest extent and change.

The analysis was made possible through a collaboration with colleagues from Google Earth Engine, who implemented the models developed at UMD for characterizing the Landsat data sets. Google Earth Engine is a massively parallel technology for high-performance processing of geospatial data and houses a copy of the entire Landsat image catalog. What would have taken a single computer 15 years to perform was

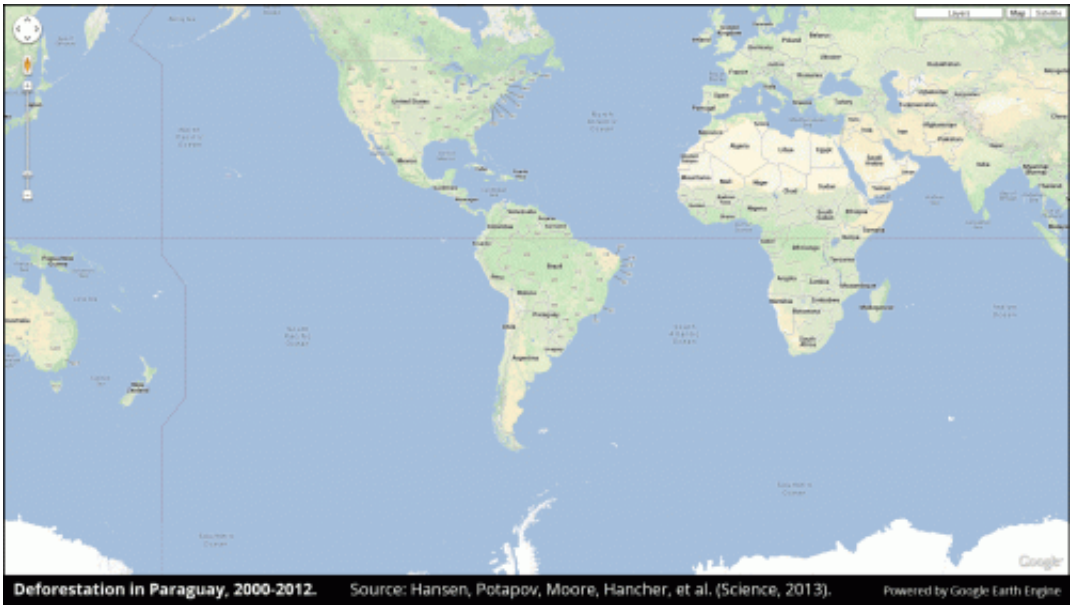
completed in a matter of days using Google Earth Engine computing.

Hansen and his coauthors say their mapping tool greatly improves upon existing knowledge of global forest cover by providing fine resolution (30 meter) maps that accurately and consistently quantify annual loss or gain of forest over more than a decade. This mapping database, which will be updated annually, quantifies all forest stand-replacement disturbances, whether due to logging, fire, disease or storms. And they say it is based on repeatable definitions and measurements while previous efforts at national and global assessments of forest cover have been largely dependent on countries' self-reported estimates based on widely varying definitions and measures of forest loss and gain.

Dynamics from local to regional to global scale are quantified. For example, subtropical forests were found to have the highest rates of change, largely due to intensive forestry land uses. The disturbance rate of North American subtropical forests, located in the Southeast United States, was found to be four times that of South American rainforests during the study period; more than 31 percent of U.S. southeastern forest cover was either lost or regrown. At national scales, Paraguay, Malaysia and Cambodia were found to have the highest rates of forest loss. Paraguay was found to have the highest ratio of forest loss to gain, indicating an intensive deforestation dynamic.

The study confirms that well-documented efforts by Brazil – which has long been responsible for a majority of the world's tropical deforestation – to reduce its rainforest clearing have had a significant effect. Brazil showed the largest decline in annual forest loss of any country, cutting annual forest loss in half, from a high of approximately 40,000 square kilometers (15,444 square miles) in 2003-2004 to 20,000 square kilometers (7,722 square miles) in 2010-2011. Indonesia had the largest increase in forest loss, more than doubling its annual loss during the study period to nearly 20,000 square kilometers (7,722 square miles) in

2011-2012.



Deforestation in Paraguay, 2000-2012. Credit: Hansen, Potapov, Moore, Hancher et al., 2013

Hansen and colleagues say the global data sets of forest change they have created contain information that can provide a "transparent, sound and consistent basis to quantify critical environmental issues," including the causes of the mapped changes in the amount of forest; the status of world's remaining intact natural forests; biodiversity threats from changes in forest cover; the carbon stored or emitted as a result of gains or losses in tree cover in both managed and unmanaged forests; and the effects of efforts to halt or reduce forest loss.

For example, Hansen says, that while their study shows the efforts of Brazil's government to slow loss of rainforest have been effective, it also shows that a 2011 Indonesian government moratorium on new logging licenses was actually followed by significant increases in deforestation in

2011 and 2012.

"Brazil used Landsat data to document its deforestation trends, then used this information in its policy formulation and implementation. They also shared these data, allowing others to assess and confirm their success," Hansen says. "Such data have not been generically available for other parts of the world. Now, with our global mapping of forest changes every nation has access to this kind of information, for their own country and the rest of the world."

More information: High-resolution global maps 21st-century forest cover change, *Science*, Nov. 15, 2013, Vol 342, 6160.

Provided by University of Maryland