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## Most new farmland comes from cutting tropical forest, says Stanford researcher

*A new study led by a Stanford researcher shows that more than 80 percent of the new farmland created in the tropics between 1980 and 2000 came from felling forests, which sends carbon into the atmosphere and drives global warming. But the research team also noted that big agribusiness has largely replaced small farmers in doing most of the tree cutting in Brazil and Indonesia, which may make it easier to rein in the trend.*

BY LOUIS BERGERON

Global agricultural expansion cut a wide swath through tropical forests during the 1980s and 1990s. More than half a million square miles of new farmland – an area roughly the size of Alaska – was created in the developing world between 1980 and 2000, of which over 80 percent was carved out of tropical forests, according to Stanford researcher Holly Gibbs.

"This has huge implications for global warming, if we continue to expand our farmland into tropical forests at that rate," said Gibbs, a postdoctoral researcher in the Department of Environmental Earth System Science, who led the study.

Gibbs and colleagues at several other universities analyzed [Landsat](#) satellite data and images from the United Nations to reach their conclusions. Theirs is the first study to map and quantify what types of land have been replaced by the immense area of new farmland developed across the tropical forest belt during the 1980s and 1990s.

While this huge increase was happening within the tropics, agricultural land in the non-tropical countries actually decreased in area.

The [study](#) was published this week in the online *Early Edition* of the *Proceedings of the National Academy of Sciences*.

The United Nations Food and Agriculture Organization estimates that to keep pace with increasing demand, global agricultural production will have to keep increasing, possibly even doubling by 2050. That would likely lead to millions of additional acres of tropical forest being felled over the next 40 years.

### Direct impact on carbon released into atmosphere

"Every million acres of forest that is cut releases the same amount of carbon into the atmosphere as 40 million cars do in a year," Gibbs said.

Most of the carbon released comes from burning the forests, but even if the trees are simply cast aside, the bulk of the carbon from the plants makes its way into the atmosphere during decomposition, she said.

Gibbs and her colleagues found that about 55 percent of the tropical forests that had been cut between 1980 and 2000 were intact forests and another 28 percent were forests that had experienced some degradation, such as some small-scale farming, logging or gathering of wood and brush for cooking or heating fuel.

"The tropical forests store more than 340 billion tons of carbon, which is 40 times the total current worldwide annual fossil fuel emissions," Gibbs said. "If we continue cutting down these forests, there is a huge potential to further contribute to climate change."

The increasing demand for agricultural production stems in part from the ever-growing number of

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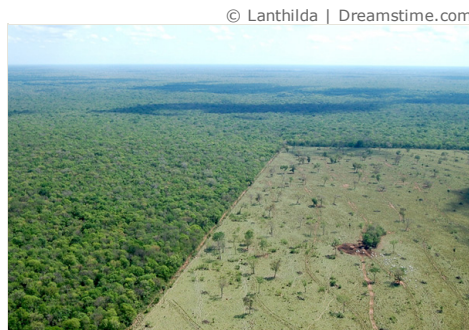
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Clear cutting for agriculture in Brazilian Pantanal.

people on the planet, who all want to eat. Additionally, members of the growing middle class in emerging economies such as China and India are showing interest in eating more meat, which further intensifies demand. And incentives to grow crops for biofuel production have increased.

But Gibbs and her colleagues also observed some encouraging signs. The patterns of change in the locations they analyzed made it clear that during the 1990s, less of the deforestation was done by small family farms than was the case in the 1980s and more was done by large, corporate-run farms. Big agribusiness tends to be more responsive to global economic signals as well as pressure campaigns from advocacy organizations and consumer groups than individual small farmers.

In Brazil, where a pattern had developed of expanding soy production by direct forest clearing and by pushing cattle ranching off pastureland and into forested areas, a campaign by Greenpeace and others resulted in agreements by key companies to rein in their expansion. Instead, they worked to increase production on land already in agricultural use.

### 'Seeing positive changes'

"These farmers effectively increased the yield of soy on existing lands and they have also increased the head of cattle per acre by a factor of five or six," Gibbs said. "It is exciting that we are starting to see how responsive industry can be to consumer demands. We really are seeing positive changes in this area."

Along with wiser use of land already cleared, Gibbs said, improvements in technology and advances in yield intensification also could slow the expansion of farming into the forests.

Other studies that analyzed land use changes between 2000 and 2007 have shown that the pace of cutting down the tropical forests has begun to slow in some regions.

But as long as the human population on the planet continues to grow, the pressure to put food on the table, feed in the barnyard and fuel in the gas tank will continue to grow, too.

"It is critical that we focus our efforts on reducing rates of deforestation while at the same time restoring degraded lands and improving land management across the tropics," Gibbs said. "The good news is that pressure from consumer groups and nongovernmental organizations combined with international climate agreements could provide a real opportunity to shift the tide in favor of forest conservation rather than farmland expansion."

In addition to her position at the Department of Environmental Earth System Science, Gibbs is affiliated with Stanford's Woods Institute for the Environment. Jon Foley, a professor of ecology, evolution and behavior, and director of the Institute on the Environment at the University of Minnesota, was Gibbs' PhD adviser when the research was begun. He is a coauthor of the paper.

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### Media Contact

Dan Stober, Stanford News Service: (650) 721-6965, [dstober@stanford.edu](mailto:dstober@stanford.edu)

Louis Bergeron, Stanford News Service: (650) 725-1944, [louisb3@stanford.edu](mailto:louisb3@stanford.edu)