

Energy and Environment

The solution to climate change that has nothing to do with cars or coal

By Chris Mooney February 11



Amazon rainforest at dawn on Dec. 29, 2015. (Photo by Harvey Locke)

AMAZONAS, Brazil – At the base of a towering, 150-foot-high angelim tree, the scattered sloth claws and clumps of fur are a dead giveaway.

The tree contains the nest of a harpy eagle, a bird so powerful it kills monkeys and sloths by tearing them from the trees with its enormous claws. Its presence is a good sign to the scientists who are studying the surrounding forest.

It means this section of trees and its vast network of life are still healthy enough to support such a high-order predator. And that, in turn, is at least a small bit of good news for the Earth's climate.

Of all the components of the recent Paris accord on climate change, the one that probably got the least attention but could have the most immediate potential involves the world's forests. In a section some hailed as historic, the document endorsed a United Nations mechanism for wealthier nations to pay developing countries like Brazil for reducing deforestation.

Trees are good at keeping carbon out of the air, and simply preserving the planet's vast forests is a straightforward way to get a huge head start on the business of slowing climate change. But that effort grows tougher every day. After years of progress, deforestation rates have increased recently in Brazil,

and deforestation continues apace across much of the global tropics. The economic forces of agriculture and trade remain too strong to resist.

Calls for saving rainforests have a long history, but including forests as a core part of the global climate solution is “very very recent,” said Naoko Ishii, CEO of the Global Environment Facility, an international body that invests in restoring tropical forests. “Without taking care of the forests, it’s going to be just impossible to achieve the Paris agreement.”

In fact, recent estimates suggest as much as a third of climate emissions could be offset by stopping deforestation and restoring forest land — and that this solution could be achieved much faster than cuts to fossil fuels.

Forests are a crucial “carbon sink,” living engines for absorbing and storing carbon. Tropical forests store the most carbon of all, and no tropical forest on Earth is bigger than the Amazon. It accounts for about half of all the carbon these forests store. But the Brazilian Amazon has lost nearly a fifth of its forest cover already — and the forest left behind also suffers because it is more fragmented and less continuous.

Thomas Lovejoy, a George Mason University ecologist, has been studying this section of Amazon for decades. While he was encouraged to see the harpy eagle at its nest on a recent afternoon, he was conscious of the forest’s overall fragility.

The Amazon system as a whole, Lovejoy said, is at a “precarious point. And you know, the obvious thing is, you don’t want to find out where the tipping point is by tipping it.”



A maturing Subadult Harpy Eagle seen in the Amazon rain forest on Dec. 30, 2015. (Photo by Harvey Locke)

Of trees and warming

The forest is protected in this roughly 4-square-mile federal research and conservation plot to the northeast of the city of Manaus, where the dark and acidic Rio Negro meets the more brownish Solimões to form the lower Amazon river, the largest in the world.

But not far from here, the smell of smoke still hangs over a recently deforested plot – trees slashed down and then burned. So it has gone throughout the Amazon, and far worse in more southern Brazilian states, such as Pará and Mato Grosso.

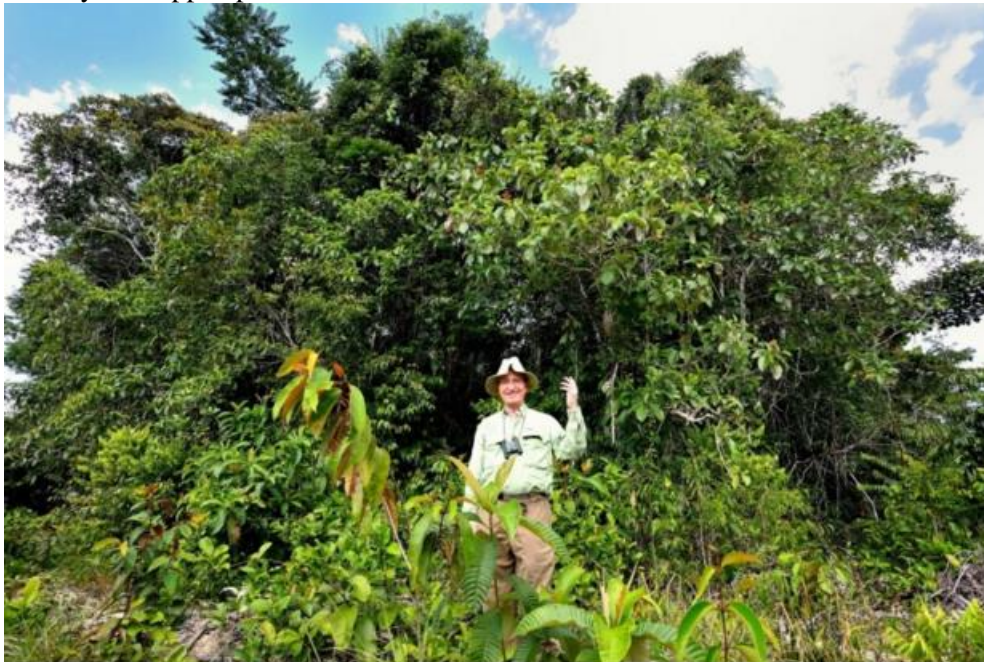
All of which makes the relentless focus on fossil fuels in the climate discussion – and the consigning of forests, at least until now, to a relative side role – somewhat puzzling. Forests, after all, are almost half carbon (if you leave out the water, that is). The billion year old process of photosynthesis stores carbon in the sugars that, in turn, fuel plant growth and metabolism.

The storage of carbon is most intense in tropical forests, where a gigantic abundance of different types of trees, thick vines and epiphytes (plants that grow on other plants) are all fighting one another for a slice of direct tropical sunlight – only a sliver of which actually reaches the forest floor. Trees don't put down very deep roots here; they stretch them outward across the ground, over a layer of often sandy soil that isn't even very rich or fertile. If the land is cleared, not only is all the carbon lost to the atmosphere, but the result often isn't even very good farmland or pasture.

Net greenhouse gas emissions due to tropical deforestation and forest degradation are about 8 to 15 percent of the global total, which doesn't sound like that much. But a recent study in *Nature Climate Change* found that stopping deforestation could nonetheless be a huge piece of the climate solution. That's because if tropical deforestation stopped, not only would those emissions go away, but on top of that, forests would start stowing away a significant part of the carbon from our fossil fuel emissions.

“One could reduce total CO₂ emissions by about 30 percent, just working in the land sector,” said Phil Duffy, president of the Woods Hole Research Center. “And that's a lot.”

Moreover, stopping deforestation could buy precious time to ratchet down fossil fuel emissions. “It's very hard to suddenly convert everyone to electric cars, and power generation is gradually changing, but it's going to take decades,” said Paul Salaman, CEO of the Rainforest Trust. “But tropical deforestation can literally be stopped point blank with commitment of countries.”



Tom Lovejoy seen at a forest fragment of Amazon rainforest on Dec. 31, 2015. (Photo by Harvey Locke)

Why a fragmented forest stores less carbon

What science is revealing, meanwhile, is that it's not just deforestation itself that's the problem – it's also the damage to what's left behind.

Camp 41, which is run collaboratively by Brazil's National Institute for Amazonian Research and the Smithsonian Tropical Research Institute, is a scientific "control" – an example of what happens when you just leave the rainforest alone and let it grow. By contrast, near here are several forest fragments, which Lovejoy helped preserve for research in the late 1970s after the surrounding land was set to be cleared for ranching.

The study of these fragments, which has been ongoing since 1980, shows that the forest left behind in the wake of deforestation also suffers greatly.

"This project I think more than any other demonstrated that forest fragmentation in patches was a very, very big problem for nature," said Harvey Locke, a conservationist and writer who visited Camp 41 with Lovejoy in December. "You never hear anybody seriously arguing now that several little patches are better than a big intact block."

Walking through an isolated, nearly 25-acre forest fragment presents a stunning contrast with the forest near the harpy eagle's angelim tree. In the intact forest, it's dark and even relatively cool at the forest floor, a simple function of the fact that trees and vines, crowding upward, have managed to claim nearly all of the sunlight.

But in the fragment, direct tropical sunlight penetrates much farther, not only from above but from every side. It's warmer as a result, and also drier – the layer of fallen leaves on the forest floor isn't wet and spongy, but crunches and crackles as you walk.

This environment sustains less life – animals and plants alike. Spider monkeys, which need to range over a huge area, can't survive in a fragment like this, Lovejoy said. And they're one food source for the harpy eagle.

"Wherever the forest has been altered or compromised, where hunting has reduced prey items, harpys are one of the first to suffer," said Bret Whitney, a specialist in Brazilian birds and a research associate at Louisiana State University who guided the recent trip to Camp 41 and identified the harpy eagle. "They really require an intact ecosystem to be out there."

"We know that tree mortality went up in this fragment compared to continuous forest," Lovejoy said. The forest, when fragmented, "becomes simpler," he said. Winds also blow down more trees in fragments, Lovejoy's research suggests, another reason that they store less carbon.

The punchline, then, isn't far from that of the movie *Avatar*: it's all connected. The climate, the trees, the animals living in the forest, and the carbon the forest stores. Indeed, recent research suggests that the poaching and killing of large forest animals like tapirs – another problem in the Amazon and around the world – also reduces the forest's carbon stock because these animals disperse the large seeds that in turn grow into the largest trees.

Without them, you'd have fewer angelims, and fewer of the other major canopy trees that dominate the tropical skyline, and that stand out if you get high enough to actually see them.

And these problems certainly aren't confined to the Amazon. "Seventy percent of the world's remaining forests are within 1 kilometer of a road," Lovejoy said. "Which is a measure of how advanced fragmentation is."

Brazil's deforestation success story turns mixed

It's not that Brazil is indifferent to the problem of deforestation – it has recently been celebrated for making considerable progress on the problem. Between 1995 and 2005, it was losing over 7,500 square miles of forest per year on average. (That's more than one Connecticut per year). However, in 2013 it only lost about 2,255 square miles, a 70 percent reduction credited to greater enforcement of forest protections.

Lately, though, the celebrations have died off a bit – deforestation in Brazil appears to have ticked up again somewhat in recent years, albeit for unclear reasons. Usually, it decreases with greater law enforcement and increases in stronger economies. But right now, with the Brazilian economy in the tank – the currency, the real, has plunged from being worth about half of a U.S. dollar in 2012-2013 to being worth only a quarter of one today – it's bucking both of these trends.

"Recently, you have high levels of enforcement, and low levels of economic activities, and an increase in deforestation," says André Guimarães, the executive director of Brazil's Amazon Environmental Research Institute. "That is striking us right now. We are still trying to understand what is going on."

Brazil recently pledged to achieve "zero illegal deforestation in the Amazon by 2030," but that would still mean major deforestation between now and then. "What they are saying is really incredible, that Brazil will coexist with illegalities in the forest sector by an additional 15 years," says Paulo Adario, the Manaus-based senior forest strategist for Greenpeace.

And the problem of tropical deforestation is far broader than Brazil. The burning of Indonesia's tropical peatlands contributed more greenhouse gases to the atmosphere than the vast majority of countries did from fossil fuels in 2015. And while Indonesia and Brazil remain the world's tropical forest loss leaders, other smaller nations like Cambodia, Sierra Leone, and Madagascar are contributing more and more to the overall total, according to recent satellite data from the University of Maryland and Google. Other countries into which the Amazon rainforest extends, like Bolivia, Peru, and Venezuela, have also seen substantial deforestation in recent years.



Amazon rainforest seen at dawn on Dec. 29, 2015. (Photo by Harvey Locke)

The dreaded feedback

A view above the Amazon forest canopy from a research tower on a wet December morning, meanwhile, underscores another disturbing problem closely tied to deforestation. Namely, even as the world tries to protect tropical forests, climate change itself could alter them further, causing them to store less carbon and triggering a feedback cycle of ever worsening warming as a result.

As the sun rises after an intense rain, the trees of the Amazon – a splash of different shades of green – seem to collectively perspire. Vast clouds of water vapor rise off them, a phenomena Lovejoy says is driven both by countless leaves opening and closing their stomata (or pores) and letting water out, and also evaporation off of the forest.

In this way the forest creates weather that fills the planet’s largest river with water and also provides crucial rain across much of South America.

The Amazon pulls in Atlantic moisture and then “it gets recycled about five times as the air mass moves to the Andes,” Lovejoy said. But now, he fears, the loss of forests is threatening this hydrological cycle – leaving too few trees to drive rains, a development underscored by droughts in 2005 and 2010.

Deforestation could dry out the Amazon, but a warmer climate might do the same. The length of the dry season here is expected to increase due to climate change, and in fact, that already seems to be happening in some Amazon regions. And this, in turn, could not only threaten regional hydrology but push a transition to less carbon-dense forests – in some cases even exacerbating the possibility of wildfires that could transform tropical forests into a different, savannah-like environment.

Thus, both continuing deforestation and a warming climate alike threaten the carbon storage, and the rain generation, of the vast Amazon system. It’s not one menace – it’s two that are closely intertwined.

Forests become part of the climate story

The forests section of the recent Paris climate agreement wasn’t one of the most noted or debated

sections. And it wasn't as strong as some would have liked. But the mere fact that it was there was a landmark, Lovejoy said.

“Happily, forests are now part of the way the whole climate agenda is put together,” he said, even though “it may have been only a couple of paragraphs in Paris.”

The key change in tone may simply reflect the huge ambition of the Paris agreement – and its citation of the seemingly unattainable 1.5 degree temperature target in particular. With goals like these, it's becoming clear that the solution to climate change isn't any one thing. It's an all-hands-on-deck moment.

The harpy eagle, glimpsed on two successive mornings in its giant tree, with its regal crest and powerful legs that Whitney says are “as thick as a man's wrist,” is no party to any of this. It's just trying to survive, and pursuing a strategy for doing so that evolved long before modern deforestation. It can't help needing very large trees and vast areas over which to hunt – so it can't help being a kind of symbol.

But what's increasingly clear is that the birds, the forests and all of its other life, the rainfall, the carbon – they all come as a package.

And what's equally clear is that climate change isn't just about temperature, or about fossil fuels. It's about all the ways that humans keep pushing gigantic systems like the Amazon, and hoping that they'll bounce back, just because they always have before.

https://www.washingtonpost.com/news/energy-environment/wp/2016/02/11/the-solution-to-climate-change-that-has-nothing-to-do-with-cars-or-coal/?tid=a_inl