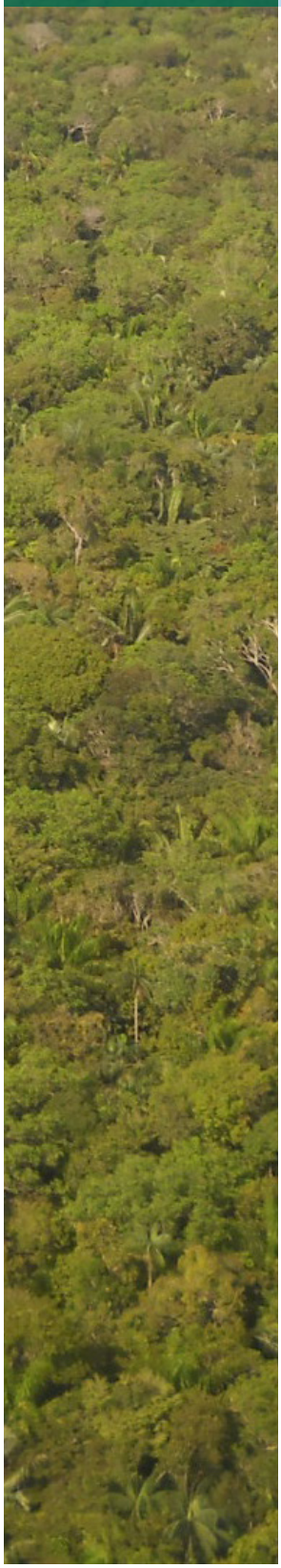
Woods Hole Research Center

POLICY BRIEF

Forests and Land Use: Undervalued Assets for Global Climate Stabilization

Why protecting and restoring forests and promoting sustainable agriculture and land use is more important than ever for the future of our planet

Richard A. Houghton, Richard A. Birdsey, Alexander Nassikas, and David McGlinchey



KEY SCIENCE POINTS

- Forests and agriculture can get us at least a quarter of the way to meeting the Paris Agreement's goal of limiting warming to 1.5 °C. While a rapid decarbonization of the global economy remains essential, aggressive action to reduce emissions from the land sector can buy additional time for this transition.
- Maximizing mitigation from forests and agriculture requires protecting and restoring forests, improving agricultural practices, and shifting to more sustainable diets. This can enhance the role of the land sector as a carbon sink.
- Levels of funding for political attention to forests and land use do not reflect their essential role in our global response to climate change.

A BRIDGE TO A FOSSIL-FUEL FREE WORLD

To avoid the worst impacts of climate change, the Paris Agreement aims to limit the average global temperature increase to 1.5 °C above pre-industrial levels. Despite existing efforts, we are not on track to meet this target.[1] Stabilizing our climate requires more ambitious action, and forests and agriculture have an important and underappreciated role to play.

Forests already remove around 30% of human-produced carbon dioxide emissions from the atmosphere, and with efforts to maximize their role as a carbon sink, they can remove much more.[2] To meet the goals of the Paris Agreement, deep reductions in fossil fuel emissions must be accompanied by rapid increases in the removal of carbon dioxide emissions from the atmosphere. We can manage forests and other land to reduce emissions and enhance this carbon sink capacity.

While a rapid decarbonization of the global economy remains essential, ending deforestation, allowing damaged forests to grow back, and leaving mature forests undisturbed can buy additional time for this energy transition to take place. In fact, ending tropical forest loss, improving tropical forest management, and restoring 500 million hectares of tropical forests could reduce sufficient emissions to provide 10-15 years of additional time to dramatically reduce our use of fossil fuels.[3] The potential is even larger if the role of the entire land use sector is considered.

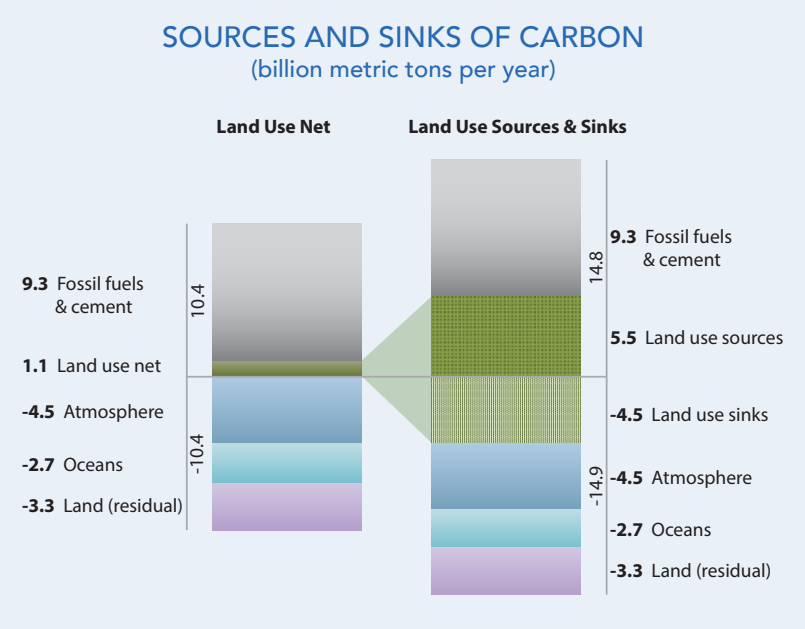
Forests and agriculture can get us at least a quarter of the way to meeting the Paris Agreement's 1.5 °C goal.[4] For this to happen, net emissions from the land sector must peak by 2020, reach zero between 2040 and 2050, and become negative afterward. Achieving 'net negative' emissions—meaning the land sector absorbs more carbon from the atmosphere than it emits—requires dramatic reductions in deforestation, forest degradation, and peatland loss; forest restoration and improved forest management; and more sustainable agricultural systems. This last category includes changing the way we both produce and consume food, by increasing soil carbon sequestration and reducing on-farm emissions while also ending food waste and shifting toward more sustainable diets.

Capturing more carbon in land and forests is a critical component of any plan to tackle global warming. It is not a substitute for eliminating our dependence on fossil fuels. But together, the near-term deployment of our collective forest and land use asset can begin significantly larger-scale carbon removal while policies and technologies are rapidly developed to constrain and eventually end fossil fuels use.

UNREALIZED CARBON SINKS

Forests and lands both emit and remove carbon from the atmosphere. This unique characteristic has obscured the importance of the land use sector for climate change mitigation, because emissions and removals are lumped together rather than treated separately.[5]

The figure illustrates how this hides significant opportunities for emissions reductions and the full scale of the carbon removals potentially available.



- In net terms (subtracting total removals from total emissions), land use is responsible for only around 10% of carbon emissions, but gross land use emissions by themselves are responsible for approximately 37% of the total.
- On the other hand, gross land use removals are responsible for 30% of negative emissions but, when added to the residual land removals (primarily from unmanaged forests), terrestrial ecosystems remove 51% of anthropogenic carbon emissions.
- Looking at the full value of carbon removals (rather than subtracting removals from the emissions) would give a better sense of the mitigation potential of the land use sector.

THE POTENTIAL OF FORESTS

With appropriate action, the cumulative size of the forest sink could increase by 100 billion metric tons of carbon by the year 2100 – significantly larger than it is today. There are three primary ways we can use forests to help mitigate climate change[6]:

1. Stopping deforestation—ending the loss of forest area.
2. Improving forest management and reducing forest degradation (the smaller scale removal of trees from standing forests). New research indicates that degradation is responsible for 70% of forest loss in the Americas and 81% in Africa.[7]
3. Allowing forests to grow back in areas that have been deforested, either through natural regeneration or by planting trees. Past efforts at afforestation (establishing forests on land not previously forested), reforestation (renewing forest cover on previously forested land), and forest restoration (improving forest condition, tree cover, and carbon stocks) offer models. For example, efforts to plant, replant and restore forests in South Korea, China, and India have removed more than 3.3 billion metric tons of carbon from the atmosphere over the past two decades, at a reasonable cost.[8] These programs, however, need to be part of a long-term strategy to ensure that their sequestration potential is realized.

Scientists estimate net emissions of 1.1 billion metric tons of carbon from forested areas and land use each year. But, this net figure obscures the magnitude of the opportunity: 5.5 billion metric tons of carbon is released through deforestation and degradation, while 4.4 billion metric tons of carbon is absorbed through standing forests on managed lands. For perspective, that 4.4 billion metric tons is 18 times the annual emissions from all cars and trucks in the United States. Maximizing the contribution of forests to climate change mitigation requires bringing the 5.5 billion metric tons of annual emissions from deforestation and degradation close to zero. But it also requires maintaining the 4.4 billion metric tons of carbon absorbed by forests each year, by improving the management of existing forests and increasing forest area. With increased efforts to manage the land for carbon, the cumulative forest sink could increase by 100 billion metric tons of carbon by 2100, equivalent to a decade of global fossil fuel use at today's rates of emissions.

Forests also provide significant climate benefits beyond avoiding and removing greenhouse gas emissions. For example, they play an important role in regulating climate locally by cooling the Earth's surface and regulating rainfall patterns.[9] Strong evidence shows deforestation directly alters local and regional rainfall and temperature, threatening food security.[10] Hundreds of millions of indigenous peoples and local communities also depend directly on forests for their livelihoods, and securing their land and resource rights is a proven strategy for avoiding deforestation.[11]

THE POTENTIAL OF AGRICULTURE AND LAND USE

More sustainable land use, especially improvements in our agricultural systems, can do even more to reduce emissions and increase carbon removals. Agricultural land use change has released significant amount of carbon from soils. Improved agricultural practices and better pasture management can reduce these emissions and increase the ability of agricultural systems to sequester carbon from the atmosphere. Restoring degraded soils by enhancing their carbon content would also increase yields and the resilience of agricultural and grazing systems in developing countries, improving food security and helping to reduce poverty. Other sources of emissions reductions in the agricultural sector include improving the production and use of synthetic fertilizers and reducing livestock emissions from manure and enteric fermentation.[12]

Maximizing the contribution of the agricultural sector to climate change mitigation will also require changes in our consumption habits. Beef, for example, is responsible for 6% of anthropogenic greenhouse gas emissions each year—more than half the annual emissions of the European Union. These emissions occur all along the supply chain. Agricultural expansion is the largest driver of forest loss, and the demand for animal feed, especially from soy, further accelerates deforestation. On the farm, cows produce significant greenhouse gas emissions through their digestion and waste.

Improving production practices can decouple beef production from deforestation and reduce on-farm emissions. A shift in diets can also generate significant emissions reductions. Addressing beef consumption in just three countries (halving it in the United States, reducing it by 25% in Brazil, and holding it at 2010 levels in China) would avoid 129 million metric tons of emissions—the equivalent of taking 100 million cars off the road.[13]

A NATURAL, EFFECTIVE CARBON REMOVAL TECHNOLOGY

We don't need to wait for a future technological fix for removing carbon for the atmosphere. A range of so-called "carbon dioxide removal" (CDR) technologies have been proposed, including direct air capture and bioenergy with carbon capture and storage (BECCS), a process involving growing biofuels (trees or other crops) to remove carbon from the atmosphere and then capturing and storing the emissions when these fuels are burned in power plants to produce electricity.[14] But reducing deforestation and increasing carbon removals from forests and other natural ecosystems is a natural CDR technology—and unlike BECCS, one that is technically proven and available immediately to be deployed at scale. It is also the only CDR technology that offers large social and environmental co-benefits.

Forests have been sequestering carbon for thousands of millennia—there is a comparable amount of carbon stored in forests as in recoverable geologic fossil fuel deposits. In terms of climate impact, forest emissions are no different than fossil fuel emissions. Reductions in emissions from forests are as permanent and important as those from fossil fuels.[15]

A WORTHWHILE INVESTMENT

Despite their importance, the level of funding for forests is an order of magnitude smaller than it would be if finance were allocated on the basis of overall mitigation potential. The Paris Agreement calls on all countries to conserve and enhance sinks and to provide finance for reducing emissions from deforestation and forest degradation. While many countries have taken important steps toward prioritizing the reduction of forest emissions, the scale of finance available remains vastly disproportionate to the size of the problem and importance of the solution. Since 2010, only $3.6 billion of the US$167 billion committed by multilateral institutions and developed country donors to climate change mitigation has actually been allocated to reducing deforestation.[16]

Climate finance should match the potential of forests and lands as a climate solution. Financial support, from both the public and private sectors, is needed to develop and implement efforts to reduce emissions from forests. Some of this funding can be shifted away from the billions currently supporting business-as-usual land management. Agricultural expansion is the largest driver of deforestation, but since 2010, 'grey finance' from all sources invested in agriculture in high-deforestation countries has been nearly 40 times larger than 'green finance' for forest conservation.[17]

CONCLUSION

The scientific evidence is compelling: reducing emissions and increasing carbon removals from forests and land use offers enormous opportunities for climate change mitigation. The converse is also true: without dramatic reductions in emissions and increases in carbon removals from forests and land use, we will not meet the goals of the Paris Agreement.

Realizing the full climate mitigation potential of forests and land use requires immediate and coordinated action at the global level. To keep global warming under 1.5°C, national governments must aggressively counter deforestation and degradation while looking for ways to increase the size of the land carbon reservoir. Climate finance should be commensurate to the importance of forests as a climate mitigation tool. Without significant attention from policy makers, this moment of opportunity could be lost.

WHRC EXPERTS

Richard A. Houghton
508-444-1516 • rhoughton@whrc.org

Richard A. Birdsey
508-444-1576 • rbirdsey@whrc.org

Alexander Nassikas
508-444-1520 • znassikas@whrc.org

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