



SUMMARY FOR POLICYMAKERS

Implications for the Private Sector of Non-Carbon Effects of Tropical Deforestation

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Tropical deforestation warms the climate more than previously thought: A [WRI report](#) shows that CO₂ emissions from deforestation are only part of the story linking forests to climate stability in ways that implicate private sector interests. Tropical forests also have non-carbon effects that directly impact commodities and supply chains, such as regulating local temperature and rainfall in ways that maintain agricultural productivity and the safety of rural workers. As a result, tropical deforestation threatens the sustainability of global supply chains in ways that compound the risks due to greenhouse warming.

While many companies and financial institutions have made commitments to get deforestation out of their supply chains and investment portfolios to address reputational and regulatory risks, very few, if any, account for material risks associated with commodity-driven forest loss. The findings on the non-carbon effects of tropical deforestation should galvanize the business and investment community to double down on their commitments, and end and reverse their contributions to tropical forest loss as a critical element of corporate climate action.

Here is what the private sector needs to know about the latest science on the impacts of forests' non-carbon effects on climate stability, how this knowledge should inform ongoing private sector action to curb deforestation, and how to accelerate private sector action to reduce deforestation-related climate risk.

NOT JUST CARBON: FORESTS' BIOPHYSICAL EFFECTS ON CLIMATE

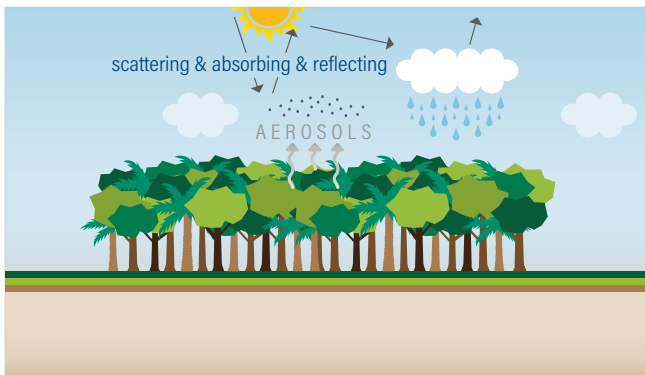
The WRI report [Not Just Carbon: Capturing All the Benefits of Forests for Stabilizing the Climate from Local to Global Scales](#) summarizes the growing body of research revealing that forests interact with the atmosphere in many ways other than through the global carbon cycle. In addition to affecting the global climate by exchanging carbon with the atmosphere, forests influence global and local temperatures and rainfall patterns through four main non-carbon, biophysical processes:

- Albedo, or how much of the sun's energy is reflected into space from a particular surface, affects how much solar energy is absorbed. Light-colored surfaces return a large part of the sun's energy back to the atmosphere and can have a cooling effect (high albedo). Dark surfaces absorb the rays from the sun and can be warming (low albedo). Dark green tree cover usually absorbs more energy than snow cover, crops, or bare soil, warming the air as leaves release that heat, much like the heat radiating from a blacktop road.

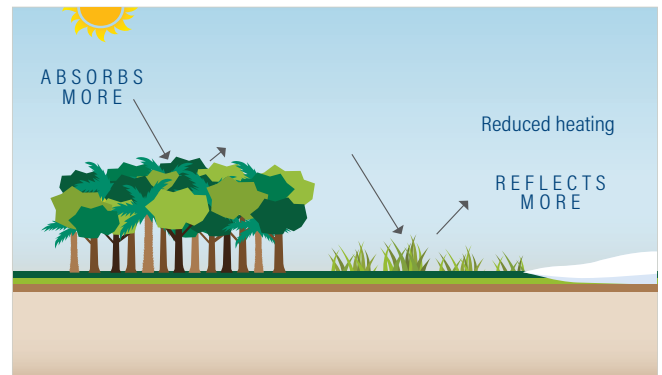
- Evapotranspiration, or the role of trees in releasing moisture into the air, produces a cooling effect. This happens when water evaporates from the surface of leaves, as well as when water pulled up through the tree's roots is released through tiny pores in leaves. These processes function as natural air conditioning, cooling Earth's surface and near-surface air.
- Surface roughness, or the unevenness of a forest canopy, affects wind speed and turbulence. This turbulence helps lift heat and moisture away from Earth's surface, providing a cooling effect.
- Aerosols are tiny particles released by forests, such as pollen. Trees also release chemical compounds, such as the ones that give Christmas trees their signature aroma. These particles and compounds interact with the atmosphere in complex ways, such as changing ozone and nitrate concentrations and affecting the color of clouds.

Figure 1 | Four non-carbon effects of forests on climate

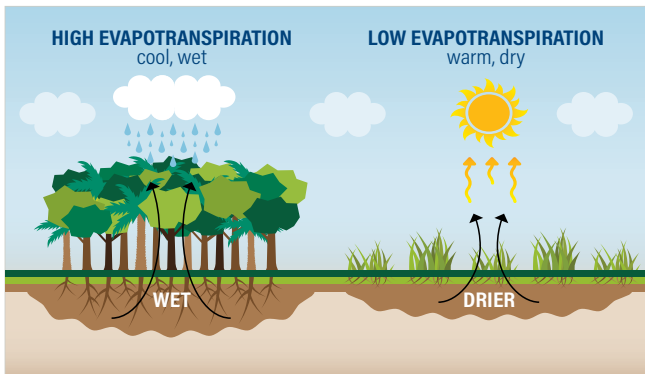
AEROSOLS



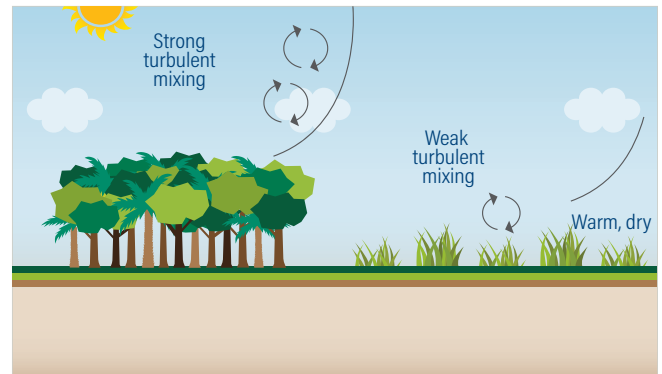
ALBEDO



EVAPOTRANSPIRATION



SURFACE ROUGHNESS



Source: Adapted from Wolosin and Harris 2018.

Together, these flows of energy, moisture, particles, and compounds can interact to generate cloud cover, which in turn increases albedo, causing more of the sun's energy to be reflected into space, with a cooling effect.

Deforestation disrupts these forest biophysical processes, and the effects of the disruption play out at global, regional, and local scales.

At the global scale, tropical deforestation contributes 50 percent more to global warming than counting carbon alone suggests.

Forests' net global cooling or warming effects depend on their latitude. Tropical forests have an outsized impact on global cooling when accounting for biophysical effects, meaning that loss of tropical forests has an outsized contribution to global warming.

At the regional scale, deforestation can decrease precipitation downwind, with implications for rainfall even across national boundaries. Tropical forests act as “precipitation sheds” that can span national borders and regulate rainfall on a local and regional scale. For example, deforestation in the Brazilian Amazon impacts rainfall in Bolivia, Uruguay, Paraguay, and Argentina. This disruption in rainfall patterns can increase the risk of drought in ways that threaten food and water security.

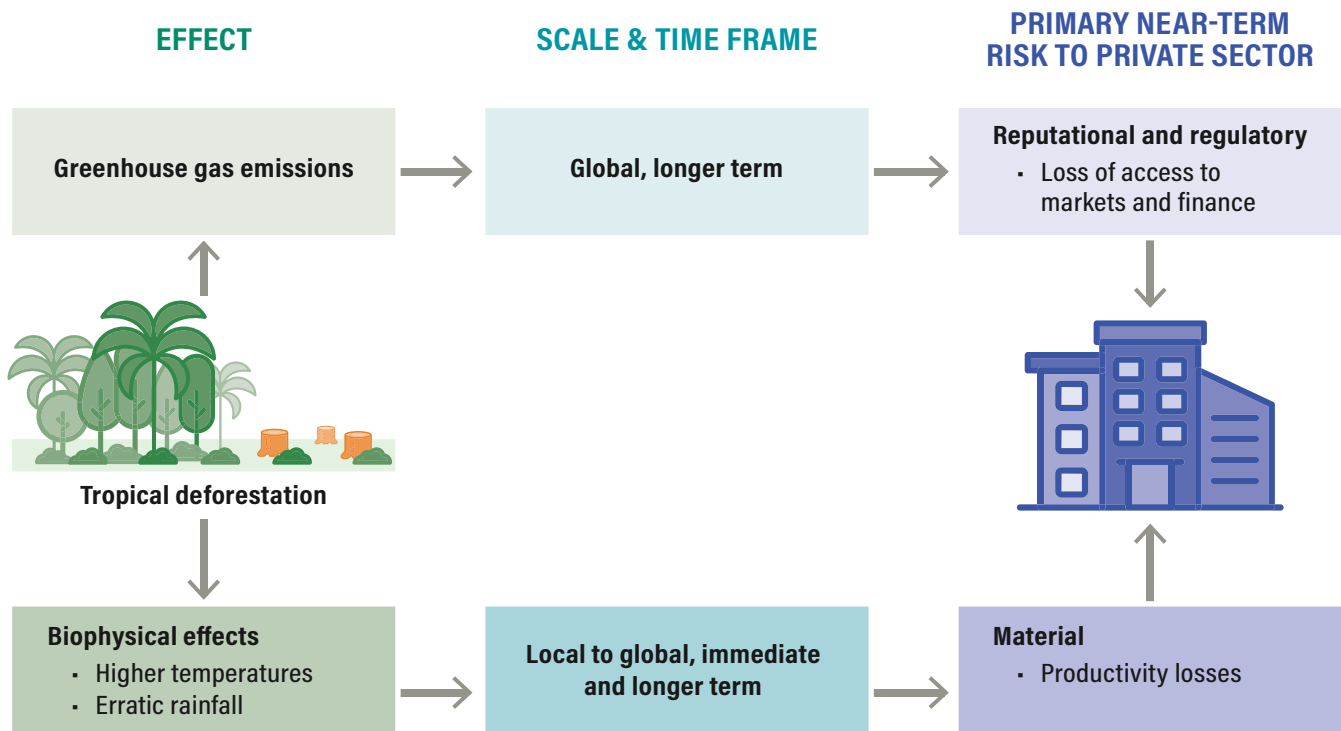
At the local scale, deforestation can cause local average and extreme temperatures to rise significantly. For example, while the average effect of greenhouse warming might be only 1°C, the hottest part of the day might be more than 7.6°C warmer in local communities that have lost the cooling effects of forests. This local increase in temperature due to deforestation compounds the local effects of global greenhouse warming, thereby magnifying heat stress on humans, agricultural crops, and livestock.

HOW DO THE NON-CARBON RISKS OF DEFORESTATION IMPACT SUPPLY CHAINS?

The primary drivers for corporate action on deforestation thus far have been **consumers** making it increasingly clear they do not want to buy products responsible for forest loss and degradation, and **pressure** for companies to make and implement commitments to achieving net zero emissions.

The *Not Just Carbon* report emphasizes that, in addition to exacerbating global warming through both carbon and non-carbon effects, tropical deforestation affects regional rainfall and local temperature, which in turn affect growing conditions for crops and livestock and working conditions for rural laborers. As a result, agricultural areas near deforested land are at risk of *present* agricultural and labor productivity declines from local and regional biophysical changes, not just *future* declines from global warming, with resulting material impacts on supply chains. Figure 2 illustrates how these two different types of effects of deforestation result in different primary near-term risks to the private sector.

Figure 2 | Deforestation introduces new material risks at local and regional scales



Source: Authors.

■ Deforestation results in crop productivity loss because of warmer, drier conditions

The effects of tropical deforestation lead to higher local temperatures and drier conditions that can directly impact crops. For example, in Brazil, a [recent study](#) estimated that increased temperature extremes due to nearby deforestation resulted in a 12 percent productivity loss on soy yields, and an associated US\$99 loss per hectare per year. Conventional wisdom holds that crop production is increased via expansion into forest frontiers. While this may be true for an individual producer at the frontier, there is evidence that [Brazil may soon reach tipping points](#) where commodity crops could experience productivity declines from continued area expansion.

The disruption of historical rainfall patterns following the deforestation of large areas presents similar risks to agricultural productivity within and across national boundaries. [In Argentina](#), farmers suffered a debilitating drought in 2017 plausibly linked to deforestation in the Amazon, resulting in crop losses of more than \$1.5 billion, and an overall impact on the economy of about \$4.6 billion.

■ Warmer, drier conditions lead to heat stress that affects worker productivity and health

In addition to losses in crop yields, deforestation-induced higher temperature extremes can also lead to lower labor productivity and health concerns. In the [Brazilian state of Pará](#), summer daylight hours when laborers can work outside without suffering from heat stress have shrunk by over an hour a day. Heat exposure not only negatively impacts work output, it also presents significant health risks to outdoor workers in or near deforested areas. [Working in extreme heat](#) risks dehydration, decreases worker productivity, and increases the risk of workplace accidents due to cognitive impairment, compounding occupational risk from pesticide use. These risks are heightened by [weak worker safety regulations and health coverage](#) associated with the informal types of employment common on deforestation frontiers. This exposes companies not only to operational risks but also to inadvertent labor rights violations.

ISN'T THE PRIVATE SECTOR ALREADY WORKING TO REMOVE DEFORESTATION FROM SUPPLY CHAINS AND FINANCIAL PORTFOLIOS?

The private sector entities most exposed to deforestation-related risks are influential companies dealing directly or via their suppliers, as well as their investors, in “[forest-risk](#)” commodities, including beef, soy, palm oil, pulp and paper, cocoa, rubber, and coffee. Such companies include large consumer goods and food and beverage corporations with land-based operations in the tropics or with forest-risk commodities in their supply chains. It also includes banks that own or lend to such companies, some of which are in high-deforestation countries, but may be headquartered anywhere in the world.

Over the last decade, [hundreds](#) of these companies and financial institutions have made commitments to eliminate commodity-driven deforestation, many in the context of larger initiatives such as the [New York Declaration on Forests](#), the [Consumer Goods Forum's Zero Net Deforestation Commitment](#), and the [Tropical Forest Alliance 2020](#) — several of which set, and missed, a target of 2020 for halting forest loss.

Despite high-profile commitments, many companies have struggled with implementation and monitoring, and [progress has been patchy](#), with a need for greater transparency and standardized reporting. Further, [one-third of the companies](#) with the largest exposure to tropical deforestation have not yet made any kind of commitment to deforestation-free supply chains.

There are similar challenges for investors. A [recent report](#) by the Forests & Finance Coalition shows that investors still hold \$40 billion in bonds and shares related to forest-risk commodities, more than three times the amount covered in the [Global Forest Finance Pledge](#) toward forest-related climate finance at UNFCCC COP26.

Yet despite missed targets, real progress on deforestation-related commitments is possible. For example, [Indonesia's recent success](#) in reducing the loss of primary forests for five years in a row is at least partially due to the implementation of such corporate commitments.

WHAT CAN COMPANIES AND FINANCIERS DO TO MANAGE DEFORESTATION'S NON-CARBON CLIMATE RISKS?

Conservation of tropical forests is even more important for climate mitigation and adaptation than previously thought. Much of what needs to be done aligns with the commitments companies and investors have already made to get deforestation out of commodity supply chains and financial portfolios, but they should accelerate these efforts on the basis of newly appreciated material risks. Some ways that companies and investors can accelerate progress include:

■ Companies can increase their coordination and engagement

Multiple companies can build collective capacity through coalitions and public-private partnerships, such as the Consumer Goods Forum's [Forest Positive Coalition of Action](#) and the [Tropical Forest Alliance](#), which promote collaboration with other stakeholders in production landscapes to address commodity-driven deforestation. Individual companies can align their sourcing policies with standards for developing and monitoring ethical supply chains, such as those of the [Accountability Framework initiative](#). Companies can also participate in jurisdictional-scale programs such as the [Cocoa & Forests Initiative](#) and those supported by the [Roundtable on Sustainable Palm Oil](#) to increase traceability and improve performance through long-term partnerships with stakeholders in producer jurisdictions.

■ Investors can leverage corporate disclosure requirements

Corporate contributions and exposure to forest- and climate-related risks are increasingly subject to disclosure requirements, such as through initiatives like the [Task Force on Climate-related Financial Disclosures](#) and the more recent [Task Force on Nature-related Financial Disclosures](#), the [International Sustainability Standards Board](#), and [CDP Forests](#). As a result, investors could increasingly reward companies that actively manage those risks to private investment, and appropriately value the risk exposure of those that do not.

■ Investors can increasingly set expectations for their lending portfolios

Following the lead of the [Glasgow Financial Alliance for Net Zero](#), [35 financial institutions](#) managing more than \$8.9 trillion in assets committed to eliminating agricultural commodity-driven deforestation risks in their investment and lending portfolios by 2025. This initiative, called the Financial Sector Deforestation Action, lays out investor [expectations](#) for portfolio companies, aligned with the Global Canopy's [Finance Sector Roadmap](#) for eliminating commodity-driven deforestation from investment funds. These initiatives complement the guidelines for investment in sustainable land use laid out by financial advisory groups such as the [UN Principles for Responsible Investment](#) and [Ceres](#).

■ Private sector action can be paired with government support

The [Glasgow Leaders' Declaration on Forests and Land Use](#) (COP26) and subsequent [Forest and Climate Leaders' Partnership](#) (COP27) demonstrate international momentum, and incentives are following. These include the [EU's new legislation](#) prohibiting products linked to forest degradation and deforestation to be sold in the EU. The business and investment community should not only adhere to but also demand public policies in alignment with private efforts to conserve natural resources, such as the [300 companies](#) that urged government leaders to make disclosure requirements on nature degradation mandatory at COP27.

In addition to increasing the pace of implementing current commitments, operating companies and financial actors should be motivated to take additional steps to address the material non-carbon climate risks posed by deforestation to their supply chains and investment portfolios. These newly appreciated risks have bottom-line implications for companies with core businesses that depend on climate stability, as well as for associated investors and financiers, that are more immediate than long-term climate risk. They thus demand enhanced attention from a broader suite of corporate decision-makers than those implicated in current deforestation-related commitments. Additional steps should include developing a better understanding of the size and scale of the risks, and investment in solutions that address the biophysical sources of risk directly. Specifically:

■ Companies and financial actors should invest in research for better spatial analysis

Improved understanding of the magnitude and scale of biophysical effects would provide companies and private investors with a more accurate picture of the economic and financial impacts of forest cover change mediated through the atmosphere. Only then

can these costs be compared to the costs of adaptation to the resulting climate instability predicted to result from forest loss, in terms of impacts on the health of agricultural crops and the people who tend them.

■ **Companies should engage in initiatives at larger spatial scales**

Companies may be able to manage reputational and regulatory risks by avoiding deforestation in their own supply chains, but to manage material risks, they need to slow nearby deforestation, including outside their supply chains. The scale of their engagement needs to mirror the scale at which the biophysical effects of deforestation put them at risk. Companies can cooperate on a large scale through [jurisdictional approaches](#), including collaboration with the governments in the places they operate.

Curbing deforestation is a complex challenge, and all actors in the private sector need to do their part. Accounting for *all* the climate-stabilizing benefits of forests is good for people, nature, and the bottom line.

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