6. Have climate issues been addressed?

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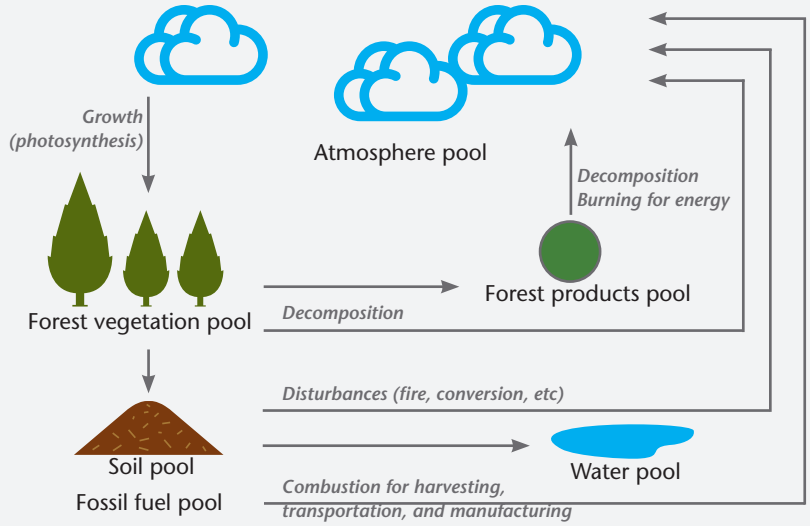
Climate and forests are intrinsically linked. As a result of climate change, forests are stressed by higher mean annual temperatures, altered precipitation patterns, and more frequent and extreme weather events. At the same time, forests mitigate climate change through uptake of carbon, and the loss of forests through land-use conversion and forest degradation causes carbon dioxide emissions that contribute to climate change (IPCC 2014).

CLIMATE CHANGE MITIGATION

Forests remove carbon from the atmosphere (carbon sequestration) and store it as trees grow (Figure 8). Global forest carbon stocks are estimated at 861 billion tons, more than half of which is stored in tropical forests (Pan et al. 2011). When trees are harvested, they stop absorbing carbon from the atmosphere, but the resulting wood products, including solid wood and paper-based products, continue to store carbon through their lifetime (Box 11).

The amount of carbon stored in wood products is estimated to be increasing by 189 million tons per year (Pan et al., 2011). The amount of carbon stored in wood products varies significantly among product types and depends on the method of disposal. On average, solid wood products last longer than paper-based products (Larson et al., 2012) and carbon in both forests and products is released back to the atmosphere either slowly through decomposition or quickly by burning.

Figure 8. Carbon pools and exchanges between pools



The burning of forest products substitutes for the use of fossil fuels.

Box 11. What does 'carbon neutrality' mean?

There is no widely accepted definition of 'carbon neutrality'. Generally, 'carbon neutrality' is achieved when the amount of carbon released from the production process is offset by an equivalent amount captured in new growth, thus resulting in net zero emissions. Wood harvested from forests with stable or increasing carbon stocks can be considered carbon neutral (WBCSD, 2013). In contrast, wood from forests that are being converted to non-forest land use would not be carbon neutral. Additionally, greenhouse gas emissions are released along the production process of wood products. Hence, wood products might not be carbon neutral if additional steps are not taken to offset the emissions from the production process (Lippke et al. 2009).

Forest restoration

Establishing new forests on suitable land and replanting on formerly forested areas can store additional carbon (Box 12). The Global Partnership on Forest and Landscape Restoration estimates that over 2 billion hectares of deforested and degraded landscapes worldwide can potentially be restored (WRI, 2011). Thanks to growing recognition of forest and landscape restoration's role in reducing carbon dioxide emissions and increasing carbon sequestration, countries have pledged over 20 million hectares to the Bonn Challenge—a global commitment to restore 150 million hectares of lost and degraded forests by 2020. Countries committed to the challenge, including Brazil, Costa Rica, El Salvador, Rwanda, and the United States, are beginning to announce their restoration pledges (IUCN, 2012).

Voluntary carbon markets

Companies seeking to supplement greenhouse gas (GHG) emissions reductions and further reduce their net carbon footprint may choose to purchase carbon credits from voluntary carbon markets to offset their emissions. In 2012, carbon offsets from conserving and expanding 26.5 million hectares of forest (an area about the size of New Zealand) were valued at $216 million USD (Forest Trends, 2013) (Box 13). The private sector continues to make up the majority of the demand, purchasing 70 percent of the total carbon offsets in 2012 as a way to demonstrate corporate social responsibility and commitment to addressing climate change (Forest Trends, 2013). A number of voluntary carbon markets are now operating and standards are in place to verify the validity of projects offering carbon credits (Table 13).

Box 12. The rate of carbon sequestration

The rate at which trees and forests recapture atmospheric carbon depends on the interplay of several factors:

- **Age of trees:** A young stand with small trees will absorb carbon as the trees grow. The amount of carbon stored is initially small, however, because the trees are small and organic matter decomposes more rapidly under an open canopy. An old stand with big trees results from a long period of biomass accumulation. The carbon accumulation rate generally increases with older and bigger trees, though the rate of growth for individual trees does not equate to the overall growth of the stand (Stephenson et al., 2014).
- **Supply and use of resources:** Trees depend on resources, such as sunlight, water, and nitrogen, to grow. As a forest stand develops, the trees increasingly compete for these resources. A tree's ability to compete for resources depends on its size and age (Caspersen, Vanderwel, Cole, and Purves, 2011; Stephenson et al., 2014).
- **Efficiency of resource use:** The efficiency of resource use depends on size and species of trees. Larger trees are generally more efficient in absorbing resources than smaller trees, though this changes over various stages of stand growth (Binkley, 2003).

Table 12. Voluntary carbon markets and voluntary carbon standards

Organization	Description	Geographic Region	Website
Voluntary carbon markets			
Carbon Trade Exchange	Members of the exchange can sell and buy carbon credits generated from four types of projects: renewable energy, forestation and afforestation, energy efficiency, and methane capture. Projects are verified by a third party.	Global	http://carbontradexchange.com/
Carbon Farming Initiative	Farmers and landholders can participate and earn carbon credits for storing carbon and reducing emissions on their land. They can then sell the credits to interested businesses as carbon offset.	Australia	http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative
Permanent Forest Sink Initiative	Awards carbon credits to forest landowners committed to long-term maintenance of biomass stocks and helps them sell credits within voluntary carbon markets.	New Zealand	http://www.permanentforests.com/
Voluntary carbon standards			
Verified Carbon Standard	Provides methodologies for certifying projects and calculating carbon credits; certified projects must go through independent auditing. Verified Carbon Standard is one of the most widely used standards for the agriculture, forestry and other land use sector.	Global	http://www.v-c-s.org/
The Gold Standard	A certification body that verifies the quality of carbon credit projects. Carbon credits that have been certified by the Gold Standard are sold through intermediary companies.	Global	http://www.goldstandard.org/
Plan Vivo Standard	Certifies carbon credit projects led by rural smallholders and rural communities. The 2013 updated standard emphasizes community participation and ownership, and non-carbon benefits.	Global	http://www.planvivo.org/

Box 13. Reducing Emissions from Deforestation and Forest Degradation (REDD)

REDD is a global effort to create financial incentives for reducing carbon dioxide emissions from forests by decreasing conversion of forested land for other uses. "REDD+" expands on this initiative and includes conservation and enhancement of forest carbon stocks and sustainable forest management.
Since negotiations on the REDD mechanism began in the United Nations Framework Convention on Climate Change (UNFCCC) in 2005, countries and international organizations have focused on developing national strategies and forest monitoring systems, building capacity, developing social and environmental safeguards, and improving forest governance.
While countries are still preparing for national implementation of a REDD+ program, carbon credits from some REDD+ projects are already being sold on the voluntary carbon market. REDD+ projects are the largest source of carbon offsets, making up 38 percent of the market share in 2013 (Forest Trends, 2014).

Wood-based biofuels

The forest industry is a major user of biofuels derived from wood. Sawmills and pulp mills both burn those parts of the tree that they cannot convert into merchantable products. Co-generation of heat and electricity is common, and some mills even export electricity to the grid (Asikainen et al., 2010). Using wood waste for fuel can help reduce the use of fossil fuels.

Harvesting wood to produce wood-based biofuels, however, is a different scenario. To determine whether harvesting wood for biofuels can reduce carbon dioxide emissions, additional factors must be considered. First among these factors is the amount of emissions associated with harvesting, transporting, and using wood-based biofuels. Second, the long-term productivity of the land and its ability to replace the carbon stock lost to harvesting (Mitchell, Harman, and O'Connell, 2012) should be considered. Finally, the biological changes resulting from continuous harvesting— such as change in stand age and soil fertility—may reduce productivity (Schulze et al., 2012). Additionally, while the emissions from harvesting wood can be offset with regrowth on the same land, the calculation of carbon savings should account for the amount of carbon that could have been sequestered if the trees were not harvested for biofuel production (Haberl et al., 2012; Searchinger, 2010; Hudiburg et al., 2011).

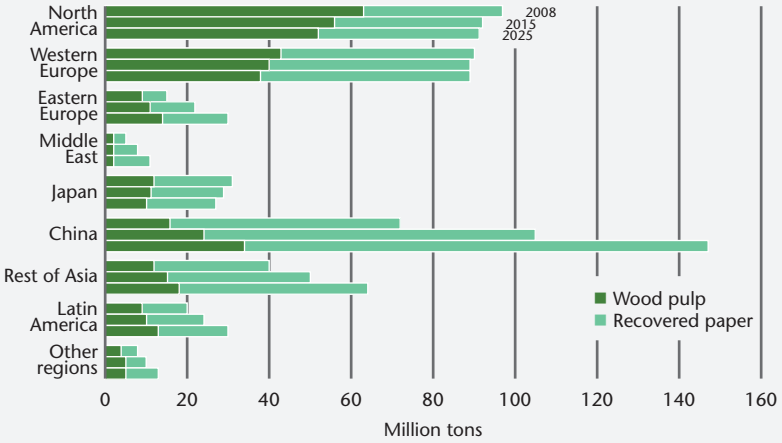
CONTRIBUTIONS TO CLIMATE CHANGE

An estimated 13 percent of global carbon dioxide emissions are attributable to land-use changes and forestry activities (Pan et al. 2011). When forests are logged, destroyed, or burned at a faster rate than the rate at which they regrow, they can contribute to climate change. Additionally, while logging of tropical hardwoods is sometimes the primary purpose of forest clearing, it can also trigger and enable other drivers of deforestation by providing other users with access roads. Other drivers of deforestation include expansion of large-scale agricultural production such as palm oil, cattle ranching and coffee; small-scale subsistence farming; and urban sprawl. When forest land is converted to other uses, there can be a significant net contribution to greenhouse gas emissions (Figure 9).

However, logging does not necessarily have to lead to deforestation. In a sustainably managed forest area, the growth of new trees can compensate for the carbon lost through annual logging within the area. In contrast, a forest that is subjected to land-use change or over-harvesting that leads to permanent forest cover loss will release more carbon than it takes up.

Compared with other materials (e.g., concrete, steel, plastic), products made from sustainably managed forests are generally advantageous from a GHG perspective because wood is produced by taking carbon from the atmosphere while producing other materials require use of fossil fuels.

Figure 9. Carbon dioxide emissions from forest and peat fires and decay between 1970 and 2010 (adapted from IPCC, 2014).



Emission sources associated with forest products include (Box 14):

- **Logging operations** – Machinery and equipment use fossil fuels for harvesting.
- **Transportation** – Transport of wood products from forest to shelf requires fossil fuels.
- **Manufacturing** – Most types of forest product manufacturing operations require fossil fuel energy. Some operations can rely entirely on biomass fuel from residuals of the forest products manufacturing process, in which case, less fossil fuel energy would be needed (Tonn and Marland, 2006).
- **Disposal** – Emissions may result when products decompose in the landfill, though paper products that end up in landfills can sequester carbon for a long time (Micales and Skog, 1996).

Box 14. Measuring greenhouse gas emissions

Many companies are now measuring, disclosing, and managing their GHG emissions. Defining a baseline level of emissions is necessary to set realistic reduction targets. Companies can choose to measure direct emissions (e.g., GHG emissions from processing mills and facilities that they own or control) or take a more comprehensive approach and measure indirect emissions across the entire value chain (e.g., emissions from transportation and distribution of goods, waste generation, and treatment of sold products at the end of the life cycle).

A number of standards and tools are now available to help companies measure their GHG emissions (see the "Guides to the Guides" section for more information):

- **WRI's Product Life Cycle Accounting and Reporting Standard**
- **WRI's Corporate Greenhouse Gas Protocol Toolset for Pulp and Paper and Wood Products**
- **Environmental Footprint Comparison Tool**
- **Forest Industry Carbon Assessment Tool (FICAT)**

Factors to consider regarding climate change

Some argue that old-growth forests with stable carbon stocks should be replaced with stands of young, vigorously growing trees as a way to increase carbon uptake. However, this would reduce the amount of carbon stored on the land, and it would take decades, or even centuries, for the GHG benefits of the newer stands to overcome the loss of carbon from the original forest. Furthermore, old-growth forests, particularly in the tropics, are important to preserving the world's biological diversity, and therefore should not be considered on the basis of carbon stocks and flows alone.

SELECTED RESOURCES: CLIMATE CHANGE

See “Guide to the Guides” chapter for more information on each resource.

Resources to assess requirements

Dutch Government Procurement Criteria for Timber

Environmental Footprint Comparison Tool

Environmental Paper Network

EPAT®

FICAT

Carbon Disclosure Project

Forest Governance Learning Group

FPAC: A Buyers’ Guide to Canada’s Sustainable Forest Products (the report)

Illegal-logging.info

Paper Profile

PREPS

Project LEAF

Sedex

Sustainable Forest Finance Toolkit

Timber Retail Coalition

The Forest Trust

Two Sides

Wood for Good

WWF GFTN

WWF Guide to Buying Paper

WWF Paper Scorecard

WWF Tissue Score