



Building  
Green  
with  
Wood



MODULE 9

# Climate Change

# Climate Change: Causes and Consequences

There is no longer any doubt that increasing emissions of greenhouse gases, mainly due to carbon dioxide from burning fossil fuels, are altering the Earth's climate.

The Fourth Assessment Report, released by the Intergovernmental Panel on Climate Change in 2007, states: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level."

The consequences of climate change are difficult to predict because of the complexity of environmental systems that determine climate, but some of the trends are already clear:

- Changes in natural habitats will result in the loss of plant and animal species.
- Species that carry tropical diseases, such as mosquitoes (malaria), will spread and settle into new areas.
- Sea levels will continue to rise, with catastrophic results for those living in coastal; or river delta area or low-lying land.

## Using Wood Can Help Tackle Climate Change

To mitigate climate change, it is necessary to reduce greenhouse gas emissions and store more carbon. A well-managed forest can do both.

As trees grow, they absorb carbon dioxide and store it. When they decompose or burn, much of the stored carbon is released back into the atmosphere, mainly as carbon dioxide, and some of the carbon remains in the forest debris and soils.

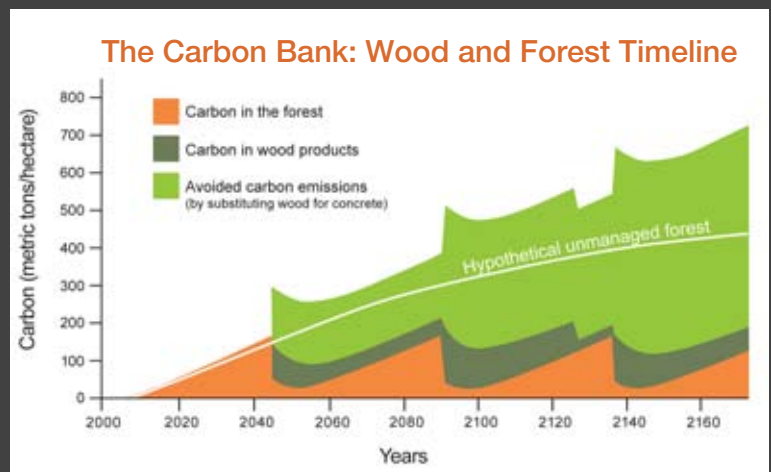
Healthy growing forests recycle carbon naturally. When biomass is used instead of fossil fuels, it can reduce the build-up of carbon dioxide in the atmosphere. When trees are used for forest products, the carbon often remains stored in the products for decades, or longer.

Vancouver architect Larry McFarland is an advocate for wood. He points to a beam in the Gulf Islands National Park Reserve operations centre he designed north of Victoria – Canada's first LEED (Leadership in Energy and Environmental Design) platinum building: "The image that when a tree is taken down, it is no longer a renewable resource is really a misunderstanding. The wood in this building is full of sequestered carbon, and that can't be said for the steel or the concrete."

In a 2007 report, the Intergovernmental Panel on Climate Change Working Group III pointed out that

forests remove carbon from the atmosphere and, at the same time, provide products that meet society's needs for timber, fibre and energy. A stable market for forest products encourages landowners to manage forests sustainably rather than converting them to other uses such as agriculture or urban development.

*Securing the Future*, a United Kingdom government strategy for sustainable development in 2005, stated: "Forestry practices can make a significant contribution by reducing greenhouse gas emissions through increasing the amount of carbon removed



*The Carbon Bank: Wood and Forest Timeline*<sup>1</sup> This graph shows the movement of carbon from one pool to another. As we create more and more long-lived wood products, the balance in our account goes up and up.

from the atmosphere by the national forest estate, by burning wood for fuel, and by using wood as a substitute for energy-intensive materials such as concrete and steel."

<sup>1</sup> Adapted from graphs in "Forests, Carbon and Climate Change: A Synthesis of Science Findings," 2006, Oregon Forest Resource Institute.



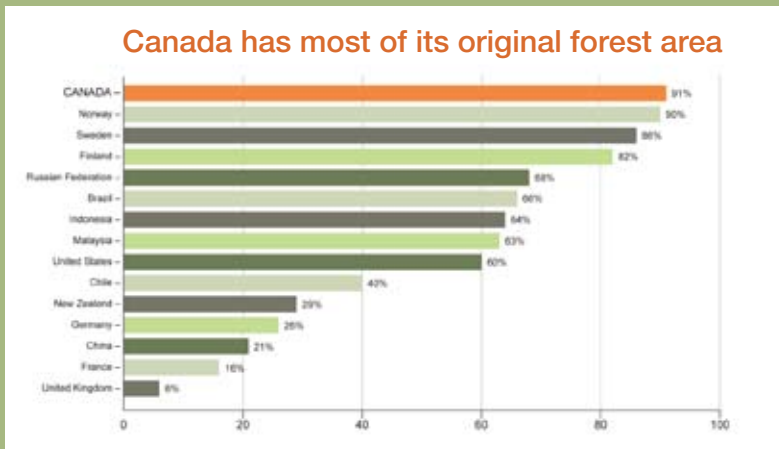
*Deforestation in developing countries is a leading contributor to CO<sub>2</sub> emissions.*

## Managing Forests to Mitigate Climate Change

When a tree is cut down, 40 to 60 per cent of the carbon stays in the forest, and the rest is removed in the logs, which are converted into forest products. Some carbon is released when the forest soil is disturbed during harvesting, and the roots, branches and leaves left behind release carbon as they decompose.<sup>2</sup>

The amount of carbon dioxide released through harvesting is small compared to what is typically experienced through forest fires and other natural disturbances such as insect infestations and disease. In extreme fire years, emissions from wildfires have represented up to 45 per cent of Canada's total greenhouse gas emissions.<sup>3</sup>

Once the harvested area is regenerated, either naturally or by planting seedlings, the forest begins to store carbon again. This combination of harvest and regrowth, along with the fact that most wood



products have a lighter environmental footprint and store carbon for long periods of time, means that sustainable forest management practices can lower greenhouse gas emissions.

<sup>2</sup> AND <sup>3</sup> Does harvesting in Canada's forests contribute to climate change? Canadian Forest Service 2007 [www.cfs.nrcan.gc.ca/news/473](http://www.cfs.nrcan.gc.ca/news/473).

# Greenhouse Gases, Carbon, and Forests

## The Greenhouse Effect

The glass panels of a greenhouse let in light and keep heat from escaping, providing warmth for the plants growing in them. A similar process occurs when the sun's energy reaches the Earth – some is absorbed by the Earth's surface, some radiates back into space, and some is trapped in the Earth's atmosphere, which keeps the planet warm enough for life to flourish. This is called the greenhouse effect.

The carbon cycle affects the amount of energy trapped in the atmosphere. Plants absorb carbon dioxide and emit oxygen during photosynthesis; oceans also absorb carbon dioxide. Humans and other animals inhale oxygen and exhale carbon dioxide. Carbon dioxide is emitted when substances decompose or burn.

Scientists agree this natural balance has been upset. The biggest human cause is the amount of carbon dioxide being released into the atmosphere through the burning of non-renewable fossil fuels, such as oil, natural gas or coal. Carbon dioxide accounts for more than 75 per cent of total greenhouse gas emissions.

Close to eight billion tonnes of carbon dioxide are emitted every year – most of this through fossil fuel

combustion and deforestation in tropical regions. Some is absorbed by water bodies, some absorbed by forests and biomass – and some is emitted into the atmosphere.

If too much carbon is emitted, it causes the atmosphere to trap more heat, warming the planet. Rising temperatures may, in turn, produce changes in weather, sea levels, and land use patterns, commonly referred to as climate change.

## Forests and the Carbon Cycle

Quantifying the substantial role of forests as carbon stores, as sources of carbon emissions and as carbon sinks has become one of the keys to understanding and modifying the global carbon cycle.

In its Global Forest Resources Assessment 2005<sup>4</sup>, the United Nations Food and Agriculture Organization says the total carbon content of forest ecosystems for the year 2005 is more than the amount of carbon in the entire atmosphere. Roughly half of total carbon is found in forest biomass and dead wood combined, and half in soils and forest debris combined.

<sup>4</sup> Global Forest Resources Assessment 2005 (FRA 2005). Food and Agriculture Organization of the United Nations. [www.fao.org/forestry/fra2005](http://www.fao.org/forestry/fra2005).





## Solid Wood and Climate Change

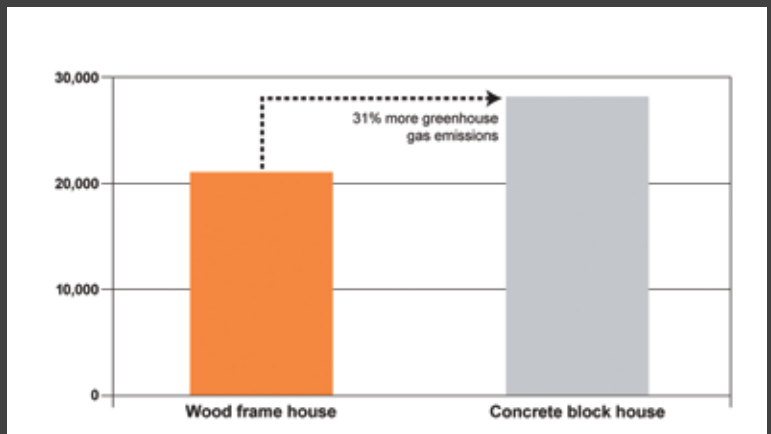
Using wood products that store carbon instead of building materials that use more energy, especially those that require more fossil fuel to manufacture, can help slow climate change. Trees grow with solar energy, and the little waste generated during processing is often used to meet the energy needs of the mill. At the end of their first life, forest products can be easily reused, recycled or used as a carbon neutral source of energy.

A typical 2,400-square-foot wood-frame house contains 29 metric tonnes of carbon, which is the equivalent of offsetting the greenhouse gas emissions produced by driving a passenger car over five year (about 12,500 litres of gasoline). No other material offers this kind of carbon credit.

Around the world government and business leaders are developing policies and procurement processes that encourage the use of more forest products from well-managed forests.

As part of its promotion of a carbon-neutral public service, the Government of New Zealand is requiring that

wood or wood-based products be considered as the main structural materials for new government-funded buildings up to four floors. In Canada, the governments of British Columbia and Quebec are moving to policies that will encourage the use of wood in public buildings.



*Life cycle assessment is the appropriate tool to examine climate change implications – it can calculate greenhouse gas emissions associated with the production, transportation, construction, use and disposal of a product.*

- *In this graph, the embodied effects are shown for two typical, identical homes, one made with wood and one with concrete. (Embodied effects are the environmental impacts in manufacturing, transporting and constructing the houses – heating and cooling the houses are not included).*
- *It shows that the concrete-block house resulted in 31 per cent more greenhouse gas emissions than the wood-frame house*



*Canada has most of its original forest area. More than half of Canada's forest are naturally reforested, and this is supplemented by the planting of 600 million seedlings per year.*

#### Green buildings

- Mitigate climate change
- Use less energy and water
- User fewer materials
- Reduce waste
- Are healthy for people and the planet

