



Forests and climate change



Mangroves provide climate change mitigation and adaption benefits, storing large amounts of carbon and protecting coastal communities against natural disasters. ©FAO/Leung Wing Tuen Veronica

According to FAO's Global Forest Resources Assessment 2020, the world's forests store an estimated 662 gigatonnes of carbon in living biomass (44 percent), soil organic matter (45 percent) and the remainder in dead wood and litter. Over the past 30 years the carbon stocks in forest biomass have decreased by almost 6 gigatonnes. The reduction is mainly driven by carbon stock changes as a result of deforestation and forest degradation.

Forests can be net sinks or net sources of carbon, depending on their age, health and susceptibility to wildfires and other disturbances and on how they are managed.

Although forest ecosystems are inherently dynamic, the speed of predicted changes is likely to far exceed the natural capacity of many forest species and ecosystems to adapt. In addition, extreme climatic events and climate-related disasters may overwhelm countries' capacities to respond to them rapidly and effectively.

Climate change can have both negative and positive impacts on forests. For example, some regions may experience increases in rainfall, which might increase forest growth, but other regions are likely to be affected by an increasing frequency and intensity of wildfire, floods, landslides, drought, storms and pest outbreaks and by the spread of invasive alien species. Climate change could change the distribution of forest types, the occurrence of tree species, the capacity of forests to deliver environmental services (such as those involved in protecting watersheds and soils), forest productivity, the suitability of habitats for certain species of flora and fauna, and the availability of food and other forest products. The incidence of forest fire is increasing in many parts of the world, and new climate-related threats to forest health, vitality and biodiversity are emerging. Mountain, dryland and coastal forests are particularly vulnerable. It is possible that climate change will lead to large-scale forest dieback, causing the emission of large quantities of greenhouse gases, further exacerbating climate change. The changing climate and increasing global trade alter the disturbance dynamics of native forest pests and pathogens, and facilitate the spread of non-native invasive species. Climate change is also influencing the risk of damaging fires through weather and climate trends that increase the potential for fires to start, travel across the landscape and impact on ecosystems, communities and infrastructure. These factors are exacerbating the vulnerability of communities dependent on forests for their livelihoods, and thus call for policy and action to increase resilience through forests.

When sustainably managed, forests can assist both the mitigation of, and adaptation to, climate change by maintaining and increasing forest and tree cover and therefore the terrestrial carbon pool. This has elevated forest issues higher on the political agenda. Forest products store and recycle large amounts of carbon, and trade moves products and their sinks around the world. This complex function will undoubtedly remain a lively discourse in shaping the future role of forests in low-carbon economies and in the run-up to a global climate accord. Integrating concrete demands for carbon offsets in forests with the conservation of biodiversity and protection of watersheds is a challenging equation in a world where consumption of forest products will continue to rise.

Mitigation and adaptation in the context of the Paris Agreement

In 2015, Parties to the UNFCCC reached a landmark agreement in Paris to combat climate change, recognizing the importance of land use in the removal of GHGs from the atmosphere. Particular emphasis was given to the role of forests in maintaining and enhancing sinks and reservoirs of carbon. This emphasis has put forests at centre stage in global efforts to address climate change and has opened up new prospects for national forest policy and related actions to achieve sustainable forest management.

The Paris Agreement encourages the development of approaches that jointly address both mitigation and adaptation for the integrated and sustainable management of forests. Nationally determined contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change.

Joint mitigation and adaptation approaches include policies that contribute to the long-term sustainability of climate change actions, such as reducing emissions from deforestation and forest degradation, and conserving and enhancing forest carbon stocks. By integrating climate change mitigation and adaptation goals into a forest policy, forest management objectives can be balanced with climate change objectives, and synergies can be captured with other forest-related processes, such as forest law enforcement, governance and trade.



Land restoration across the Sahel. ©FAO/Giulio Napolitano

Forest products in climate change mitigation

In addition to their direct role in climate change mitigation, sustainably managed forests contribute to mitigation indirectly when their products are used as substitutes for fossil fuels and other, more carbon-intensive products such as steel, aluminum and plastics. The promotion of low-carbon fuels and products is a cornerstone of green economic development. Fuelwood, charcoal and various other forms of renewable wood-based energy constitute the world's most important source of bioenergy. More than two billion people depend on wood energy for cooking and heating, mostly in developing countries. In parts of Africa, woodfuel – often the only domestically available and affordable source of energy – accounts for almost 90 percent of primary energy consumption.

The carbon captured by trees from the atmosphere can be stored for decades in long-lived wood products such as construction timber and furniture; thus, a wood-based carbon pool exists outside forests in the form of finished wood products. While such products continue to store carbon, the forests from which

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they were harvested, if subject to SFM, regrow and thereby sequester additional carbon from the atmosphere. Increasing the use of wood in long-lived applications is therefore another strategy for climate-change mitigation and green economic development.

There is a huge gap between reality and the potential of forests and wood products in climate change mitigation. To close this gap, public policies, positive incentives and concerted efforts are needed to stimulate supply and demand of sustainable forest products and ecosystem services.



Wooden structures can endure for hundreds of years, trapping carbon. ©FAO/Kenichi Shono

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