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REDD+ ACADEMY Learning Journal

Forests and Climate

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Authors: Maria Antonova, Guillemette Gandon, UNEP-WCMC.

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Welcome & introduction

Welcome to the Learning Journal on Forests and Climate.

This Learning Journal is part of the revitalized REDD+ Academy. It is designed to further the understanding of the role of forests in the carbon cycle and global climate change, drawing on the scientific consensus of the Intergovernmental Panel on Climate Change. By engaging with this resource, you will gain a more fundamental understanding of the scientific basis of REDD+ and the necessity to protect, conserve and restore forest ecosystems.

Who is it for?

This Learning Journal is for government practitioners but may also be of interest to the general public interested in learning about the relationship between forests and climate, and the role of forests in mitigating climate change.

At a glance

This Learning Journal provides an overview of how forests interact with the carbon cycle and shape the global climate system. It examines how human activities, such as deforestation and land-use change, disrupt this balance, and explains the concepts of carbon stocks and fluxes in relation to REDD+ implementation. Drawing on scientific evidence and IPCC projections, it highlights the vital role of forests in achieving global climate goals, maintaining ecosystem resilience, and contributing to international policy frameworks such as the Paris Agreement.

How to make the best use of this Learning Journal

Read the key chapters of relevance to you.

Download this publication at **REDD+ Academy Platform** and use the online version to access all hyperlinks in the text.

As a practitioner, reference the sections linked to forests and climate

Utilize it as a supplement for any lifelong learning opportunities.

Use the QR CODES to access the additional online tools to reinforce your knowledge.

Check your knowledge before starting. What do you already know about Forests and Climate? Go to the REDD+ Academy Platform and answer the preliminary test questions to find out which topics you already are familiar with and which ones you need to learn more about.

LEARNING TOOL

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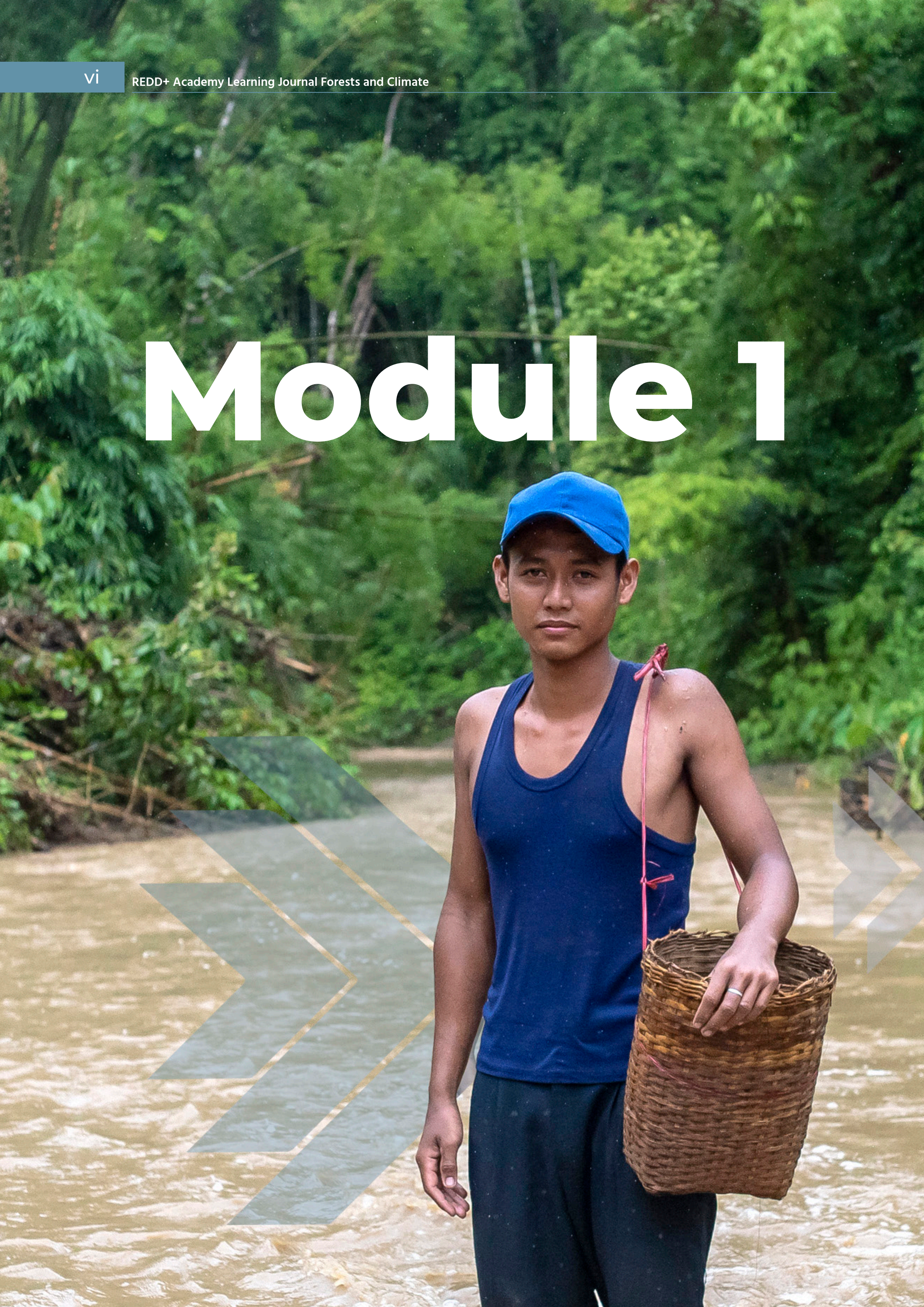
Acronyms

LULUCF	Land Use, Land-Use Change and Forestry
CH_4	Methane
CO_2	Carbon dioxide
Ha	Hectare
GHG	Greenhouse Gases
GtC	Gigatonnes of carbon
IPCC	Intergovernmental Panel on Climate Change
Kha	kilohectare, equivalent to 1,000 hectares
Mha	million hectares
N_2O	Nitrous oxide
O_3	Ozone
REDD+	Reducing Emissions from Deforestation and forest Degradation
SSPs	Shared Socioeconomic Pathways
UNFCCC	United Nations Framework Convention on Climate Change

Module 1



Introduction

This module

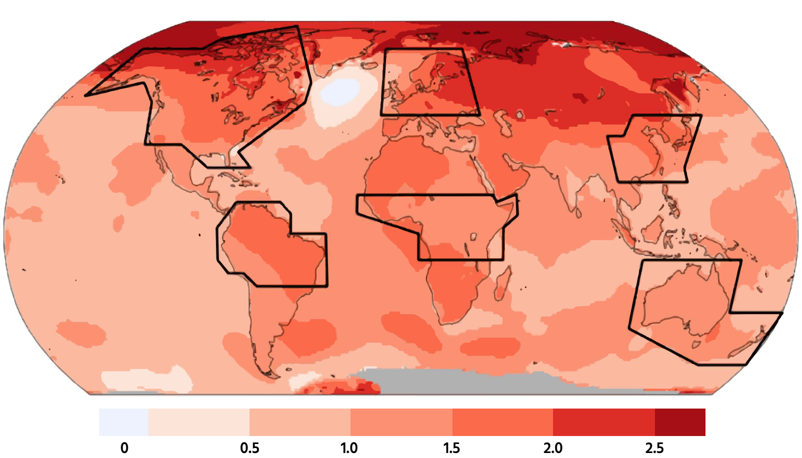
Provides an overview of the science and evidence of climate change, setting the foundation for understanding its causes, current trends, and far-reaching impacts on ecosystems and societies. It introduces key findings from the Intergovernmental Panel on Climate Change (IPCC) and illustrates how human activities—especially greenhouse gas emissions—are driving unprecedented global warming and environmental disruption.

You will be able to...

- Explain the scientific basis of climate change and the main drivers behind global warming.
- Identify key indicators and observed impacts of climate change on natural and human systems.

The Earth’s climate is changing and human activity is the primary cause. As the Intergovernmental Panel on Climate Change (IPCC) notes in its Sixth Assessment Report, “human activities, principally through emissions of greenhouse gases (GHG), have unequivocally caused global warming” (p.42). This warming is most evident in rising global average temperatures and sea levels. A striking illustration of this is the observed surface temperature change in 2020 compared to the pre-industrial baseline of 1850–1900. The IPCC’s global map (Figure 1) shows that nearly all regions have warmed, with the Arctic experiencing the most dramatic increases, depicted in deep red. Only a few areas show little or no warming, and some regions remain white due to insufficient data. This visual evidence underscores the widespread and intensifying nature of climate change.

Figure 1: Map of observed surface temperature change in 2020 relative to 1850–1900, showing the largest warming in the Arctic.[1]



Average temperatures have been clearly rising since 1850 (Figure 2), with the most recent decades being successively warmer than any preceding period. The rise in surface temperature is not the only evidence of a changing climate: Figure 3 illustrates change measured in several other ways.

Figure 2: Contribution of historical CO_2, CH_4, and N_2O emissions to global surface temperature change from 1850–1900 to 2010–2019, alongside observed annual global surface temperature anomalies relative to 1850–1900.

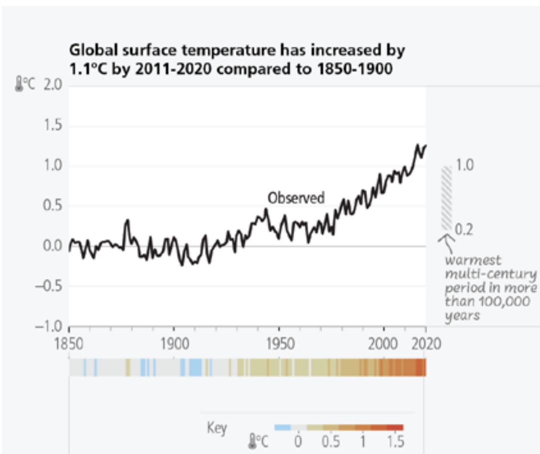
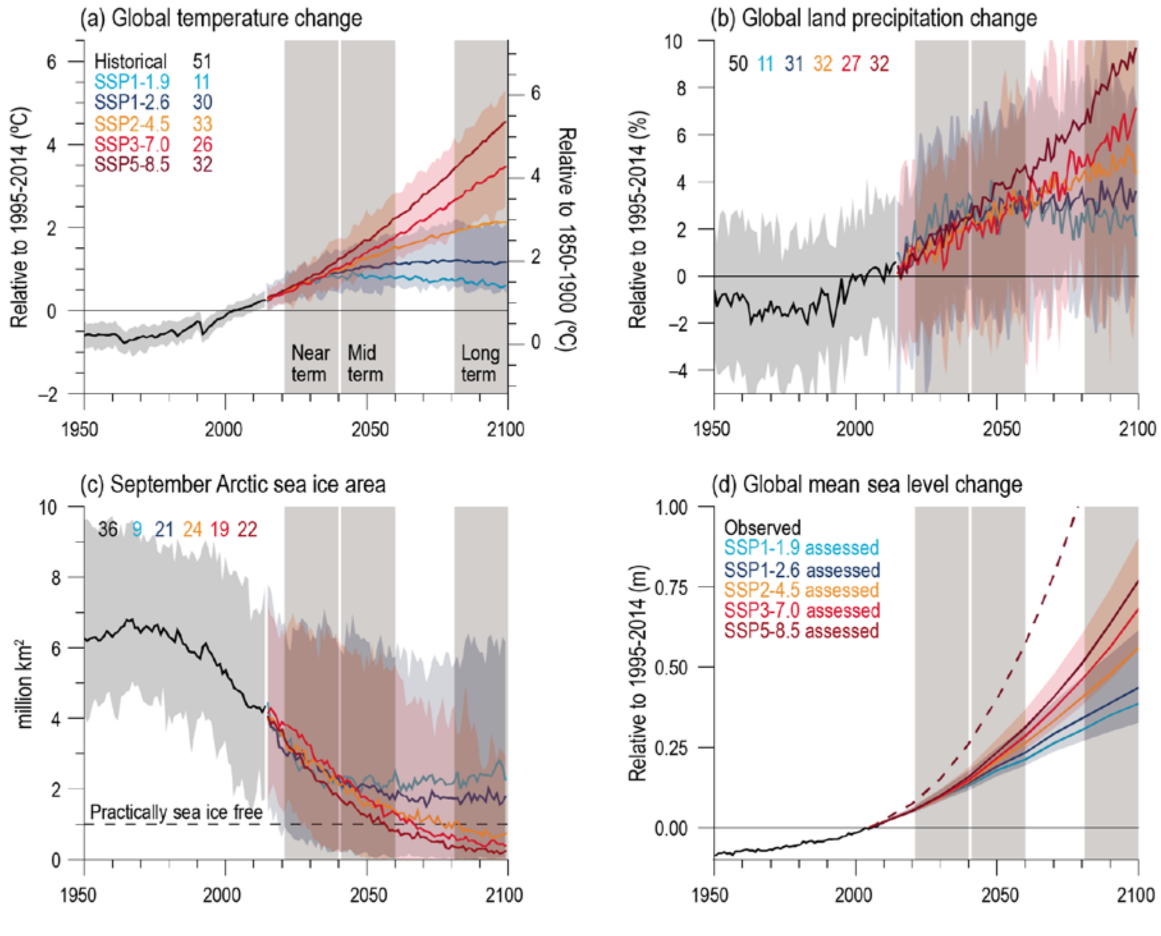


Figure 3: Selected indicators of global climate change from historical data and scenario simulations, including temperature, precipitation, Arctic sea ice, and global mean sea level.



Arctic summer ice has been shrinking, particularly since 1960 (Figure 3). The melting ice contributes to higher sea levels, although the greatest driver of this is thermal expansion of the ocean waters. Rising global temperatures have also been accompanied by other changes in climate, including shifts in rainfall patterns, and more frequent climate extremes, resulting in more floods, droughts, and heat waves.[2]

According to the IPCC[1] climate change has already caused substantial changes, and in some cases irreversible losses, to ecosystems and human systems. These impacts include the alteration of ecosystems, reduced food security and water availability, damage to infrastructure and settlements, and increased risks to human health, livelihoods, and mortality. Such changes have serious implications for biodiversity as well as human well-being. People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized within societies, such as Indigenous Peoples, local communities and other local stakeholders, are often especially vulnerable to and disproportionately affected by changes in climate, biodiversity and ecosystem services. For example, given their roles in communities and households, women are often heavily dependent on, but have unequal access to land, water, and other natural resources (including forests). They also frequently experience unequal rights, limited mobility, and restricted decision-making power, which climate change exacerbates, pushing millions of women further into poverty.[3]

Module 2

What is causing climate change?

This module

Explores the scientific foundations of what drives climate change, focusing on the greenhouse effect and the role of human activities in intensifying it. It explains how natural processes maintain the Earth's energy balance and how industrialization, deforestation, and the burning of fossil fuels have disrupted this balance, leading to increased concentrations of greenhouse gases and accelerated global warming.

You will be able to...

- Describe how the greenhouse effect functions and how it has been altered by human activities.
- Identify the main greenhouse gases and their sources, and explain their role in driving current climate change.

Human activity is the confirmed primary driver of recent changes in the Earth's climate. While the climate system is inherently complex and influenced by natural factors such as solar radiation, volcanic activity, ocean currents, and naturally occurring aerosols, the dominant force behind current global warming is anthropogenic greenhouse gas emissions.

2.1 The greenhouse effect

The IPCC[1] has provided a clear description of how the greenhouse effect (Figure 4) - resulting from Earth's climate system - warms the planet, and how it is modified by human activities:

The Sun powers Earth's climate, radiating energy at very short wavelengths, predominately in the visible or near-visible (e.g., ultraviolet) part of the spectrum. Roughly one- third of the solar energy that reaches the top of Earth's atmosphere is reflected directly back to space. The remaining two-thirds is absorbed by the surface and, to a lesser extent, by the atmosphere. To balance the absorbed incoming energy, the Earth must, on average, radiate the same amount of energy back to space. Because the Earth is much colder than the Sun, it radiates at much longer wavelengths, primarily in the infrared part of the spectrum.

Much of this thermal radiation emitted by the land and ocean is absorbed by the atmosphere, including clouds, and reradiated back to Earth. This is called the greenhouse effect. The glass walls in a greenhouse reduce airflow and increase the temperature of the air inside.

Analogously, but through a different physical process, the Earth's greenhouse effect warms the surface of the planet. Without the natural greenhouse effect, the average temperature at Earth's surface would be below the freezing point of water. Thus, Earth's natural greenhouse effect makes life as we know it possible.

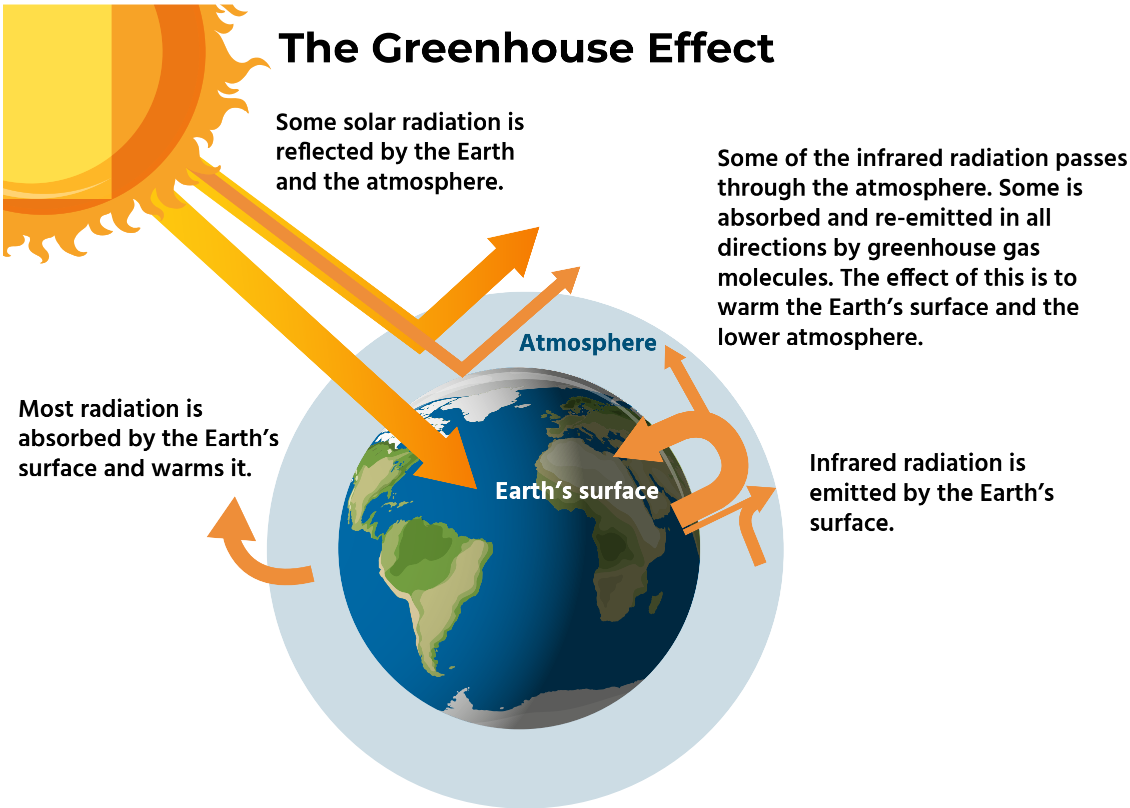
However, human activities, primarily the burning of fossil fuels and clearing of forests, have greatly intensified the natural greenhouse effect, causing global warming.

The two most abundant gases in the atmosphere, nitrogen (comprising 78 per cent of the dry atmosphere) and oxygen (comprising 21 per cent), exert almost no greenhouse effect. Instead, the greenhouse effect comes from molecules that are more complex and much less common.

Water vapour is the most important greenhouse gas, and carbon dioxide (CO_2) is the second- most important one. Methane (CH_4), nitrous oxide (N_2O), ozone (O_3) and several other gases present in the atmosphere in small amounts also contribute to the greenhouse effect. In the humid equatorial regions, where there is so much water vapour in the air that the greenhouse effect is very large, adding a small additional amount of CO_2 or water vapour has only a small direct impact on downward infrared radiation.

However, in the cold, dry polar regions, the effect of a small increase in CO_2 or water vapour is much greater. The same is true for the cold, dry upper atmosphere where a small increase in water vapour has a greater influence on the greenhouse effect than the same change in water vapour would have near the surface".

Figure 4: The "greenhouse effect".



Source: Environmental Protection Agency (EPA). Basics of Climate Change. Washington, DC: EPA; 2025. Available from: https://www.epa.gov/climatechange-science/basics-climate-change [Accessed 25 September 2025].

There is broad scientific consensus that the primary cause of climate change is anthropogenic (i.e. human-induced), resulting from the emission of greenhouse gases (GHGs) to the atmosphere.

The observed warming of the climate system is unequivocal, and the largest driver is the increase in the atmospheric concentration of CO_2, largely as a result of burning fossil fuels, cement production and land-use changes.

Figure 6 shows how the concentration of atmospheric CO_2, CH_4 and N_2O have increased in the recent past.

Go to the REDD+ Academy Platform to explore the interactive presentation to better explain what is causing climate change and what should be done to mitigate this.

LEARNING TOOL

Module 3

How does climate change link to the carbon cycle and forests?

This module

Explores the connections between climate change, the global carbon cycle, and forests. It examines how carbon is stored and transferred within natural systems and human activities, the consequences of increased greenhouse gas emissions, and the critical role of forests in maintaining carbon balance. It also introduces future climate scenarios, the concept of the carbon budget, and the implications for global temperature targets under the Paris Agreement.

You will be able to...

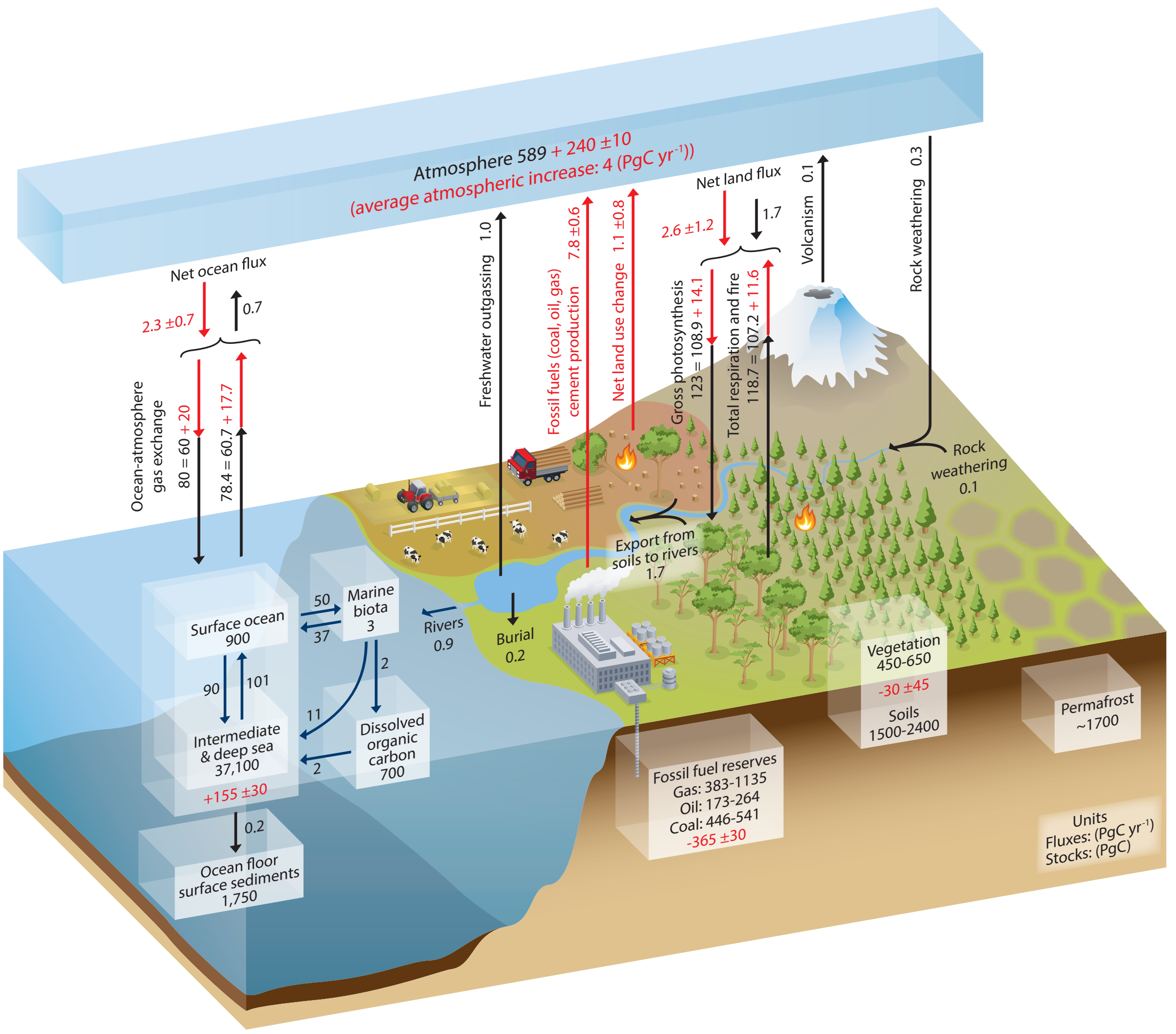
- The key components of the carbon cycle (stocks and fluxes).
- How human activities alter the balance of the carbon cycle.
- The role of forests as both carbon sinks and sources.
- The relationship between emission pathways, temperature rise, and climate impacts.

Carbon can be found in various forms and locations. These include living organisms (including trees and other plants), fossil fuels (coal, oil and gas) and CO_2 in the atmosphere. The absolute quantity of carbon held in each form at a particular point in time is called a stock, and changes in these stocks are referred to as fluxes. Carbon flows between stocks through several processes and these flows are collectively known as the 'carbon cycle'. The fluxes include natural processes such as plant growth and respiration, and human interventions such as the burning of fossil fuels and the destruction of forests.

Figure 5 below illustrates the global carbon cycle with its stocks and flows, which are shown in two ways:

- How they were before large-scale human intervention (roughly before 1750 – black figures and arrows).
- How they were changed by human intervention since the industrial revolution (red figures and arrows).

Figure 5: Simplified schematic of the global carbon cycle.[34]



Earth's temperature is governed by natural and human-induced drivers, and scientists have speculated since early 20th century that burning of fossil fuels such as coal will warm the planet as increasing concentrations of CO^2 will retain more of the heat that was previously radiated by the planet into space[2]. Economic activity since the 19th century including high-energy sectors like cement production and land use change for expansion of agriculture are creating disequilibrium, through increasing emissions. Bigger fluxes from 'sources' (stocks from which carbon is being released to the atmosphere) are compensated partly by bigger fluxes into 'sinks' (through processes or mechanisms that remove carbon dioxide from the atmosphere), particularly the ocean and land sinks (this will be revisited later).

The carbon cycle means that vegetation (including forests), soil, oceans and the atmosphere are connected. It is important to consider the role vegetation and changes in vegetation cover play in controlling overall GHG and hence climate change. Overall, the IPCC[3] estimates that net emissions from land use, land-use change and forestry (LULUCF) were approximately 11 per cent of total net anthropogenic greenhouse gas emissions in 2019. 'Net emissions' take into account the absorption by recovering and new forests that counterbalance some of the emissions from deforestation and forest degradation.

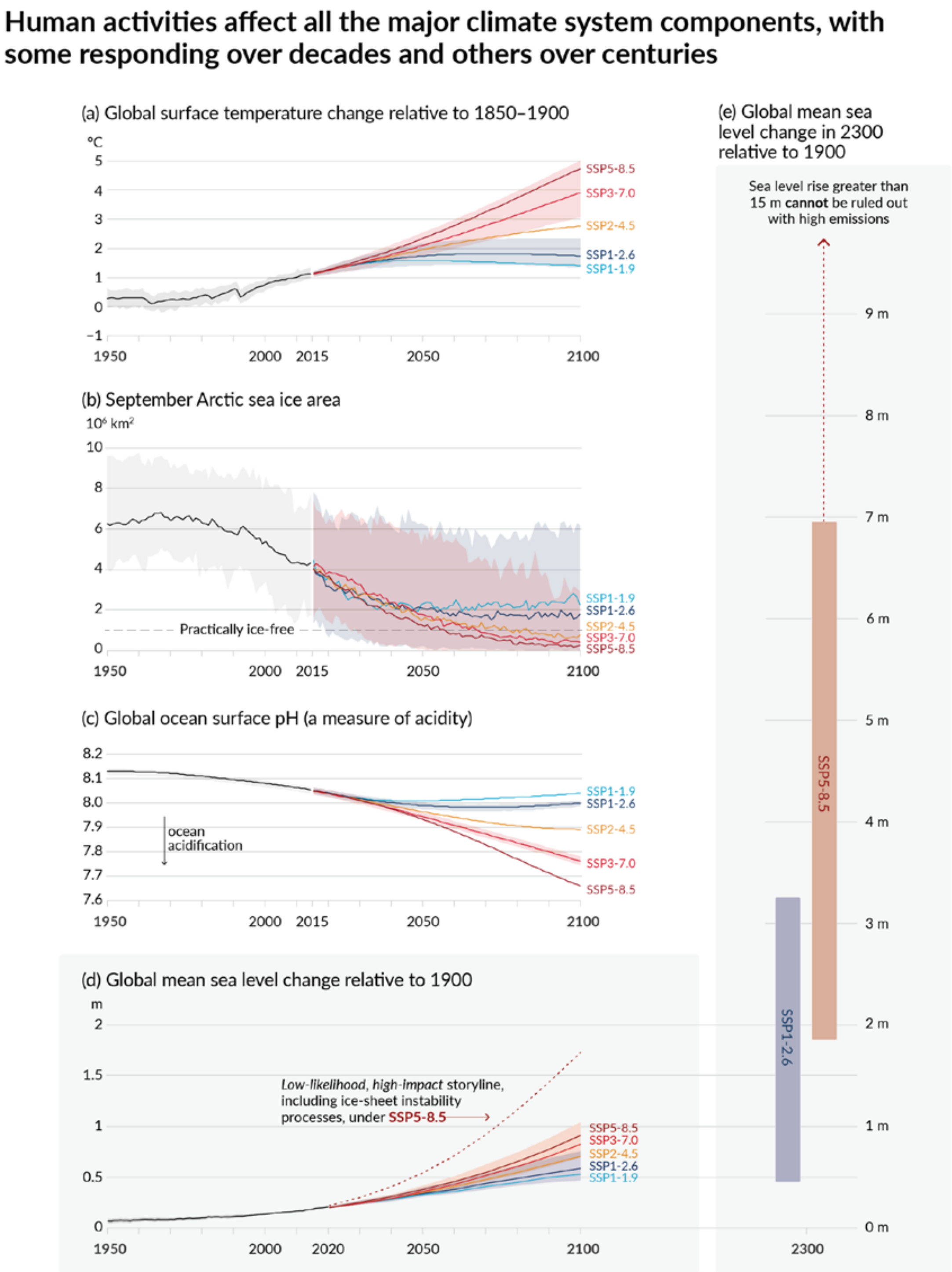
3.1 Expected changes in the future

Several scenarios have been developed to provide an idea of what the future climate could look like, and to provide a basis for addressing the practical implications of climate change. Shared Socioeconomic Pathways (SSPs) are projections of the IPCC based on emission scenarios. These scenarios describe ways in which emissions could fluctuate up to the year 2100, incorporating socioeconomic factors (Figure 3). SSP5-8.5 presents a very high emissions scenario with continued fossil fuel growth, SSP1-1.9 and SSP1-2.6 present scenarios of sharp emission reductions consistent with limiting warming to 1.5°C and 2°C respectively, while SSP2-4.5 and SSP3-7.0 present intermediate and high emission pathways. These projections are useful for informing decisions related to climate change mitigation and adaptation. Projected global temperature changes (Figure 6) and associated changes in rainfall will strongly affect the environment and human societies around the world. Many of the most severe impacts will be felt in developing countries and by those who face inequalities and social exclusion on the basis of age, class, gender, ethnicity and/ or disability. Such marginalized groups will have significantly reduced abilities and resources to cope with and respond to climate change impacts, which in turn could further deepen existing inequalities and undermine their health, education and livelihoods.

Go to the REDD+ Academy Platform to explore the interactive presentation to better explain how does climate change link to the carbon cycle and forests.

LEARNING TOOL

Figure 6: Global surface temperature projections under different SSP scenarios, 1850-2100.[4]



Unless serious climate change mitigation action is taken there will be drastic changes in the climate, in ocean acidity, and in sea levels. Together these will have major impacts on the environment, human welfare and livelihoods, particularly for those who are from more marginalized groups in society (e.g. Indigenous Peoples, local communities, women, youth, persons with disabilities, etc.) (Figure 6).

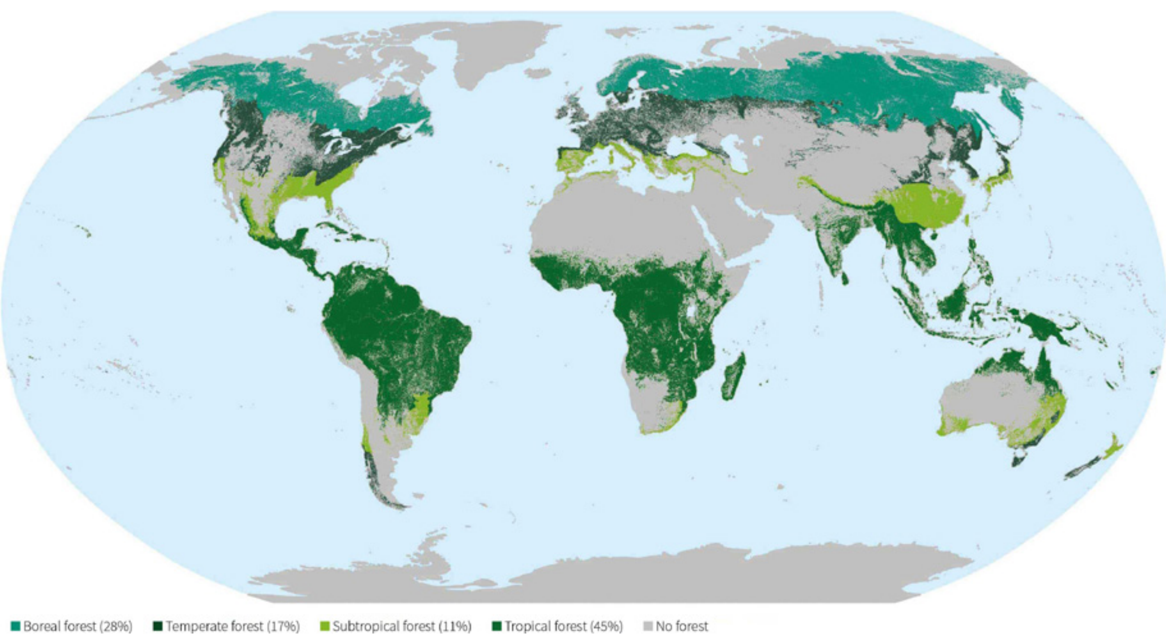
In the landmark Paris Agreement under the United Nations Convention on Climate Change (UNFCCC), representatives from 195 countries and regional organizations agreed to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels." The planet has now reached approximately 1.3-1.55°C of warming from pre-industrial levels, with 2024 being the first calendar year that the average global temperature exceeded 1.5°C above its pre-industrial level.[5] However, the Paris Agreement targets refer to long-term average warming rather than individual years, meaning we have not yet permanently breached the 1.5°C threshold. The "carbon budget" represents the total amount of CO_2 we can still emit while maintaining a reasonable chance of limiting long-term warming to 1.5°C by the end of the century. If emission rates stay at current levels, this remaining carbon budget limiting warming to 1.5°C would be exhausted in approximately 6-9 years, while for a two-in-three chance of staying within 1.5°C, the budget shrinks to one-and-a-half years. The scientific community increasingly recognizes that the 1.5 overshoot is inevitable, but adopting the highest possible ambition will give the planet a chance to get back on track and avoid a catastrophic scenario.[6]

3.2 The extent of forests and forest carbon stocks

Globally, forests cover about 32 per cent of the total land area, or 4.14 billion ha, 45 per cent of which is in the tropical zone (Figure 7).[7] A 2015 global survey had estimated that there are 3.04 trillion trees with a diameter of more than 10 cm at breast height, or the equivalent of 420 trees for every person on the planet.[8]

The different forest biomes, along with other types of ecosystems, contain varying amounts of carbon (Figure 8). On a global scale, tropical forests contain the largest carbon stock. However, there are significant differences within tropical areas based on soil type and hydrology. Mangrove forests and tropical peat swamp forests contain particularly high levels of biomass in their vegetation cover and soils, with peat soils accounting for over 85-90 per cent of the total ecosystem carbon stock in tropical peat forests.[9] Sites with deep peat deposits (that can exceed 12 m) can store over 7,500 Mg C/ha,[10] making them unmatched in carbon density compared to other terrestrial ecosystems.

Figure 7: Forest cover in 2025.[12]

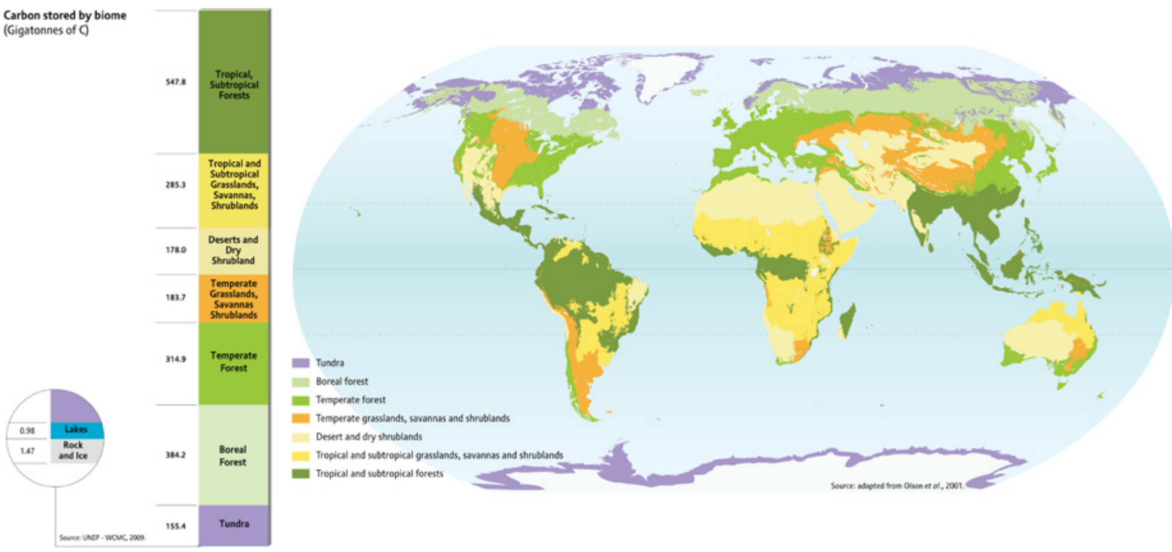


The planet's human population depends on forests directly or indirectly for vital ecosystem services and forest products. An estimated one third of humanity has a close dependence on forests and the products they provide, including wood, fuel, food, and medicinal ingredients.[11] The economic value of non-wood forest products was around US$ 9.41 billion according to 2020 data, with the most significant category being edible plants.[12] Those who rely on forests for their livelihoods are among the poorest people on the planet, and they are disproportionately women.[12]

3.3 Emissions from forest carbon stocks

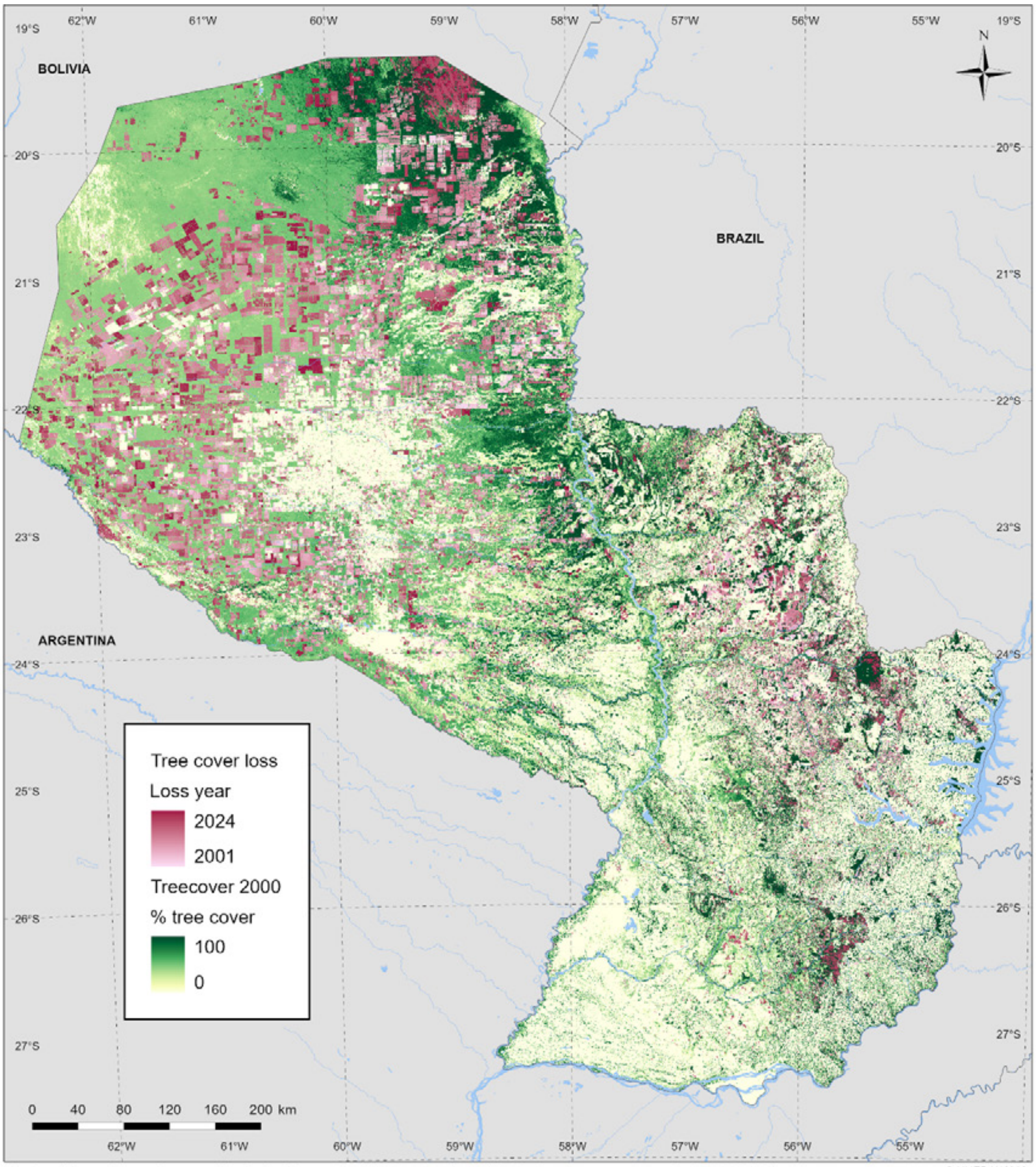
As forests contain substantial stores of carbon, their degradation and or conversion to other land cover causes the release of some of the carbon stored within them. Forest degradation can be defined as human activities that reduce the carbon stocks and other ecosystem functions of a forest, but that fall short of deforestation, for example, damage caused by selective logging. The level of emissions depends on the amount of carbon originally stored in the forest, the extent to which the vegetation cover and soil structure is damaged or destroyed, as well as what happens to the land afterwards. Particularly high emissions will result if the vegetation is completely destroyed and then the area is burned afterwards, as is carried out during slash and burn agriculture in some parts of the world. The extent of forest destruction is very high in some areas. For example, a closer look at loss of tree cover in Paraguay over recent decades shows that this loss has been increasing and spreading to new areas (Figure 9). Between 2002 and 2024, Paraguay lost 1.2 Mha of humid primary forest, which accounted of 35 per cent of humid primary forest in the country.

Figure 8: Carbon storage by ecosystem.



Source: http://www.unep.org/pdf/BioseqRRA_scr.pdf

Figure 9: A representation of forest loss in Paraguay between 2001 and 2024 (7.22Mha). Darker red marks areas with most recent tree cover loss, while darker green marks areas where tree cover is more dense. The figure does not account for tree cover gain, which was 642kha between 2000 and 2020.[13]



The boundaries and names shown, and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

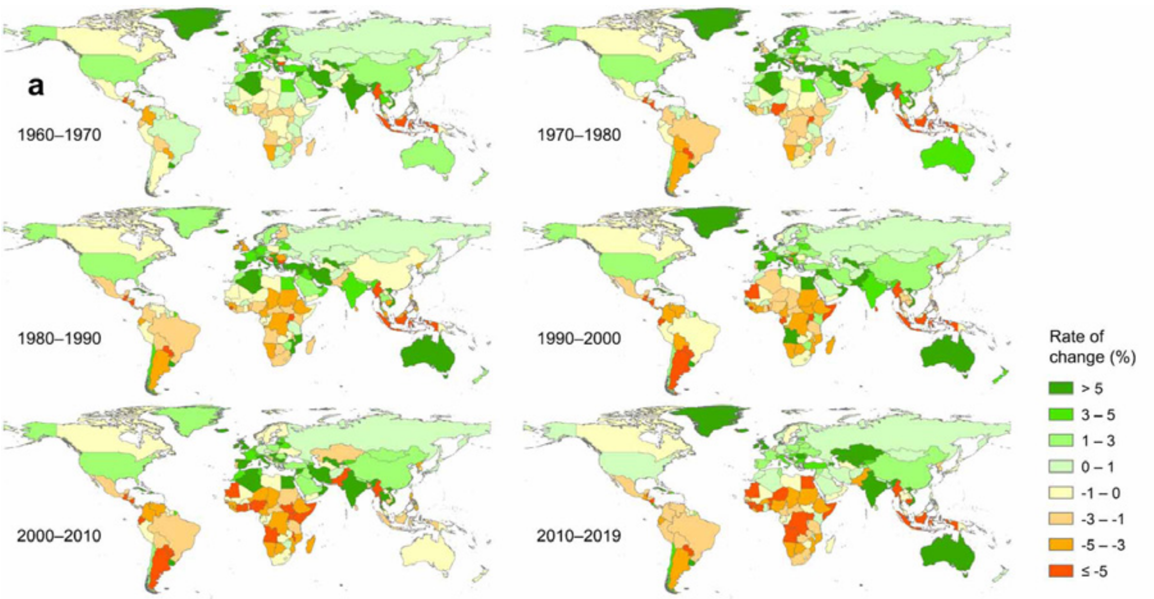
© UNEP-WCMC

Data sources: Base layers: United Nations Geospatial, 2025 ;
Global Forest cover change: Hansen/UMD/Google/USGS/NASA

Spatial Reference: WGS 1984 UTM Zone 21S

Historically, deforestation occurred largely in the United States of America, Europe and Eastern Europe. Today, the highest deforestation rates are observed in tropical rainforest regions. Tropical forest fires have become a major source of emissions, making a significant contribution to climate change. In 2024, fires accounted for almost half of global tropical primary forest loss of over 6.7 million hectares, which caused 3.1 gigatons of GHG emissions.[14] Forests in the northern hemisphere are actually experiencing net forest gain, while many regions with tropical forests have seen accelerated forest loss (Figure 10), though others have also seen important gains in some decades over this period. This highlights an important issue: although the destruction of forests causes the release of carbon dioxide, their restoration can act as a sink for atmospheric carbon. As mentioned previously, the net contribution of land-use change and forestry to global emissions is about 11 per cent, which is the contribution calculated by combining both emissions due to deforestation and the sequestration of carbon due to forest recovery. The gross emissions from deforestation and degradation are larger than the net emissions (about 2.8 ± 0.5 GtC/yr for the 2000s[15] because of the significant regrowth that compensates for the gross emissions.

Figure 10: Country level forest change over the past 60 years, relative to the area of forest at the start of each decade.[16]



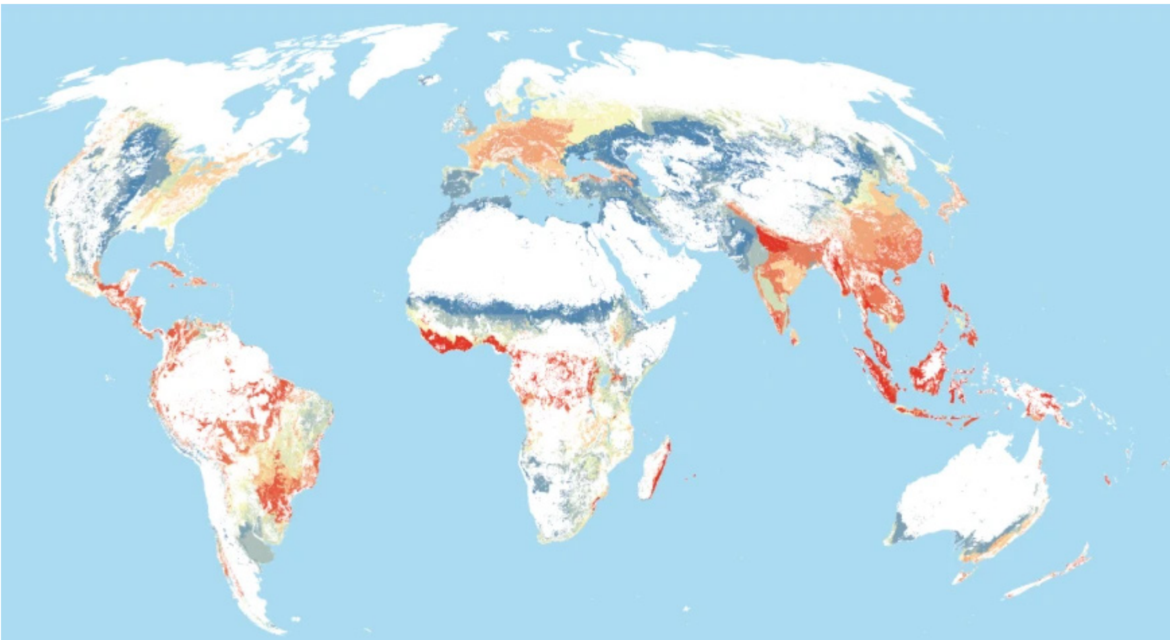
3.4 Carbon sequestration potential of forests

The observed increases in atmospheric CO_2 are lower than would be expected if anthropogenic emissions were considered alone, due to the combined action of natural land and ocean sinks which removed an average 59 per cent of the total anthropogenic emissions every year during the period 1850–2019.[17] The increased storage of carbon in terrestrial ecosystems not affected by land use change is partially caused by enhanced photosynthesis at higher CO_2 levels, and it means that intact forests are helping to act as a buffer against anthropogenic CO_2 emissions.

Forests are not only potential sources of carbon emissions to the atmosphere; they can also act as carbon sinks, sequestering carbon. Forests sequester carbon as they grow, when they are being restored, and as part of the terrestrial carbon sink.

In areas that have been deforested but are not currently densely populated or cultivated it may be possible to undertake some form of restoration, ranging from complete reforestation of closed canopy cover to more mosaic restoration that includes restored forest areas interspersed with other land uses including agroforestry, small scale agriculture and settlements. Such restoration sequesters carbon, with the level of sequestration depending on the extent of recovery of plant biomass and soil carbon and can restore other important ecosystem services. Figure 11 shows which of the world's natural areas (including forests) that have been converted would have priority for restoration if the focus was on the mitigation of climate change.

Figure 11: Global priority areas for restoration of converted lands to natural ecosystems, focused on mitigation of climate change. The colors range from red (highest priority) to blue (lowest priority). Restoration of wetlands and forests have the highest importance for mitigation of climate change, especially in tropical and subtropical zones.[35]



In these forest restoration efforts, involvement of people living near and around forests is crucial. Indigenous Peoples manage or have tenure rights over a total of at least 38 million km^2, including at least 36 per cent of the world's intact forests.[18] Many Indigenous, rural and local traditional practices are rooted in a deep understanding of and respect for ecological systems, and promote sustainable resource use, which has successfully conserved forests for hundreds of years.[19]

3.5 Forests and climate change mitigation

The links between forests and the carbon cycle mean that actions that affect the forest sector can have a large impact on GHG flux and so on climate change. The total amount of CO_2 entering the atmosphere can be reduced by decreasing emissions from both deforestation and forest degradation. Maintaining standing forests can preserve their role as a terrestrial carbon sink and restoring forests can increase the sequestration of carbon thereby decreasing the overall levels of CO_2 in the atmosphere. If all deforestation were halted, emissions could be reduced by an estimated 6.5 gigatonnes of CO_2 per year.[13,20] How much of this potential is realized depends on a range of factors. For example, national goals and policies, economic factors, and socio-cultural and institutional dynamics play key roles that can help or hinder the amount of change achieved and how this change impacts on other sectors or society more widely. In this process, the role of both state and non-state actors (Indigenous Peoples, local communities, women, civil society and non-governmental organizations, academic institutions, etc.) should not be underestimated. These actors are key agents of change in the fight against deforestation and forest degradation and their invaluable knowledge and expertise remains crucial in forest conservation, sustainable management and restoration efforts (see UN-REDD Learning Journal and Social Inclusion and Gender for more information).

The changing climate's impact on the world's forests can exacerbate forest degradation, effectively creating a feedback loop: increased temperature and drought can lead to more tree mortality, make plants more susceptible to pests and disease and increase the risk of fires, which leads to more GHG emissions and climate change.[21]

Faced with growing human pressure and stressors such as the changing climate, forests are increasingly vulnerable to climate-driven tipping points - thresholds beyond which ecosystems may undergo abrupt and potentially irreversible changes. The Amazon rainforest, for instance, faces a risk of transitioning into a savannah-like state due to the combined effects of deforestation, drought, fire, and regional warming. Such a shift would drastically reduce its carbon storage capacity and biodiversity, while releasing large quantities of greenhouse gases into the atmosphere. Some assessments warn that continued forest loss and fragmentation could undermine the resilience of tropical forests, turning them from carbon sinks into net carbon sources.[22,23]

By absorbing large volumes of CO_2, tropical forests help slow the pace of global warming, thereby delaying or preventing the transgression of climate tipping points. However, warming beyond 1.5–2°C dramatically increases the risk of forest degradation and biome shifts, particularly in the Amazon and Congo Basin.[24] These transitions would not only release stored carbon but also reduce the forests' ability to recover, amplifying feedback loops that accelerate

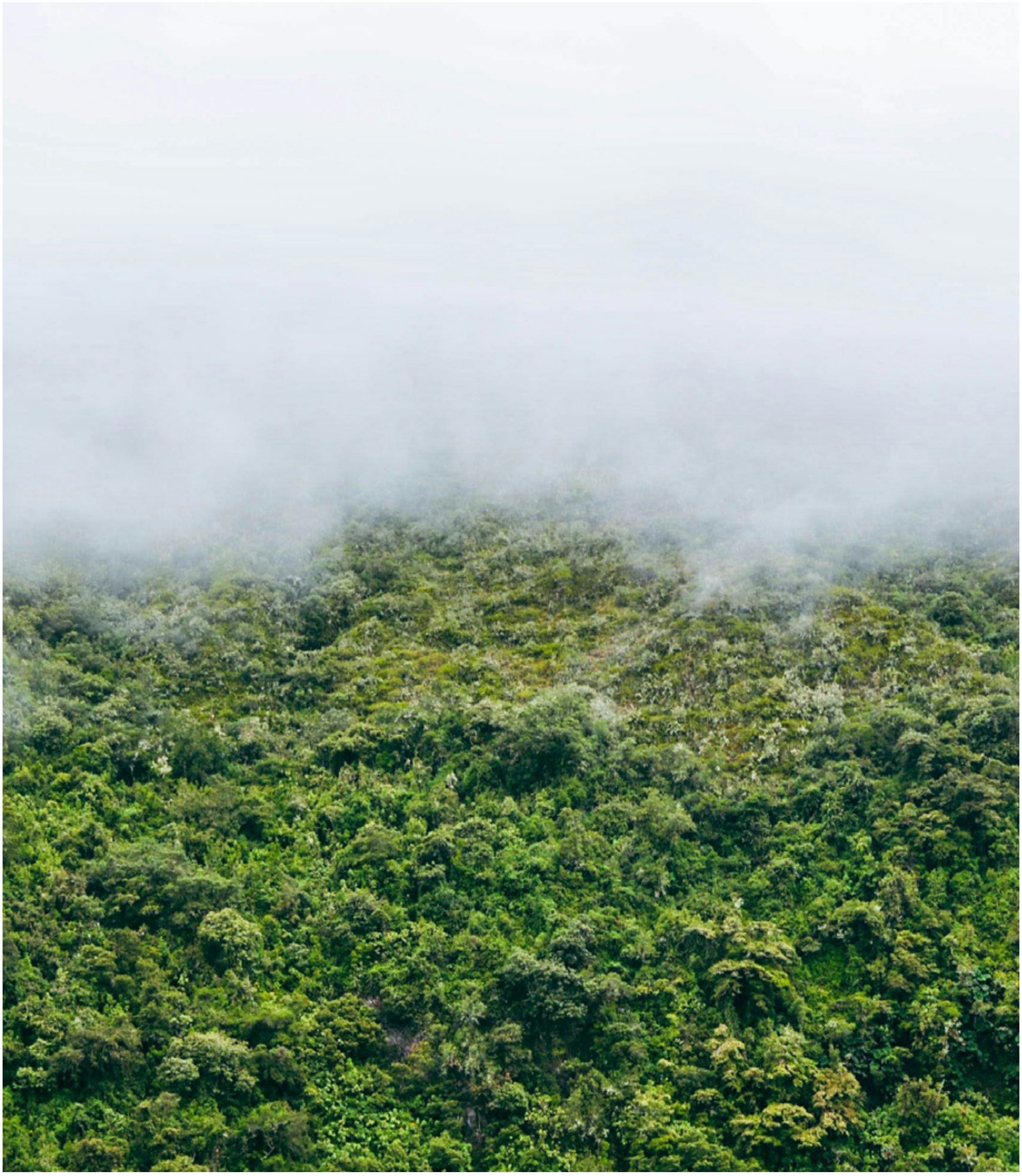
LEARNING TOOL

Go to the REDD+ Academy Platform to identify the definitions of National Strategies/Action Plans and their importance in design processes.

climate change. It is therefore critical to ensure the highest level of climate ambition, and preserving tropical rainforests is one of the most effective natural strategies to achieve this.[25]

The UNFCCC recognizes the role of forests in mitigating climate change in multiple ways, including through the negotiated framework for REDD+, which includes reducing emissions from deforestation and forest degradation, the conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks, in developing countries.

REDD+ is an important approach to reduce total GHG emissions and thus mitigate climate change - but will only be successful in doing so alongside a wider suite of measures that lead to a rapid decarbonization of the global economy.



Module 4

Beyond carbon: Forests and global climate

This module

Explores the essential yet often overlooked ways in which forests regulate the global climate beyond carbon storage and sequestration. The module also examines how forest loss impacts vulnerable groups, including women, Indigenous Peoples, and forest-dependent communities, by reducing vital ecosystem services and exacerbating existing social and gender inequalities.

You will be able to...

- Explain how forests regulate climate beyond carbon, including their roles in evapotranspiration, rainfall generation, and atmospheric moisture transport.
- Describe the impacts of deforestation on precipitation patterns, temperature, drought intensity, and regional climate stability.
- Assess how forest protection and restoration contribute to climate resilience, disaster risk reduction, and biodiversity conservation.

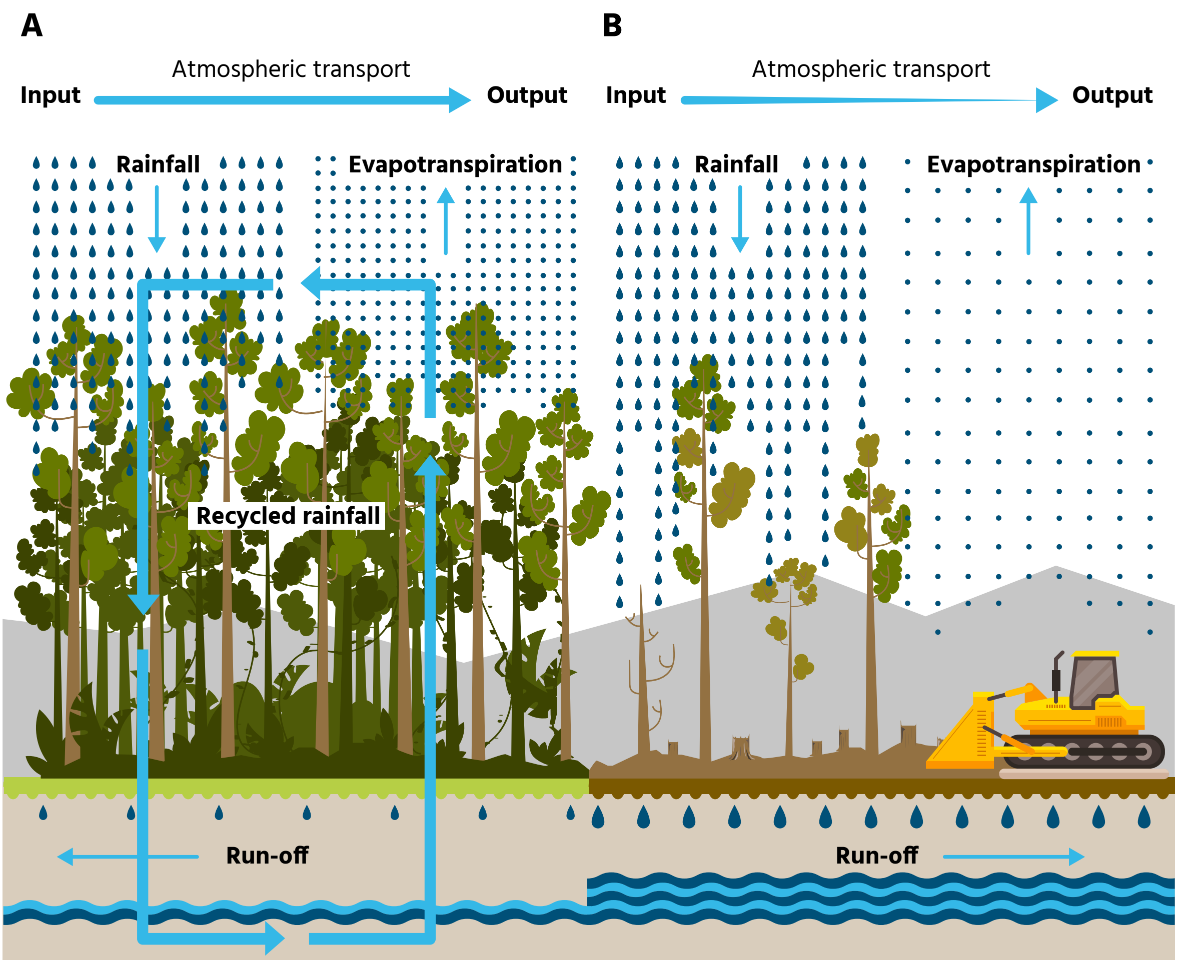
The relationship between forests and climate is not limited to the amount of carbon stored or sequestered by forest, or emissions directly caused by deforestation and forest degradation. Forests also sustain precipitation patterns and deforestation can change the water cycle (Figure 12). Forest loss leads to reduced precipitation (rainfall) and evapotranspiration (the process of transfer of water from the Earth's surface to the atmosphere). This exacerbates drought and increases local air temperatures.[26,27]

Studies have shown that periods of extensive deforestation in the Amazon have led to a hotter and dryer climate in the region.[28,29] Moisture cycled in the Congo Basin through evapotranspiration in the rainforest not only contributes to rainfall in the Basin itself, but also provides about 40 per cent or more of rainfall in Sahelian Sudan and the Ethiopian highland during the summer season.[30] On a global level, large intact forests complement the world's oceans and lakes as sources of atmospheric moisture, helping

LEARNING TOOL

Review what you have just learned. Go to the REDD+ Academy Platform and watch the video with crucial considerations and takeaways on climate change and the role of forests.

Figure 12: Forests and the water cycle a) In a rainforest, much of the rain water is recycled. Trees transport water from soil into vegetation and into the atmosphere through the evapotranspiration process. The resultant vapour can be carried away to other areas or return into the soil in form of rain. b) This cycling of water is disrupted when forest is removed.[36]



transport it across continents. This sustains farmers' livelihoods and underpins food security in areas that rely on rainfed agriculture.[31]

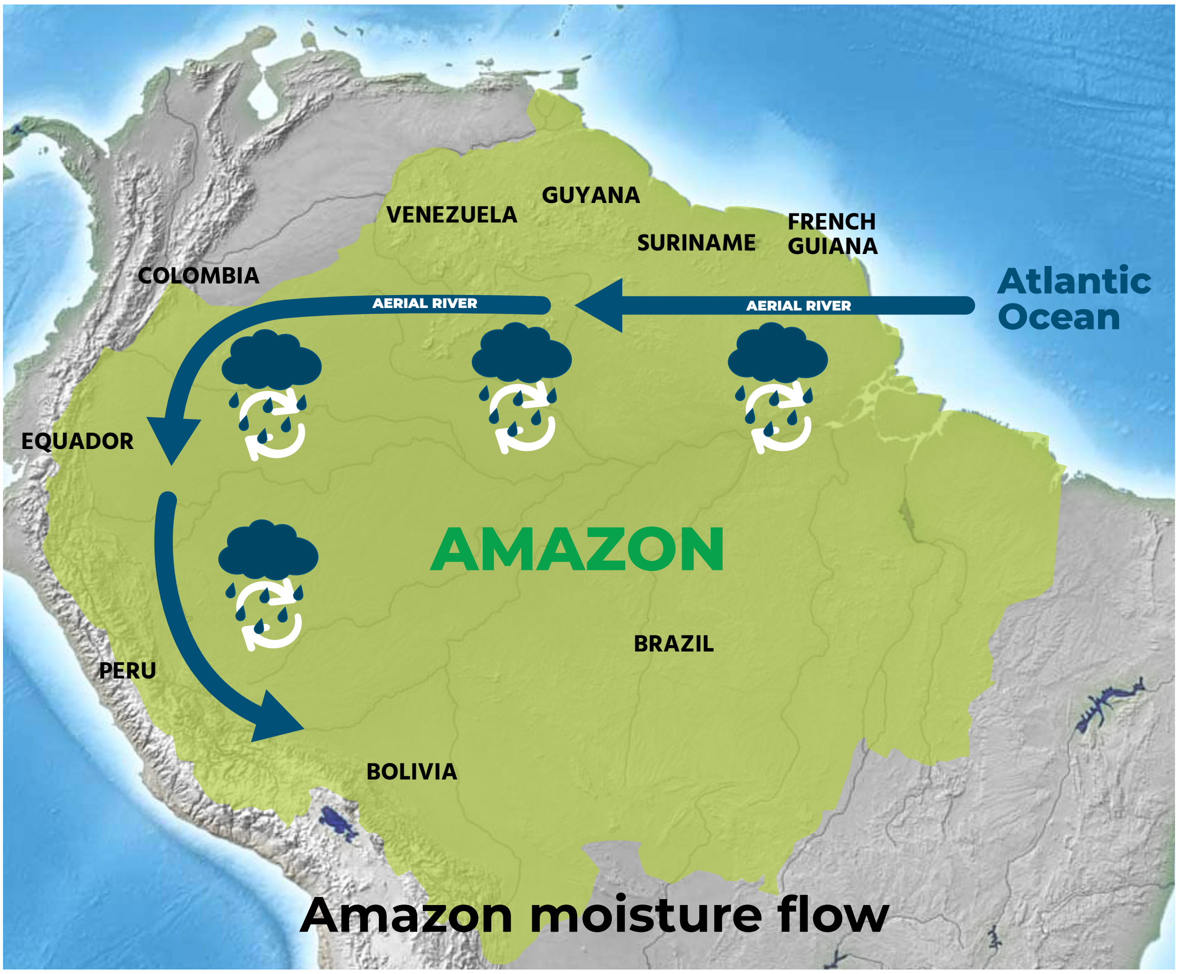
Deforestation and forest degradation impacts people through the reduction or loss of other important ecosystem services, such as reduced forest products and foods, affecting livelihoods and food security. The impacts of forest loss tend to be greater for people in vulnerable situations, such as women and Indigenous Peoples, and can reinforce and exacerbate existing social and gender inequalities, from inequitable access to natural resources, to gender-based violence.

Protecting and conserving, as well as restoring forests, not only provides livelihoods to communities relying on natural resources, it also strengthens adaptation and resilience to climate change. For example, tree roots stabilise soil and mitigate flood risks and landslides, thus reducing hazard risks of climate change-related disasters.[32] Protecting vulnerable forest ecosystems is also beneficial for nature and biodiversity, since many of the world's most important forest carbon stocks also overlap with areas of highest biodiversity.[33] Thus, through sustainable forest programmes, countries have the opportunity to make good on both their forest and climate global commitments.

Your learning journey is concluded: What do you know now about forests and climate? Go to the REDD+ Academy Platform and answer the questions to assess your actual knowledge.

LEARNING TOOL

Figure 13: A schematic representation of aerial river flow over the Amazon basin, with rainforest helping transport moisture and cycling it over the continent.[37]



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