Climate change mitigation and adaptation

RESEARCH PROGRAM ON
Forests, Trees and Agroforestry

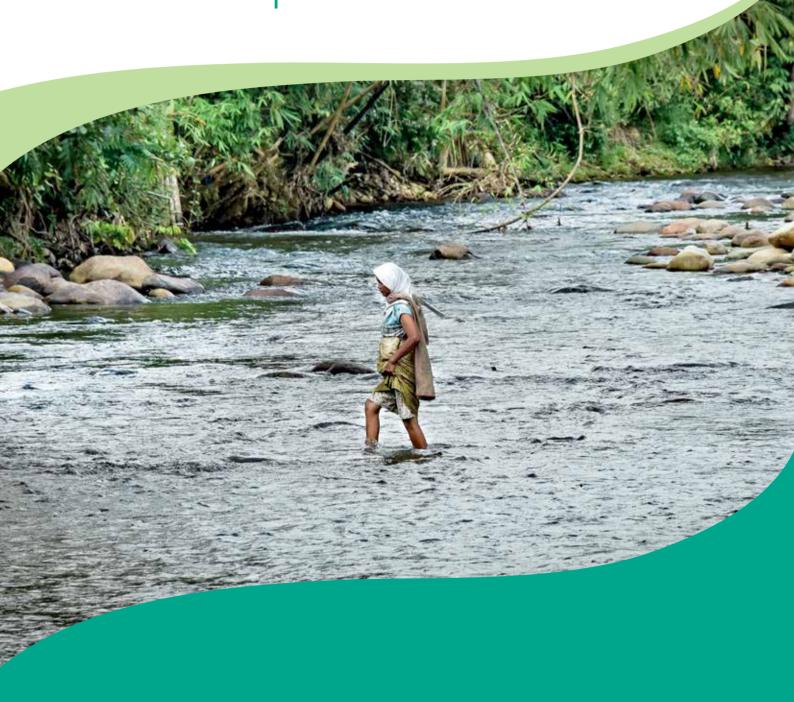**CGIAR**

The CGIAR Research Program on Forests, Trees and Agroforestry (FTA) works on enhancing all possible contributions of forests, trees and agroforestry to sustainable development. In this context, climate change is a major focus of FTA's work, through one of its five research domains and across the program.

Forests, trees and agroforestry's role in climate change

The importance of forests in climate change mitigation and adaptation cannot be overstated.

Forest, tree and agroforestry systems have an important role to play in both emission reduction and the mitigation of climate change. They are key in the necessary adaptation of forests and people to examples of climate change that are already occurring, such as increasing temperatures, changing rainfall patterns and the increase of extreme weather events.

They can also provide bioenergy resources for the transition to a cleaner energy system, as emphasized by the UN Sustainable Development Goals (SDGs).

The objectives of the Paris Climate Agreement cannot be achieved without forests, trees and agroforestry. This is recognized by the agreement itself and acknowledged by countries that give a large place to forests and trees in their nationally determined contributions (NDCs). Many countries need support for the implementation of these objectives.

There can be no effective climate change mitigation and adaptation strategies and policies without involving the potential of forest, tree and agroforestry resources in integrative cross-sectoral approaches. Also, countries need methods to reliably assess and monitor the performance of mitigation and adaptation policy and practice, as well as related costs and benefits.

FTA's role in climate change

Scientists work together across the whole of FTA to develop — at international, national and local levels — effective, equitable and inclusive solutions to jointly address climate change and development outcomes, that make the most of the potential of trees, forests and agroforestry.

FTA addresses this challenge by generating knowledge and tools, advice on policy and practice, technology transfer, and supporting capacity development at a national level. FTA research aims to inform and facilitate improved policy change, changes of practice at different levels, and institutional change, including an enabling environment, as well as adopting when necessary a political economy lens to facilitate change.

Key questions for this research domain

FTA organizes its work on climate change around the following four questions.

1. How can forest, tree and agroforestry systems contribute to achieving effective land-based mitigation of climate change?
2. How can forest, tree and agroforestry systems adapt to climate change and contribute to the adaptation of agriculture, people, livelihoods and landscapes to climate change at different scales?
3. How can bioenergy be sustainably produced in developing countries?
4. How can the performance of policies and practices addressing these goals be reliably assessed?

What is FTA researching on climate change?

Achieving climate change mitigation with forests, trees and agroforestry

The Paris goals require immediate, coordinated efforts from all sectors in reducing greenhouse gas (GHG) emissions. FTA's work on mitigation provides analysis and guidance on GHG emission reduction options for tropical landscapes using forests, trees and agroforestry as resources, integrated within economic and social development.

△ A woman carries crop roots, to be used as cooking fuel, in an arid area of India where efforts are being made to reduce villagers' consumption of fuelwood. Photo by C. Pye-Smith/ICRAF

It supports mechanisms such as NDCs, reducing emissions from deforestation and forest degradation (REDD+), National Adaptation and Mitigation Actions (NAMAs); sustainable forest management (SFM) and zero-deforestation pledges from the private sector.

FTA seeks to advance knowledge through country-specific, as well as global, comparative analyses of emission reduction options, incentives, policies, governance and partnership mechanisms. FTA provides guidance on policy design and architecture, and a focus on the political economy of enabling policies. FTA plans to undertake more foresight studies on forest, tree and agroforestry-based mitigation and adaptation with respect to the SDGs and Paris targets.

Current key research activities on mitigation are:

- **REDD+:** The Global Comparative Study on REDD+ policies and their implementation is in its seventh year. It investigates national policies and enabling frameworks; measurement, reporting and verification (MRV); landscape integration; and carbon and social effects (by gender) of the interventions.
- **NDCs and other mechanisms:** FTA undertakes comparative analyses of NDCs, and works on NAMAs and SFM.
- **Supporting the Bonn Challenge:** FTA undertakes research on the policy and practice of forest restoration and on enhancing the forest carbon sink capacity.
- **Forest fires:** FTA studies the complex challenge of forest fire policies, particularly in Indonesia.
- **Climate finance:** FTA assesses the effectiveness and efficiency of results-based climate finance and incentive mechanisms.
- **Political economy:** FTA advises on the enabling policy architecture of climate mitigation policies.
- **Corporate pledges of deforestation-free production:** FTA researches public-private partnership mechanisms, standards and certification that could support corporate zero-deforestation commitments and other mitigation initiatives.

Adaptation of people and forests to climate change

Forests, trees and agroforestry already play a key role in ensuring the resilience of landscapes and households to physical and economic risks. With climate change, this function will be more important than ever. At the same time, land-based economic activities in developing countries are particularly vulnerable to climate change. Adaptation is urgently needed. FTA addresses how forests, trees and agroforestry can adapt to climate change, and how forests and trees can help people and livelihoods adapt to climate change.

Some tree-crop commodities (such as cocoa and coffee) are particularly sensitive to climate change. FTA works with partners to integrate climate change predictions on tree suitability areas, as well as on appropriate "climate proof" tree germplasm and intervention options, including appropriate incorporation and management of companion trees. FTA works on agroforestry in the context of climate change and on the potential for using shade trees to improve microclimates and improve productivity.

Increasing resilience to climate change has reestablished the importance of diversity breeding and decentralized participatory domestication approaches, which consider production traits enhanced by genetic variation and which use local landscape-level deployment to maintain planting material diversity. FTA research indicates how tree planting patterns will need to change and the modifications that will be required to deliver planting material for climate-smart agricultural and restoration-based responses. FTA works on finding important tree traits for adaption, including new trait combinations for novel environments, and uses climate models to indicate planting domain shifts under future climates.

As climate change advances, with deepening and lengthening dry spells in the seasonally dry tropics, trees and shrubs are increasingly seen as a supplementary fodder source. Heat stress is an increasing cause of animal production loss and a major animal welfare challenge. FTA works with the International Livestock Research Institute (ILRI) on how to best develop multistrata silvopastoral systems, live fences, windbreaks and fodder banks as key development options to sustain smallholder livelihoods based on pasture use in the context of climate change.

Furthermore, to combine climate risk reduction with increased resilience, FTA uses empirical research supporting policy integration, practice and assessment at local, national and international levels. FTA seeks to advance knowledge on synergies between, and incentives for, mitigation and adaptation approaches as recognized under Joint Mitigation and Adaptation (JMA) in the Paris Agreement.

Current and planned key research activities on adaptation are:

- **JMA:** Studies on synergies and tradeoffs between mitigation and adaptation in support of the Paris Agreement
- **Site-matched, "future-proofed" tree-planting material,** with high adaptive capacity, including for landscape restoration, reforestation and agroforestry
- **Livestock:** Multistrata silvopastoral systems in the context of climate change
- **Vulnerability:** Assessment of potential impacts of climate change on biodiversity, ecological functions and ecosystem services to assess risks and vulnerability of both forests and people (by gender), and contribution of analysis to the "loss and damage" debate
- **Risk:** Identifying options to reduce climate-related risks, analyzing tradeoffs, exploring adaptation economics, developing adaptive capacity of social groups (by gender) and supporting climate-smart agriculture
- **Ecosystem-based adaptation (EbA):** Study of mechanisms (e.g. land-use planning, multistakeholder dialogues) that strengthen local capacity (by gender) to respond to climate change and variability, and their integration into national development and adaptation plans (National Adaptation Plans and National Adaptation Programs of Action) across scales
- **Assessment:** Development and testing of approaches to measure and monitor the effectiveness and efficiency of EbA actions in reducing vulnerability and increasing resilience
- **Data for risk reduction:** Experimentation with and development of flexible, data-driven approaches that emphasize flexibility and heterogeneity as risk reduction strategies and feedback-based policy responses

Bioenergy to improve energy sector sustainability

Bioenergy is part of a coherent approach across FTA that considers energy poverty, climate change, and food and nutritional security through diverse production systems involving forest landscapes. Bioenergy is key to improving the sustainability of the energy sector and achieving the Paris goals.

Many governments have renewable energy targets and the Paris goal of balancing sources and sinks requires a thorough understanding of the role bioenergy can play. Also, in many regions, biofuels are unsustainable, contribute to climate change and human health problems (e.g. open cooking fires, charcoal production), and face the problem of being considered "backwater technologies" by national actors.

FTA analyzes climate benefits and disadvantages of bioenergy policies under current and plausible future scenarios. Developing countries can include renewable energy efficiency targets in NDCs, making for an interesting investment arena.

Current and planned key research activities on bioenergy are:

- **Status:** Analysis of the current status of bioenergy types, including relative benefits, disadvantages and the extent of their utilization in different regions
- **Drivers:** Analysis of international and national drivers of bioenergy development to understand how markets and standards (e.g. EU Renewable Energy Directive) affect land allocation to bioenergy production
- **Genetic resources:** Site-matched tree-planting material, with high bioenergy capacity
- **Marginal land use:** Assessments of potential of bioenergy production on degraded land
- **Side effects:** Analysis of the impact of bioenergy on social and environmental outcomes (e.g. health, poverty, migration, gender, biodiversity)
- **Economics:** Studies of demand and supply, costs, social and environmental impacts, carbon footprints and synergies/ tradeoffs with food production and variation by world region, feedstock type and scale of bioenergy production
- **Scenario development:** Analysis of how bioenergy extraction links to landscape configuration, and assessment of how future energy developments may affect the role of biofuels, including new developments (e.g. lignocellulosic fuels)

Performance assessment of policies and practices, including gender aspects

Policies and practices need to be assessed, while stakeholders need to be able to quantify progress and learn from successful and unsuccessful approaches. Climate finance and funding mechanisms are often conditional on result evaluation and assessments. Performance assessment goes beyond the traditional MRV approach to include policy performance assessment as the basis for evidence-based policy and practice.

This is broader than the traditional MRV and is called monitoring, measuring, reporting and verification (MMRV). MMRV is needed to achieve intended emission and risk reduction effectively, in line with the Paris Agreement and Low Emission Development Strategies (LEDS).

REDD+ needs effective and reliable information systems; NDC implementation, both in adaptation and mitigation, calls for appropriate metrics, transparent assumptions, time frames and realistic implementation pathways. Private-sector pledges also require performance assessments. Evidence-based approaches will improve confidence and enable effective and transparent policy implementation.

Finally, in relation to forest and tree resources, men and women face varying challenges and opportunities to mitigate and adapt to climate change impacts, vis-à-vis climate change policies and interventions, and related risk and benefit sharing, due to gender-differentiated roles and responsibilities. FTA looks into the structural causes of this situation and the factors that can strengthen the voice, influence and entitlements of marginalized groups in adaptation and mitigation policies and interventions.

Current and planned key research activities are:

- **Reference levels:** Research that supports the setting of country targets, baselines/reference levels/points of departure for REDD+, NAMAs, Intended Nationally Determined Contributions (INDCs) and LEDS; developing criteria and tools to measure and contribute to private-sector assessment
- **Carbon and climate:** Research to understand carbon source/ sink dynamics to improve regional and global models and feed into Intergovernmental Panel on Climate Change processes
- **Non-carbon benefits:** Measurement of biodiversity, governance and livelihood outcomes, social equality, and informing the implementation of safeguarded information systems, and identifying causal change
- **REDD performance:** Impact assessment of REDD+ policy and practice, building on eight years of comparative research and longitudinal datasets
- **Policy recommendations and learning platforms:** Support of gender equity in REDD+ processes
- **MMRV in practice:** Develop approaches for cost-efficient, transparent, reliable MMRV that countries can use
- **Complexity of land-use decisions:** Coupled bioeconomic modeling to understand emergent properties, complexity and conditions of landscape systems. Development of decision-making tools, e.g. landscape management for LEDS, models of future scenarios and climate/carbon outcomes under different land-use policies, and spatial economic analyses to assess the cost and equity implications of policy mix options

How does FTA work on climate change?

FTA undertakes high-quality research that is relevant, scientifically credible, legitimate and effective toward change. This involves:

- Early engagement and trust-building with collaborating partners from all levels and sectors in developing countries, understanding the political economy context and the interest and needs of local stakeholders e.g. through multistakeholder consultations → **relevance and legitimacy**;
- Joint definition of relevant research questions (responding to needs) → **relevance**;
- Research in partnership with national institutions (output) → **legitimacy**;
- Delivery, directly and through research and development partners, of knowledge and tools to users of FTA research, i.e. national and global policymakers and practitioners → **effectiveness**.

Who does FTA partner with on climate change?

FTA works directly with target agencies or with intermediate partners that have the mandates, capacity, networks or potential to reach key national decision makers and practitioners. FTA also supports the university education of future leaders in developing countries.

FTA works with local, national and international partners to support all implementation levels. Some examples include:

- **Advanced research centers:** Wageningen University in the Netherlands on monitoring, reporting and verification and drivers of deforestation and the Norwegian University of Life Sciences (NMBU) in Norway, e.g. on REDD policies and the political economy of REDD
- **Developing country research partners:** Law, Environment and Natural Resources (DAR) in Peru and Iwokrama in Guyana, e.g. on developing REDD+ country profiles
- **National policy actors:** Line ministries such as ministries of environment, forestry, agriculture, rural development, finance and others, e.g. to support decision making with information, tools and knowledge
- **Civil society organizations:** Groups that run REDD+ projects and other activities in the field
- **Multistakeholder roundtables and networks:** Governors' Climate and Forests Task Force (GCF) that can create impact across several jurisdictions and even country boundaries
- **Donors and agencies:** The Norwegian Agency for Development Cooperation (Norad), International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), United States Agency for International Development (USAID), Germany's Federal Ministry for Economic Cooperation and Development (BMZ) and many others, to inform their policies
- **International policy actors:** Green Climate Fund, UNFCCC Secretariat, United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD) and the Food and Agriculture Organization of the United Nations (FAO) to inform international policy actors and processes
- **Media in developing countries:** International Institute for Sustainable Development (IISD) and individual journalists specializing in reporting on climate change

This list is not exhaustive but exemplifies the importance of the program's partnerships. FTA has strong and reliable partnerships with Brazil, Ethiopia, Indonesia, Peru, Vietnam, the Democratic Republic of Congo, Guyana, Mexico and Myanmar, among many other countries.

FTA's research on climate change links to other CGIAR Research Programs, especially the CGIAR Research Program on Policies, Institutions, and Markets (PIM) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

A mother, accompanied by her baby, fetches water using a bicycle in Burkina Faso. Photo by O. Girard/CIFOR

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