

Adaptation Framework Thematic Brief: Forestry



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Climate Change and Forests

Climate change directly influences the growth and productivity of forests through changes in temperature, precipitation, fire regimes, storms and extreme events, as well as indirectly through changes in the distribution of pests and disease, or encroachment resulting from changes in suitability for agriculture. Climate change brings opportunities to the forest sector as well as challenges, for example through longer growing seasons in some regions, and higher concentrations of carbon dioxide could increase forest productivity (the CO₂ fertilisation effect), if other factors such as nutrient and water availability are not limiting. Taking advantage of these opportunities, however, and ensuring that forestry objectives are met, will require forest managers to integrate adaptive measures into forest management plans.

Increasing temperatures will shift the distribution of different tree species. Depending on location this may increase the range of commercially important species (for example allowing cultivation at higher latitudes or elevations), or reduce productivity and mean that certain species are no longer viable in a given location. Drought is expected to increase in frequency and severity in many regions, and in snowmelt-dependent regions rising temperatures will affect the seasonal availability of water resources. Studies show a clear risk that climate change could force some forest ecosystems past tipping points at which forests are no longer viable, and the system shifts to grassland. Substantial shifts in suitability for different species are likely, and assessments of which species are commercially viable must take these modelled changes into account.

Natural disturbances are a key part of the natural dynamics of a forest. Climate change has been identified as a key driver in recent increases in the frequency and severity of forest fires, insect

outbreaks, and drought, and it is expected that climate change will further alter disturbance regimes. Forests are likely to experience outbreaks of pests and diseases previously not endemic to the area, as climate change alters their geographic suitability. Pathogens will be able to migrate faster than host species and are likely to be better able to adapt to changing climatic conditions.

Modelled changes in fire frequency, burn area and severity generally show increases under future climate change, however, changes are dependent on a complex interaction between climate, CO₂, fuel and human activity, and there is important spatial variability. The clearest response is an increase in fires at higher latitudes, while projections for areas such as sub-Saharan Africa are more uncertain. Overall, however, fire risk is expected to increase. Depending on location forests may also experience stronger and more damaging storms.

Sea-level rise will impact mangrove forests, as increases in flood height and duration can increase plant death. Mangrove systems which are already under pressure will be more severely affected. The impacts on mangrove forests will vary regionally, both because of regional differences in the rate of sea-level rise, and factors such as tidal range and geomorphic setting. Potential increases in storm intensity may increase the likelihood of extreme storm events leading to large-scale forest loss, while decreases in precipitation can increase salinity and affect the productivity and survival of mangrove forests. Conversely, rising temperatures may allow mangroves to expand beyond their existing range in some areas.

The impacts described above can interact to increase the risk to forests and forestry; trees weakened through drought will be less resilient to attacks from insects for example. Climate change is likely to increase forest susceptibility to a range of existing stresses, and in general, impacts on temperate forests is likely to be lower than on tropical forests. Overall, climate change has the potential to significantly reduce forest productivity and the expected returns from forestry projects, in the absence of effective adaptation measures.

Adaptation and typical options available

Adaptation measures are needed to ensure that forestry objectives are met, and that forests continue to provide their key ecosystem services despite a changing climate. Maintaining, restoring or expanding forests provides an important opportunity to reduce the impacts of extreme events on a range of other sectors, for example through slope stabilisation reducing the likelihood of landslides, afforestation in upland areas helping to attenuate peak flows and reduce downstream flooding, or coastal forests helping to protect against storm surges and sea-level rise. Forestry is also a sector where Adaptation and Mitigation are intrinsically linked, with all measures taken to reduce climate impacts on forests ensuring that they continue to remove and sequester carbon, and many opportunities to restore or expand forests and contribute to both mitigation and adaptation. Adapting to climate change will require a combination of technological, social and policy responses.

Integrating a gender perspective in adaptation is critical, and it is clear that empowering women has positive outcomes in terms of capacity to adapt to climate change. Given the inequitable impacts of climate change, and the key role that forests play in the livelihoods of many indigenous groups, interventions need to be designed which specifically address the challenges faced by women, indigenous and marginalised groups, and poor people. Without this specific focus, there is a risk that adaptation can perpetuate and enhance existing inequalities.

Forest governance

Many existing policies designed to address forest degradation and fragmentation contribute to adaptation and mitigation in the forest sector. Sustainable Forest Management frameworks provide a strong foundation for effective adaptation in the Forestry sector, emphasising the need for

participatory approaches, an understanding of forests as coupled socio-ecological systems, the incorporation of indigenous knowledge, and the need to meet multiple objectives. It is important that SFM frameworks explicitly incorporate uncertainties associated with climate change, and seek to develop strategies that will achieve their objectives under a range of different scenarios. Adopting adaptive management approaches allows for the flexibility and experimentation which is likely to lead to more effective adaptation in the forest sector. The dynamic nature of forest ecosystems also means that in many cases the institutional arrangements to manage forests are well positioned for adaptive management approaches.

Monitoring

A key aspect of adaptation in the forestry sector is to establish, or improve, existing forest monitoring or early-warning systems for impacts climate risks including fire and forest pests and diseases. Vulnerability assessments should take into account likely changes in the distribution of pests and diseases, including the possibility of the occurrence of novel species not previously endemic to an area. Developing the systems necessary to spot new outbreaks as early as possible, and clear management plans to respond rapidly to outbreaks will allow new diseases to be managed so as to minimise damage. Monitoring the effectiveness of adaptation measures that have been put in place is critical to allow an informed adaptive management approach to take place. Climate change is likely to require additional resources for monitoring, including for training, communication and equipment.

Landscape management

Forest landscapes can be managed to reduce the impact of climate change. Planting approaches that seek to reduce fire risk by planting fire-resistant species as firebreaks, or the maintenance and restoration of appropriate fire regimes, for example, can reduce the likelihood of extreme, uncontrolled forest fires. Proactively adjusting the mix of species in the forest to take into account shifting climatic conditions and changes in suitability can increase a forest's resilience to climate change, for example to include species which will be able to take advantage of higher temperatures. Increasing both species and structural diversity in a forest can increase resilience to disturbance events and reduce susceptibility to drought and disease. Reducing existing pressures on forest ecosystems, while taking measures to reduce forest fragmentation and increase connectivity are all also recommended in helping forests to adapt. Adaptation should be integrated into forest management plans.

Mangrove adaptation

Mangroves play an important role in both coastal protection and are a source of productive livelihoods. In addition to the role that mangroves can play in helping coastal areas adapt to climate change it is important that mangrove forests themselves are managed in such a way to allow them to adapt to rising sea-level, changes in storminess, and changes in precipitation regimes. Reducing existing stresses on mangroves will allow them to better withstand the effects of climate change, while rehabilitating high tide habitats can increase capacity for the inland retreat of mangroves in response to rising sea-level. The introduction of mangrove species that are better adapted to higher salinity, or an increased tidal range, and measures to reduce erosion, and increase sedimentation will also help mangroves to adapt to rising sea-levels.

Experience from the ASAP I programme

The Adaptation for Smallholder Agriculture Programme I (ASAP I) programme was launched in 2012, providing co-financing resources to scale up and integrate climate change adaptation into IFAD's investments. The programme reached eight million vulnerable smallholders in 43 countries, increasing their capacity to cope with climate change impacts and ability to build more resilient livelihoods.

Although no ASAP projects focussed specifically on forestry, several projects sought to promote agro-forestry approaches as part of wider objectives to support climate-resilient agriculture, including, for example, the Agricultural Services Programme for Innovations, Resilience and Extension (ASPIRE) project in Cambodia. ASAP projects in The Gambia (NEMA-CHOSSO) and Djibouti (PRAREV) have worked on mangrove restoration and rehabilitation, and enhancing community management of natural resources.

NDC Priorities

The forestry sector is included in the (Intended) Nationally Determined Contributions (INDC/NDC¹) of 86 IFAD partner countries. On a global scale, there is clearly recognition of the need for adaptation in the sector. However, at the national level, NDCs vary significantly in their depth and scope.

The most common priority across all regions is measures to address degradation and deforestation, through restoration and regeneration of forests, afforestation, or activities aimed at reducing erosion and land degradation. Sustainable forest management, and community-led forest management is frequently cited as a priority, as is protection of forests against encroachment. In both the East and Southern Africa, and West and Central African regions many NDCs also highlight the need for agro-forestry systems, and approaches integrating cropping, forestry and livestock, as well as noting the need to address drivers of deforestation such as fuelwood extraction and charcoal production. Relatively few NDCs highlight note the identification and planting of more resilient tree species, or research into climate impacts and response as a priority.

¹ In the following, NDCs is used to refer to both, NDCs and INDCs.

NDC priority	Asia and the Pacific	Latin America and the Caribbean	Near East, North Africa and Europe	East and Southern Africa	West and Central Africa	Total
Number of countries	18	17	12	16	23	86
Afforestation, reforestation, restoration and regeneration of forests and degraded forest lands; prevention of erosion and degradation	15	11	12	14	16	68
Sustainable forest management; community-management	8	9	1	4	12	34
Protection of forests, control and limitation of deforestation and encroachment	4	10	3	8	10	35
Agroforestry, silvo-pastoralism and integrated agro-forest-livestock systems; use of non-timber forest products	1	5	1	8	7	22
Identification, preservation and planting of resilient tree species (native/indigenous & new)	2	4	2	3	0	11
Disaster Risk Reduction and Management; mitigation and control of wildfires	3	5	1	4	1	14
Arboriculture and forest plantations for sustainable forest and forest product exploitation	0	0	2	5	1	8
Research into resilient forest species, management and CC impacts on forests	1	0	0	0	5	6
Promote alternative livelihood sources for forest users & use of non-timber products	0	0	0	2	2	4
Address unsustainable fuelwood and charcoal extraction, e.g. through improved cooking stoves and more efficient kilns	0	0	1	7	10	18

Accessing the Green Climate Fund (GCF)

The GCF invests in adaptation and mitigation projects and programmes in developing countries, with the objective of limiting or reducing greenhouse gas emissions and supporting vulnerable people to adapt to climate change. Key to GCF access is ensuring that projects have a strong climate rationale – the justification for how the project addresses specific climate impacts and vulnerabilities. While there are lots of other GCF assessment criteria, in this brief we summarise how to craft a strong climate rationale. A strong climate rationale must first set out the need for adaptation, and then clearly describe the rationale for planned adaptation interventions and why they have been selected.

Step 1: Adaptation Evidence

The project team must describe the project context, namely expected climate change impacts, risks and vulnerabilities. Expected climate impacts should be based on scientific evidence, and thus the project team needs to demonstrate clear use of climate data in the assessment of impacts and vulnerabilities. Demonstrating clear risks from climate change, including, where possible estimates of economic damage and number of people affected, is key if a project is to qualify for GCF funding.

Assessment Criteria – project should answer:

- What are the climate risks, vulnerabilities, and impacts related to climate variability and change relevant to the project context?
- What aspects of climate vulnerability will be targeted?
- Which climate-related risks might prevent project objectives being achieved?
- What is likely business-as-usual development and what are climate change related vulnerabilities?

Step 2: Prioritization of Interventions

The second step is to identify and describe adaptation measures for the project that are clearly linked to the previously identified climate risks and vulnerabilities. Adaptation measures should be consistent with national priorities for adaptation and sustainable development. The Adaptation Options System provides a foundation for identifying and prioritising appropriate adaptation options for the project. Transparency of decision-making around project interventions, including assumptions and uncertainty behind the choice of options strengthens a climate rationale. A theory of change should describe how the adaptation interventions are expected to contribute to the project objective.

Assessment Criteria:

- What options are available to address identified climate related vulnerabilities and are the proposed adaptation options realistic?
- Are the options robust and within an appropriate envelope of uncertainty?
- What type of adaptation is being pursued: reducing adaptation deficit, incremental, or transformational adaptation?
- With the investment, what are the specific adaptation activities to be implemented to increase the climate change resilience of the business-as-usual activity or baseline?
- Project states intent to address outlined vulnerabilities and risks through the proposed interventions.
- Does this project respond to national adaptation and sustainable development priorities?

Tools available to support project design

Various tools are available to help integrate adaptation into project design. In this note three main tools are highlighted, with a selection of additional data sources and tools provided under the resources section. Together, these tools provide support to IFAD staff to identify the relevant climate risks during project design, and integrate appropriate adaptation measures. They also provide the evidence base needed for the climate finance contribution from adaptation projects to be reported.

FAO: Climate change for forest policy-makers

FAO has produced a practical guide which is aimed at helping forest policy-makers to integrate climate change adaptation and mitigation into forest management plans. It highlights eight key elements, and provides step-by-step suggestions for both strategic outcomes and operational actions under each of the eight elements, as well as useful tools and resources.

USDA: Forest Adaptation Resources

The US Department of Agriculture has developed a set of Adaptation Resources for forest managers, including guidance on vulnerability assessments, adaptation strategies, and examples of best-practice projects. Although the tools have been developed for a U.S context, they provide useful information on adaptation strategies and approaches, including menus of possible adaptation measures to respond to different risks. An Adaptation workbook provides structured guidance on integrating adaptation into forestry projects.

Adaptation Options Prioritisation System

A database of adaptation options, and system for the assessment and prioritisation of adaptation options have been developed as part of IFAD's Adaptation Framework. The prioritisation comprises two main elements. First, the adaptation options in the database are filtered based on project sector, and the climate risks identified during the climate screening process. A multi-criteria analysis is then carried out on the shortlist of adaptation options to assist IFAD staff in choosing measures to integrate into the project using the following criteria:

- Technical feasibility
- Cost-benefit ratio
- How well the option addresses risks in the project context
- Complementarity to other IFAD themes
- Flexibility (i.e avoids lock-in)
- Mitigation co-benefits
- Transformative potential
- Accessibility for small-holder farmers

The Adaptation Options System uses a simple scoring system based on the eight criteria above. The first four criteria require a minimum score of 2; options which score lower than 2 on any of these criteria do not meet the minimum requirements and are not deemed to be suitable. Adaptation options which are scored the highest are most suitable for a project. The guidance below sets out how users of the system should score assign scores to the adaptation options for each of the criteria in the multi-criteria assessment.

Technical feasibility

The technical feasibility criterion is important in assessing which adaptation options are practical, given the skills, experience and capacity of the organisations tasked with implementing the project. If there is no prior experience with an adaptation option then the barrier to implementation may be too high, and there is an increased risk that it fails to meet its objectives.

1: Executing Agency has no experience implementing this type of adaptation option and there are no project partners with this experience.

2: Executing Agency does not have direct experience with this adaptation option, but partners are available who can provide technical expertise and experience with this type of option.

3: Executing Agency has previously implemented this type of adaptation option, and there is technical expertise within the organisation itself.

Economic case

The economic case includes a cost-benefit analysis and other instruments to establish the business case for public investment. The benefits must exceed the costs: the ratio of benefits to costs is greater than 1 in a cost-benefit analysis. Comparing the costs and benefits of different options allows for a comparison of the efficiency of different options, but requires costs and benefits to be calculated over the lifetime of the option and therefore requires a discount rate to be applied. The choice of discount rate for the analysis has an important bearing on the overall ratio of benefits to costs. Cost-benefit analysis for adaptation should also make some allowance for benefits that are hard to value in a traditional assessment, such as the benefits arising from improved environmental goods and services.

1: The benefits are less than the costs ($BCR < 1$) over the lifetime of the option, even with indirect benefits included

2: The benefit-cost ratio is in the range of 1-2. Benefits of implementing the option are higher than the estimated costs over the lifetime of the option although the benefits are not large and may be distributed unevenly among beneficiaries.

3: The benefit-cost ratio is greater than 2. Benefits of implementing the option are significantly higher than the estimated costs over the lifetime of the option and should be readily achieved.

Addresses climate risks

The extent to which an adaptation option increases resilience to the climate risks facing the project is a key consideration in prioritising options. All other things being equal, an option which increases resilience to several of the identified risks (e.g. livelihood diversification) should be prioritised over options that only address a single risk (e.g. increased flood protection). In the final consideration of which options to include in the project, care should be taken to select a package of options which address the different risks identified in the climate screening process.

1: Adaptation option is not relevant or may not be effective for the risks identified for the project.

2: Adaptation option effectively addresses at least one of the identified risks.

3: Adaptation option is relevant for all of the major climate risks identified for the project.

Accessibility for project beneficiaries

Adaptation options for IFAD projects should be appropriate for the project beneficiaries. This means ensuring that the adaptation option is affordable for target groups such as rural smallholders, youth or indigenous populations, or will not exacerbate existing gender inequalities (for example an insurance product that is only accessible to heads of the household, who may be predominately men).

- 1: Adaptation option is inaccessible for the main project beneficiaries (e.g. unaffordable, requiring regular complex maintenance), or exacerbates existing inequalities.
- 2: Adaptation option is accessible for the majority of the project's target beneficiaries.
- 3: Adaptation option is accessible to project beneficiaries and specifically benefits women or other marginalised groups.

Flexibility

Flexible and agile strategies for dealing with the uncertainty inherent in predictions of climate change ensure that adaptation options and strategies are developed in response to pressing needs and opportunities. This includes allowing for changes in approach as new information becomes available, or certain impacts start to pose a major risk. Flexibility in adaptation options is a function of the timeframe being considered, the design of the option, and the approach to managing change in the options being considered.

- 1: The adaptation option has a long life-time (>10 years) and its design does not allow for any adjustment. For example, a flood defence designed to cope with an additional 1m of flooding, and which would have to be completely replaced if greater protection was required.
- 2: The adaptation option being considered has a short lifetime (<10 years) meaning that considerations of flexibility are not as relevant.
- 3: The adaptation option is low or no regrets or is part of an adaptive management approach. Low regrets mean the option has benefits across a wide range of conditions. Thresholds and trigger points identified in adaptation strategies support adjustments in response to new information, risks or opportunities.

Mitigation co-benefits

Where possible we should prioritise those options which also have emissions reductions potential. For example, the reforestation to stabilise slopes prone to landslides has clear mitigation benefits, while a reduction in the use of fertilizer resulting from the implementation of low or no-till agricultural practices would decrease the emissions used in food production.

- 1: No mitigation co-benefits or adaptation significantly increases greenhouse gas emissions.
- 2: Adaptation option leads to emissions reductions, either at present or in the future.
- 3: Adaptation option involves reforestation, restoration of carbon sinks, or the substitution of fossil fuels for renewable energy sources.

Transformative potential

An adaptation option may enable fundamental change in the target system so that it becomes more resilient to climate change. Key attributes of transformative adaptation are that it addresses underlying barriers to change, and that it operates at scale; for example enabling access to insurance

products amongst smallholders may create knock-on effects in risk-taking and ability to invest in productive assets and thus create transformative change in livelihoods and significantly increase resilience to climate change at a large scale.

1: Adaptation option is limited to small increases in the resilience of target group, but does not involve changes in wider systems.

2: Adaptation option operates at scale or enables wider implementation of the option, for instance with a declining marginal cost.

3: Adaptation option enables change in the system in question which significantly increases opportunities for target beneficiaries to adapt to climate change.

Complementarity to IFAD themes

Where possible the adaptation options selected should complement the other IFAD cross-cutting themes (Gender, Youth and Nutrition). For example, a drought-resistant crop variety may be introduced which is nutritionally superior to existing varieties.

1: No complementarity

2: Complements at least one other cross-cutting theme that is directly relevant to adaptation outcomes.

3: Complements more than one other cross-cutting theme to support systemic resilience.

Resources

IFAD Guidance

- How to do: Climate Change Risk Assessments in Value Chain Projects
- How to do: Measuring Climate Resilience
- IFAD Climate Finance Tracking guidelines
- Climate change mitigation potential of agricultural practices supported by IFAD investments

Adaptation Framework:

- Adaptation Options prioritisation system
- Access climate finance from the Green Climate Fund
- NDC Priorities database

Tools and Guidance

- FAO Climate change for forest policy-makers: an approach for integrating climate change into national forest policy in support of sustainable forest management. FAO Forestry Paper 181. <http://www.fao.org/3/CA2309EN/ca2309en.pdf>
- USDA Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers. https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs87-2.pdf

Useful reports

- FAO (2019) Valuing Forest Ecosystem Services: A training manual for planners and project developers. <http://www.fao.org/3/ca2886en/CA2886EN.pdf>
- FAO (2013) Climate change guidelines for forest managers. <http://www.fao.org/3/i3383e/i3383e.pdf>
- Chow, J. (2017) Mangrove management for climate change adaptation and sustainable development in coastal zones. *Journal of Sustainable Forestry*.
- Seidl, R. et al. (2017) Forest disturbances under climate change. *Nature Climate Change* 7: 395-402
- Ward, R.D. et al. (2016) Impacts of Climate Change on Mangrove Ecosystems: a region by region overview. *Ecosystem Health and Sustainability* 2(4)
- The Center for People and Forests (2012) *Linking Adaptation and Mitigation through Community Forestry. Case Studies from Asia*
- Sturrock, R.N. et al. (2011) Climate change and forest diseases. *Plant Pathology* 60(1): 133-149.

Climate data portals:

[World Bank Climate Portal](#)

[KNMI Climate Explorer](#)

[Climate Information Portal](#)

[COPERNICUS Climate Change Service](#)

[CCAFS Downscaled Climate Data Portal](#)

Climate hazards data

[ThinkHazard](#)

[Global Flood Risk Analyzer](#)

