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Forest Methodology

Assessing the greenhouse gas impacts of forest policies[1]

June 2019

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PART I: INTRODUCTION, OBJECTIVES, KEY STEPS AND OVERVIEW OF FOREST POLICIES

1. INTRODUCTION

With the adoption of the Paris Agreement in 2015, governments around the world are increasingly focused on implementing policies and actions that achieve greenhouse gas (GHG) mitigation objectives. The agriculture, forestry and other land use (AFOLU) sector contributes to approximately one quarter of anthropogenic GHG emissions.[2] In the forestry sector, emissions are mainly from deforestation. Cost-effective mitigation options in forestry are afforestation, sustainable forest management and reducing deforestation. There is an increasing need to assess and communicate the multiple impacts of forest policies to ensure they are effective in delivering GHG mitigation and helping countries meet their social targets and commitments.

Purpose of the methodology

This document provides methodological guidance for assessing the GHG impacts of forest policies that enable or incentivize afforestation and reforestation, sustainable forest management, and reduced deforestation and/or degradation activities to increase carbon sequestration and reduce GHG emissions.

This methodology is part of the Initiative for Climate Action Transparency (ICAT) series of methodologies for assessing the impacts of policies and actions. It is intended to be used in combination with any other ICAT guidance documents that users choose to apply. The series of methodologies is intended to enable users that choose to assess GHG impacts, sustainable development impacts and transformational impacts of a policy to do so in an integrated and consistent way within a single impact assessment process. Refer to the ICAT *Introductory Guide* for more information about the ICAT guidance documents and how to apply them in combination.

Intended Users

This methodology is intended for use by policymakers and practitioners seeking to estimate GHG mitigation impacts in the context of Nationally Determined Contribution (NDC) development and implementation, national low carbon strategies, Nationally Appropriate Mitigation Actions (NAMAs) and other mechanisms. The primary intended users are developing country governments and their partners who are implementing and assessing forest policies. Throughout the document, the term “user” refers to the entity implementing the methodology.

The main emphasis of the methodology is on the assessment of GHG impacts. Impact assessment can also inform and improve the design and implementation of policies. Thus, the intended users include any stakeholders involved in the design and implementation of forest policies, strategies, NDCs or NAMAs, including research institutions, businesses and non-governmental organizations.

[2] IPCC 2014.

Scope and applicability of the methodology

This document provides general principles, concepts and procedures for estimating GHG impacts of forest policies[3] that increase carbon sequestration and/or reduce GHG emissions from the following activities (which are further described in Chapter 4):

- **Afforestation and/or reforestation (A/R)**: Increase carbon sequestration and/or reduce emissions by establishing, increasing or restoring vegetative cover through the planting, sowing or human-assisted natural regeneration of trees.
- **Sustainable forest management (SFM)**: Increase carbon sequestration and/or reduce emissions on forest lands managed for wood products such as sawtimber, pulpwood and fuelwood by increasing biomass carbon stocks through improving forest management practices.
- **Reduced deforestation and/or degradation**: Reduce net GHG emissions by reducing the conversion of forest lands with high carbon stocks to forest or non-forest lands with lower carbon stocks.

This methodology details a process for users to follow when conducting a GHG assessment of forest policies. It provides guidance on defining the assessment, an approach to GHG assessment including ex-ante (forward-looking) assessments and ex-post (backward-looking) assessments, and monitoring and reporting. Throughout the document, examples and case studies are provided to illustrate how to apply the methodology.

This methodology is applicable to users that have defined the individual policy instruments and mitigation practices and/or technologies that could be implemented to reduce GHG emissions. Examples of relevant policy instruments and mitigation practices and/or technologies are further described in Chapter 3. Policies that are not well-defined or have not undergone a policy development process can be difficult to assess since the level of detail needed to estimate GHG impacts may not be available without further policy development.

The steps for estimating emission reductions and removals are based on the 2006 IPCC *Guidelines for National Greenhouse Gas Inventories*, referred to throughout this document as IPCC 2006 GL.[4] Countries that have a GHG inventory for the forestry sector can use data from compiling the inventory to estimate emission reductions.

The methodology is applicable to policies:

- At any level of government (national, subnational, municipal) in all countries and regions
- That are planned, adopted or implemented
- That are new policies, or extensions, modifications or eliminations of existing policies

[3] Throughout this document, where the word "policy" is used without "action," it is used as shorthand to refer policies and actions and policies and measures. See Glossary for definition of "policies or actions".

[4] Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html As the IPCC Guidelines are updated or refined, users may refer to subsequent versions to improve impact assessment estimation. Note, the enhanced transparency framework states that, "*Each Party shall use the 2006 IPCC Guidelines and any subsequent version or refinement of the IPCC Guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA)".*

Appendix C lists the full criteria used to choose the scope of the methodology.

When to use the methodology

The methodology can be used at multiple points in time throughout a policy design and implementation process, including:

- **Before policy implementation**: To assess the expected future impacts of a policy (through ex-ante assessment)
- **During policy implementation**: To assess the achieved impacts to date, ongoing performance of key performance indicators, and expected future impacts of a policy
- **After policy implementation**: To assess what impacts have occurred as a result of a policy (through ex-post assessment)

Depending on individual objectives and when the methodology is applied, users can implement the steps related to ex-ante assessment, ex-post assessment or both. The most comprehensive approach is to apply the methodology first before implementation, regularly during policy implementation, and again after implementation.

Key recommendations

The methodology includes *key recommendations* that represent recommended steps to follow when assessing and reporting impacts. These recommendations are intended to assist users in producing credible impact assessments that are high quality and are based on the principles of relevance, completeness, consistency, transparency and accuracy.

Key recommendations are indicated in subsequent chapters by the phrase "It is a *key recommendation* to…." All key recommendations are also compiled in a checklist at the beginning of each chapter.

Users that want to follow a more flexible approach can choose to use the methodology without adhering to the key recommendations. The ICAT *Introductory Guide* provides further description of how and why key recommendations are used within the ICAT guidance documents, as well as more information about following either the "flexible approach" or the "key recommendations" approach when using the documents. Refer to the *Introductory Guide* before deciding on which approach to follow.

Relationship to other guidance and resources

This methodology uses and builds on existing resources mentioned throughout the document. This includes the IPCC 2006 GL, Volume 4, Agriculture, Forestry and Other Land Use.[5]

The methodology builds upon the Greenhouse Gas Protocol *Policy and Action Standard* (which provides guidance on estimating the greenhouse gas impacts of policies and actions and discussion on many of the accounting concepts in this document such as baseline and policy scenarios) to provide a detailed method for forest policies.[6] As such, this methodology adapts the structure and some of the tables, figures and text from the *Policy and Action Standard* where relevant. Figures and tables adapted from the

[5] Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

[6] WRI 2014. Available at: http://www.ghgprotocol.org/policy-and-action-standard

Policy and Action Standard are cited, but for readability not all text taken directly or adapted from the standard is cited.

A full list of references is provided at the end of this document.

Alignment with the enhanced transparency framework of the Paris Agreement

This methodology can help countries in fulfilling their accounting and reporting requirements under the enhanced transparency framework of the Paris Agreement. Specifically, the methodology can help countries understand the impacts of forest policies, estimate baseline emissions and GHG impacts, conduct projections and monitor progress using indicators and parameters over time. This enables countries to account for their contributions and track progress towards implementation and achievement of their NDCs. Alignment of indicators and parameters (i.e., use the same indicators and parameters to assess the impacts of a forest policy and to meet reporting requirements of the transparency framework) is recommended for the following:

- Estimating baseline emissions and GHG impacts: Align input parameters used to estimate baseline emissions and GHG impacts of forest policies with the input parameters used for GHG accounting of NDCs (Chapter 7 and 8).
- Projections: Align the parameters and timeframe used to develop projections for forest policies with the parameters and timeframe used to meet reporting requirements of the transparency framework (Chapter 7).
- Monitoring and tracking progress toward NDCs: Indicators and parameters used in this methodology to monitor forest policy implementation can also be used to track progress towards implementation and achievement of a NDC. Some indicators suggested in this methodology can be used to track sustainable development impacts (Chapter 11).

Process for developing the methodology

This methodology has been developed through an inclusive, multi-stakeholder process convened by the Initiative for Climate Action Transparency. The development is led by the Greenhouse Gas Management Institute (technical lead) and Verra (co-lead), who serve as the Secretariat and guide the development process. The first draft was developed by drafting teams, consisting of a subset of a broader Technical Working Group (TWG) and the Secretariat. The TWG consists of experts and stakeholders from a range of countries identified through a public call for expressions of interest. The TWG contributed to the development of the technical content for the methodology through participation in regular meetings and written comments. A Review Group provided written feedback on the first draft of the methodology.

The second draft was applied by ICAT participating countries and other non-state actors to ensure that it can be practically implemented. This version of the methodology was informed by the feedback gathered from that experience and includes case studies from those applications.

ICAT's Advisory Committee provides strategic advice to the initiative. More information about the methodology development process, including governance of the initiative and the participating countries, is available on the ICAT website[7].

All contributors are listed in the "Contributors" section.

[7] https://climateactiontransparency.org/

2. Objectives of Estimating GHG impacts

This chapter provides an overview of objectives users may have in assessing the GHG impacts of forest policies. Determining the assessment objectives is an important first step, since decisions made in later chapters should be guided by the stated objectives.

Checklist of key recommendations

- Determine the objectives of the assessment at the beginning of the impact assessment process

Assessing the GHG impacts of policies is a key step towards identifying opportunities and gaps in effective GHG mitigation strategies. Impact assessment supports evidence-based decision-making by enabling policymakers and stakeholders to understand the relationship between policies and expected or achieved GHG impacts. It is a *key recommendation* to determine the objectives of the assessment at the beginning of the impact assessment process.

Examples of objectives for assessing the GHG impacts of a policy are listed below. The ICAT *Sustainable Development Methodology* can be used to assess the broader sustainable development impacts of forest policies and users should refer to that methodology for objectives for assessing such impacts.

Objectives of assessing impacts before policy implementation

- **Inform policy selection** by comparing policy options based on their expected future impacts
- **Improve policy design and implementation** by understanding the impacts of different design and implementation choices
- **Inform goal setting** by assessing the potential contribution of policy options to national goals, such as NDCs and NAMAs
- **Report** on the multiple expected future impacts of policies, domestically and/or internationally
- **Access financing** for policies under consideration by demonstrating expected future results

Objectives of assessing impacts during or after policy implementation

- **Assess policy effectiveness** by determining whether policies are delivering the intended results
- **Improve policy implementation** by determining whether policies are being implemented as planned
- **Learn from experience** and share best practices about the impacts of policies
- **Track progress toward national goals** such as NDCs, SDGs and national REDD+ strategies/action plans and understand the contribution of policies toward achieving them
- **Inform future policy design**, including reformulation of NDCs toward enhanced ambition, and decide whether to continue current actions, enhance current actions or implement additional actions
- **Report** domestically or internationally, including under the Paris Agreement’s enhanced transparency framework, on the impacts of policies achieved to date

- **Meet funder requirements** to report on impacts of policies, if relevant

Users should also identify the intended audience of the assessment report. Possible audiences include policymakers, the general public, NGOs, companies, funders, financial institutions, analysts, research institutions, or other stakeholders affected by or who can influence the policy. For more information on identifying stakeholders, refer to the ICAT *Stakeholder Participation Guide* (Chapter 5).

Subsequent chapters provide flexibility to enable users to choose how best to assess the impacts of policies in the context of their objectives, including which impacts to include in the GHG assessment boundary and which methods and data sources to use. The appropriate level of accuracy and completeness is likely to vary by objective. Users should assess the impacts of their policies with a sufficient level of accuracy and completeness to meet the stated objectives of the assessment.

3. Overview of Forest Policies

This chapter provides an overview of the types of forest policy instruments, and mitigation practices and technologies, to which this methodology can be applied. The forestry sector together with the agriculture sector present a large opportunity for countries to meet their commitments to the Paris Agreement and to reduce GHG emissions from the atmosphere and enhance carbon stocks. This methodology is primarily designed to assess specific policy instruments and associated mitigation practices and/or technologies in the forestry sector. In this document, policies are instruments that enables or incentivize the implementation of GHG mitigation measures. Measures are the practices and/or technologies that reduce emissions.

3.1 Forest policy instruments

This methodology can be used to assess the GHG impacts of a range of policy instruments that enable or incentivize reducing or removing emissions in the forestry sector. Table 3.1 presents examples of common policy instruments to which this methodology can be applied. This list is not exhaustive, and some users may have policy instruments of other types. Further information about types of policies and actions is provided in the ICAT *Introductory Guide*.

Table 3.1 Common policy instruments applicable to the forestry sector

Type of policy Instrument	Description	Examples of policy instruments
Regulations and standards	Rules or standards that specify abatement technologies (technology standard) or increasing the minimum diameter limit of cutting thresholds, or other management activities (performance standard). They typically include legal penalties for noncompliance.	• Standards for timber management practices • Standards for implementing agroforestry or silvopastoral systems • Conservation mandate requiring landowners to reforest an area equivalent to 10% of cultivated lands into conservation reserve • Laws that promote connectivity between natural ecosystems • Moratorium on new land concessions • Moratorium on exporting forest risk commodities from deforestation risk regions (e.g., Brazil municipality black list) • New systems to effectively enforce existing or new environmental regulation (e.g., improve coordination of observation, enforcement, and prosecution agencies against illegal logging and land grabbing)
Subsidies and incentives	Direct payments, tax reductions, price supports or the equivalent thereof from a government to an entity for implementing a practice or performing a specified action.	• Payments for setting aside agricultural land • Payments for ecosystem services

Voluntary agreements or actions	Agreements, commitments or actions undertaken voluntarily by public or private sector actors, either unilaterally or jointly in a negotiated agreement. Some voluntary agreements include rewards or penalties associated with participating in the agreement or achieving the commitments.	• Zero net-deforestation commitments • Ecosystem restoration commitments (e.g., Bonn Challenge) • Agroforestry agreements with landowners • National programmes to reduce emissions in a sector (e.g., NAMA) • Low carbon development projects
Information instruments	Requirements for public disclosure of information. These include labeling programmes, emissions reporting programmes, rating and certification systems, benchmarking, and information or education campaigns aimed at changing behaviour by increasing awareness.	• Programmes requiring standardized labeling on environmental attributes of agricultural and forest products
Trading programmes	A programme that establishes a limit on aggregate emissions or pollutants from specified sources, requires sources to hold permits, allowances , or other units equal to their actual emissions or pollution, and allows permits to be traded among sources	• Nutrient trading programmes • Cap-and-trade programmes
Research, development and deployment policies	Policies aimed at supporting technological advancement, through direct government funding or investment, or facilitation of investment, in technology research, development, demonstration, and deployment activities	• Efforts to strengthen formal education of land managers, provide training and introduce new technologies or practices, provided by extension services or other programmes supported by the government to support improved practices, technology adoption, and even monitoring of activities • Training modules about sustainable production and climate change disseminated through extension agents • Regional workshops for land managers
Financing and investment	Public or private sector grants or loans (for example, those supporting low-carbon development strategies or policies)	• Low-interest rate loans for forest land managers that implement sustainable timber management practices

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3.2 Mitigation practices or technologies

This methodology can be used to assess a range of mitigation practices or technologies that reduce emissions and/or enhance removals in the forestry sector. Box 3.1 below lists common mitigation practices in the forestry sector that reduce emissions and/or enhance removals from afforestation/reforestation, sustainable forest management and reduced deforestation/degradation, and to which this methodology is applicable. These mitigation practices are enabled or incentivized by the policy instruments described above.

Box 3.1 Common mitigation practices in the forestry sector

Common mitigation practices that reduce emissions or enhance removals through afforestation/reforestation

- Planting trees/woody biomass (including agroforestry and silvopasture)
- Removing vegetation that competes with trees
- Making sites suitable for natural regeneration (e.g., protecting mother trees and seedlings)
- Removing ongoing disturbances that prevent reforestation or natural regeneration

Common mitigation practices that reduce emissions or enhance removals through sustainable forest management

- Improving forest management practices (e.g., increasing the minimum age or the minimum diameter of cutting thresholds, extending the re-entry period for selective harvesting, improving the selection of trees for harvesting, implementing a sustainable harvest modeling, or implementing stocking retention requirements)
- Enhancing productivity (e.g., supplemental planting and thinning or introducing tree species with higher growing rates)
- Improving harvest efficiency (e.g., reducing damage or felling of other trees, and reducing the size of logging roads)
- Improving mill efficiency and utilization of wood products

Common mitigation practices that reduce emissions from reduced deforestation/degradation

- Conserving forests on public or private land
- Providing alternative sources for fuelwood (e.g., woodlots for fuel or gas kerosene for cooking)
- Converting logged forests to protected forests
- Increasing sustainable agricultural intensification to reduce conversion of forest lands

4. Using the Methodology

This chapter provides an overview of the steps involved in assessing the GHG impacts of forest policies, and outlines assessment principles to help guide the assessment.

Checklist of key recommendations

- Base the assessment on the principles of relevance, completeness, consistency, transparency and accuracy

4.1 Overview of steps

This document is organized according to the steps a user follows in assessing the GHG impacts of a policy (see Figure 4.1). Depending on when the methodology is applied and the approach chosen, users can skip certain chapters. For example, if the user is assessing impacts ex-ante but not ex-post, the user can skip Chapter 9.

Figure 4.1: Overview of steps

Part I: Introduction, objectives, key concepts and overview of forest policies

Understand the purpose and applicability of the methodology (Chapter 1)
Determine the objectives of the assessment (Chapter 2)
Understand forest policies (Chapter 3)
Understand steps and assessment principles (Chapter 4)

↓

Part II: Defining the assessment

Clearly describe the policy to be assessed (Chapter 5)
Identify the GHG impacts to assess (Chapter 6)

↓

Part III: Assessing impacts

Estimate the baseline scenario and emissions (Chapter 7)
Estimate the implementation potential of the policy and quantify the emissions ex-ante (Chapter 8)
Estimate the impact of the policy ex-post (Chapter 9)

↓

Part IV: Monitoring and reporting

Monitor the performance of the policy over time (Chapter 10)
Report the results and methodology used (Chapter 11)

4.2 Planning for the assessment

Users should review this methodology and plan the steps, responsibilities and resources needed to meet their objectives for assessing GHG impacts of forest policies in advance. The time and human resources required to implement the methodology and carry out an impact assessment depend on a variety of factors, such as the complexity of the policy being assessed, the extent of data collection needed and whether relevant data has already been collected, and the desired level of accuracy and completeness needed to meet the objectives of the assessment.

4.2.1 Choosing a desired level of accuracy based on objectives

There is a range of options for assessing GHG impacts that allow users to manage trade-offs between the accuracy of the results and the resources, time, and data needed to complete the assessment, based on objectives. Some objectives require more detailed assessments that yield more accurate results (to demonstrate that a specific reduction in GHG emissions is attributed to a specific policy, with a higher level of certainty), while other objectives may be achieved with simplified assessments that yield less accurate results (to show that a policy contributes to reducing GHG impacts, but with less certainty around the magnitude of the impact).

Users should choose approaches and methods that are sufficient to accurately meet the stated objectives of the assessment and ensure that the resulting claims are appropriate. For example, whether a policy contributes to achieving GHG emission reductions or whether emission reductions can be attributed to that policy. Users should also consider the resources needed to obtain the data needed to meet the stated objectives of the assessment.

4.2.2 Approaches for assessing the GHG impacts of forest policies

This methodology provides two approaches for estimating the GHG impacts of forest policies ex-ante:

- **Emissions approach**: This compares the difference in GHG emissions and removals between the policy scenario and baseline scenario. The difference between policy and baseline scenario emissions and removals is the net change in GHG impact resulting from the policy.
- **Activity data approach**: This focuses on estimating the effect of the policy on activity data by estimating the expected increase or decrease in the area of land in a land category or in the adoption of a mitigation practice that is triggered by the policy. The emissions associated with the increase or decrease in activity data are estimated to give the expected net change in GHG impact resulting from the policy.

Emissions approach

In this method, users determine the most likely baseline scenario for land use, land-use change and/or timber management practices, and estimate baseline emissions and removals (Chapter 7). Users then develop the most likely policy scenario by determining the likely implementation potential of the policy (Sections 8.2 – 8.5). Policy scenario emissions and removals are quantified by using the same method that was used to estimate the baseline emissions and removals with parameter values that are adjusted for the policy scenario. The net change in GHG emissions and removals is the difference between policy and baseline emissions and removals.

Activity data approach

In this approach, users estimate the maximum implementation potential of the policy (following the methodology in Chapter 8) based on the causal chain that is developed in Chapter 6. The maximum implementation potential is estimated in terms of activity data. The activity data used for this approach is a parameter that is expected to change in value as a result of the policy. This approach is best for policies that target changes in activity data (e.g., hectares of forest land remaining forest land)

Users then evaluate how barriers to implementation and other factors may limit the policy's overall effectiveness, and determine its likely implementation potential. The likely implementation potential represents the effects that are expected to occur as a result of the policy (most likely policy scenario). The implementation potential is the area of land in a land category that will be impacted by the policy (e.g., the hectares of degraded land that are planted with trees) or the expected adoption of a mitigation practice (e.g., the percentage of timber land managers increasing the diameter cutting threshold). Implicitly, these effects are relative to the baseline scenario.

The GHG emissions and removals are estimated based on the increase or decrease in activity data (Section 8.6) with emission factors that are updated to represent the policy scenario. Estimating baseline emissions is optional when using this approach and the GHG impacts of the policy can be calculated directly, without explicitly determining separate baseline and policy scenarios. In such cases, users can skip Chapter 7.

Table 4.1: Advantages and disadvantages of different approaches

Approach	Advantages	Disadvantages
Emissions approach	• Enables more robust and accurate understanding of the GHG impacts of forestry policies • Meets wider set of objectives (related to understanding policy impact) • Meets widest set of stakeholder needs	• Increased time, cost, data and capacity needs, depending on approach taken (simpler to more complex)
Activity data approach	• Gives an understanding of expected GHG impacts • Easier, simpler, requires less time, resources and capacity	• Provides a more informative estimate of the GHG impacts of the policy, which limits the range of objectives the assessment can meet • Risk of over-simplification or limited understanding of relevant impact drivers

Box 4.1: Choosing an approach based on objectives

If the user's objective is to understand the impact of a policy and use that information to meet a variety of objectives—such as informing policy design, improving policy implementation, evaluating policy effectiveness, reporting on policy impacts, and attracting finance based on policy impacts—users should assess impacts using a more robust approach for assessing impacts and obtaining and estimating data.

The approach to follow should be guided by the user's objectives, capacity and resources. Some objectives may be achieved with an activity data approach, such as getting an understanding of a wide variety of impacts in a short amount of time to guide decision-making. Other objectives may require a more rigorous emissions approach, such as attracting public or private financing to implement an intervention and achieve specific results. The emissions approach to assessing GHG impacts better supports several objectives, but generally requires more time and resources, while the activity data approach is less resource-intensive, but may not fully meet all objectives a user has. In general, users should quantify significant impacts of the policy where feasible.

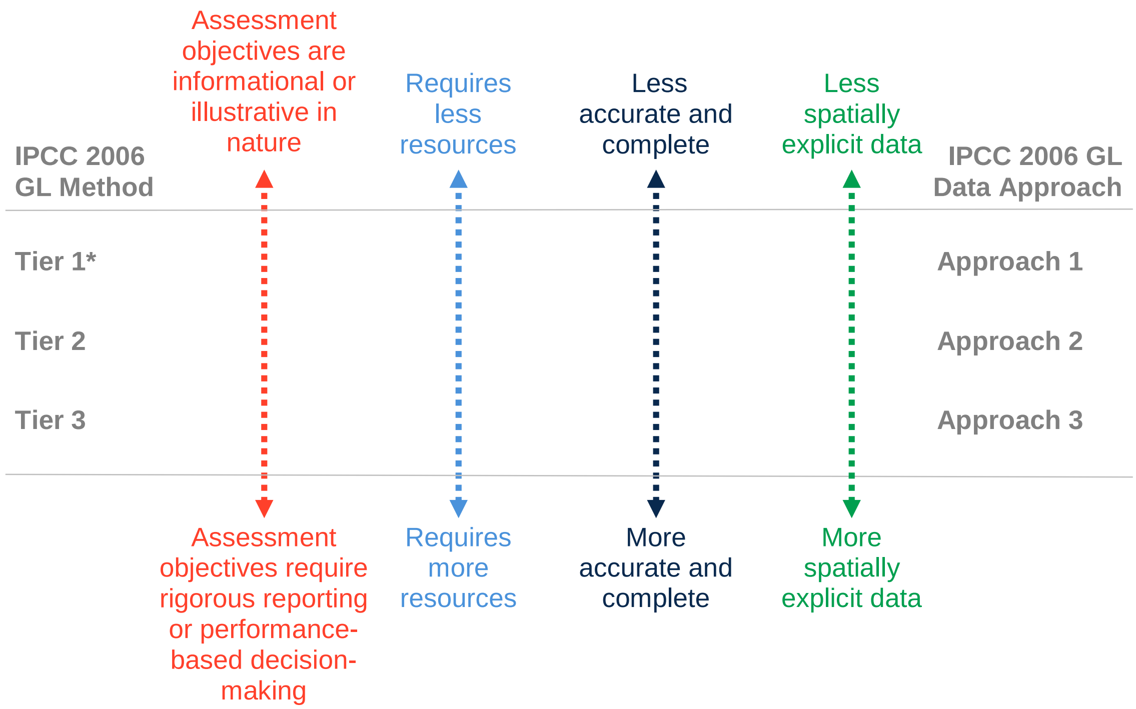
4.2.3 Methods for obtaining or estimating data

This methodology provides simplified (Tier 1) methods for estimating spatial data and carbon stock change (e.g., emission factors). This methodology does not provide more robust measurement, modeling or estimation methods (e.g., higher Tier 3 methods). The use of tiers and approaches is consistent with IPCC 2006 GL. It is helpful to become familiar with basic IPCC 2006 GL best practices and tables available therein[8].

Users may determine their method of assessment based on both their assessment objectives and their capacity, resources and time available to carry out the assessment. For planning purposes, it is helpful for the user to identify the desired estimation method prior to beginning an impact assessment. Users may rely on a combination of methods within a policy estimation. For example, if a policy impacts multiple carbon pools, each carbon pool estimate could utilize a different methodological tier. Similarly, data availability may vary across policy locations requiring the use of varying approaches. If using a combination of methods and approaches, users should heed the consistency and comparability assessment principles described in the next section.

[8] For reference on Tiers see IPCC 2006 GL, Chapter.1, Section 1.3.2, Box 1.1, and Figures 1.2 and 1.3. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_01_Ch1_Introduction.pdf. For reference on Approaches see IPCC 2006 GL, Chapter.3, Section 3.3.1 and Figure 3.1. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf.

Figure 4.2: Range of methods and approaches for estimating GHG emission based on data availability



** Note: It is not appropriate to use a Tier 1 method for a stock-difference calculation.*

4.2.4 Expert judgment

It is likely that expert judgment and assumptions will be needed in order to complete an assessment where information is not available or requires interpretation. Expert judgment is defined by the IPCC as a carefully considered, well-documented qualitative or quantitative judgment made in the absence of unequivocal observational evidence by a person or persons who have a demonstrable expertise in the given field.[9] The goal is to be as representative as possible in order to reduce bias and increase accuracy. The user can apply their own expert judgment or consult experts.

When relying on expert judgment, information can be obtained through methods that help to avoid bias known as “expert elicitation.” The IPCC 2006 GL provides a procedure for expert elicitation, including a process for helping experts understand the elicitation process, avoiding biases, and producing independent and reliable judgments.

Expert judgment can be associated with a high level of uncertainty. As such, experts can be consulted to provide a range of possible values and the related uncertainty range, or they can be consulted to help select suitable values from a range of values. Expert judgment can be informed or supported through broader consultations with stakeholders. It is important to document the reason that no data sources are available and the rationale for the value chosen.

[9] IPCC 2000.

4.2.5 Planning stakeholder participation

Stakeholder participation is recommended in many steps throughout the methodology. It can strengthen the impact assessment and the contribution of policies to GHG mitigation goals in many ways, including by:

- Establishing a mechanism through which people who may be affected by or can influence a policy have an opportunity to raise issues and have these issues considered before, during and after policy implementation
- Raising awareness and enabling better understanding of complex issues for all parties involved, building their capacity to contribute effectively
- Building trust, collaboration, shared ownership and support for policies among stakeholder groups, leading to less conflict and easier implementation
- Addressing stakeholder perceptions of risks and impacts and helping to develop measures to reduce negative impacts and enhance benefits for all stakeholder groups, including the most vulnerable
- Enhancing the credibility, accuracy and comprehensiveness of the assessment, drawing on diverse expert, local and traditional knowledge and practices
- Enhancing transparency, accountability, legitimacy and respect for stakeholders' rights
- Enabling enhanced ambition and financing by strengthening the effectiveness of policies and credibility of reporting

Various sections throughout this methodology explain where stakeholder participation is recommended—for example, in identifying the impacts of the policy (Chapter 6), estimating the baseline scenario and emissions (Chapter 7), estimating GHG impacts ex-ante (Chapter 8) and monitoring performance over time (Chapter 10).

Before beginning the assessment process, consider how stakeholder participation can support identified objectives and include relevant activities and associated resources in assessment plans. It may be helpful to combine stakeholder participation for GHG impacts assessment with other participatory processes involving similar stakeholders for the same or related policies, such as those being conducted for assessment of sustainable development and transformational impacts and for technical review.

It is important to ensure conformity with national legal requirements and norms for stakeholder participation in public policies, as well as the requirements of specific donors and of international treaties, conventions and other instruments to which the country is party. These are likely to include requirements for disclosure, impact assessments and consultations, and may include specific requirements for certain stakeholder groups (e.g., UN Declaration of the Rights of Indigenous Peoples, International Labour Organisation Convention 169) or specific types of policies (e.g., UNFCCC guidance on safeguards for activities reducing emissions from deforestation and degradation in developing countries).

During the planning phase, identify stakeholder groups that may be affected by or may influence the policy. Appropriate approaches should be identified to engage with the identified stakeholder groups, including through their legitimate representatives. To facilitate effective stakeholder participation, consider establishing a multi-stakeholder working group or advisory body consisting of stakeholders and experts with relevant and diverse knowledge and experience. Such a group may advise and potentially contribute to decision-making to ensure that stakeholder interests are reflected in design, implementation and assessment of policies, including on stakeholder participation in the assessment of GHG impacts of a particular policy. It is also important to ensure that stakeholders have access to a grievance redress mechanism to secure adequate protection of stakeholders' rights related to the impacts of the policy.

Refer to the ICAT *Stakeholder Participation Guide* for more information, such as how to plan effective stakeholder participation (Chapter 4), identify and analyze different stakeholder groups (Chapter 5), establish multi-stakeholder bodies (Chapter 6), provide information (Chapter 7), design and conduct consultations (Chapter 8) and establish grievance redress mechanisms (Chapter 9). Appendix A summarizes the steps in this methodology where stakeholder participation is recommended along with specific references to relevant guidance in the ICAT *Stakeholder Participation Guide*.

4.2.6 Planning technical review (if relevant)

Before beginning the assessment process, consider whether technical review of the assessment report will be pursued. The technical review process emphasises learning and continual improvement and can help identify areas for improving future impact assessments. Technical review can also provide confidence that the impacts of policies have been estimated and reported according to ICAT key recommendations. Refer to the ICAT *Technical Review Guide* for more information on the technical review process.

4.3 Assessment principles

Assessment principles are intended to underpin and guide the impact assessment process, especially where the methodology provides flexibility. It is *a key recommendation* to base the assessment on the principles of relevance, completeness, consistency, transparency and accuracy, as follows:[10]

- **Relevance**: Ensure the assessment appropriately reflects the GHG impacts of the policy and serves the decision-making needs of users and stakeholders, both internal and external to the reporting entity. Applying the principle of relevance depends on the objectives of the assessment, broader policy objectives, national circumstances and stakeholder priorities.
- **Completeness**: Include all significant impacts in the GHG assessment boundary, including both positive and negative impacts. Disclose and justify any specific exclusions.
- **Consistency**: Use consistent assessment approaches, data collection methods and calculation methods to allow for meaningful performance tracking over time. Document any changes to the data sources, GHG assessment boundary, methods, or any other relevant factors in the time series.
- **Transparency**: Provide clear and complete information for stakeholders to assess the credibility and reliability of the results. Disclose and document all relevant methods, data sources, calculations, assumptions and uncertainties. Disclose the processes, procedures and limitations of the assessment in a clear, factual, neutral, and understandable manner with clear documentation. The information should be sufficient to enable a party external to the assessment

[10] Adapted from WRI 2014

process to derive the same results if provided with the same source data. Chapter 11 provides a list of recommended information to report to ensure transparency.

- **Accuracy**: Ensure that the estimated impacts are systematically neither over nor under actual values, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users and stakeholders to make appropriate and informed decisions with reasonable confidence as to the integrity of the reported information. If accurate data for a given impact category is not currently available, users should strive to improve accuracy over time as better data becomes available. Accuracy should be pursued as far as possible, but once uncertainty can no longer be practically reduced, conservative estimates should be used. Box 4.2 provides guidance on conservativeness.

In addition to the principles above, users should follow the principle of comparability if it is relevant to the assessment objectives, for example if the objective is to compare multiple policies based on their GHG impacts or to aggregate the results of multiple impact assessments and compare the collective impacts to national goals (described further in Box 4.3).

- **Comparability**: Ensure common methods, data sources, assumptions and reporting formats such that the estimated impacts of multiple policies can be compared.

Box 4.2: Conservativeness

Conservative values and assumptions are those more likely to overestimate negative impacts or underestimate positive impacts resulting from a policy. Users should consider conservativeness in addition to accuracy when uncertainty can no longer be practically reduced, when a range of possible values or probabilities exists (for example, when developing baseline scenarios), or when uncertainty is high.

Whether to use conservative estimates and how conservative to be depends on the objectives and the intended use of the results. For some objectives, accuracy should be prioritized over conservativeness in order to obtain unbiased results. The principle of relevance can help guide what approach to use and how conservative to be.

Box 4.3: Applying the principle of comparability when comparing or aggregating results

Users may want to compare the estimated impacts of multiple policies, for example to determine which has the greatest positive impacts. Valid comparisons require that assessments have followed a consistent methodology, for example regarding the assessment period, the types of impact categories, impacts, and indicators included in the GHG assessment boundary, baseline assumptions, calculation methods, and data sources. Users should exercise caution when comparing the results of multiple assessments, since differences in reported impacts may be a result of differences in methodology rather than real-world differences. To understand whether comparisons are valid, all methods, assumptions and data sources used should be transparently reported. Comparability can be more easily achieved if a single person or organization assesses and compares multiple policies using the same methodology.

Users may also want to aggregate the impacts of multiple policies, for example to compare the collective impact of multiple policies in relation to a national goal. Users should likewise exercise caution when aggregating the results if different methods have been used and if there are potential overlaps or interactions between the policies being aggregated. In such a case, the sum would either over or underestimate the impacts resulting from the combination of policies. For example, the combined impact of a local energy efficiency policy and a national energy efficiency policy in the same country is likely less than the sum of the impacts had they been implemented separately, since they affect the same activities. Chapter 4 provides more information on policy interactions.

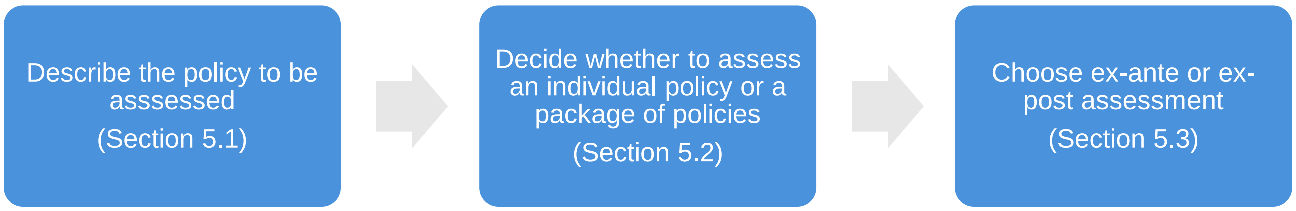
In practice, users may encounter trade-offs between principles when developing an assessment. For example, a user may find that achieving the most complete assessment requires using less accurate data for a portion of the assessment, which could compromise overall accuracy. Users should balance trade-offs between principles depending on their objectives. Over time, as the accuracy and completeness of data increases, the trade-off between these principles will likely diminish.

Part II: Defining the Assessment

5. Describing the Policy

This chapter provides guidance on describing the policy. In order to assess the GHG impacts of a policy, users need to describe the policy that will be assessed, decide whether to assess an individual policy or a package of related policies, and choose whether to carry out an ex-ante and/or ex-post assessment.

Figure 5.1: Overview of steps in the chapter



Checklist of key recommendations

- Clearly describe the policy (or package of policies) that is being assessed

5.1 Describe the policy to be assessed

In order to effectively carry out an impact assessment in subsequent chapters, it is necessary to have a detailed understanding and description of the policy being assessed. It is a *key recommendation* to clearly describe the policy (or package of policies) that is being assessed. Table 5.1 provides a checklist of recommended information that should be included in a description to enable an effective assessment. Table 5.2: Checklist of additional information that may be relevant to describe the policy being assessed outlines additional information that may be relevant depending on the context.

If assessing a package of policies, these tables can be used to document either the package as a whole or each policy in the package separately. The first two steps in this chapter (Sections 5.1 and 5.2) can be done together or iteratively.

Users that are assessing the sustainable development and/or transformational impacts of the policy (using the ICAT *Sustainable Development Methodology* and/or *Transformational Change Methodology*) should describe the policy in the same way to ensure a consistent and integrated assessment.

Table 5.1: Checklist of recommended information to describe the policy being assessed

Information	Description	Example
Title of the policy	Policy name	Payment for Ecosystem Services (PES) system and tax for ecosystem service users
Type of policy	The type of policy, such as those presented in Table 3.1, or other categories of policies that may be more relevant	Subsidies and incentives Taxes and charges

Description of specific interventions	The specific mitigation practice and/or technology carried out as part of the policy or action, such as those presented in Box 3.1.	Reducing emissions and enhancing removals, through (a) sustainable forest management, and/or (b) afforestation/reforestation. (a) SFM strategies: increasing the minimum age of tree diameter of cutting thresholds, extending the re-entry period for selective harvesting, and improving the selection of trees for harvesting (b) A/R strategies: planting trees/woody biomass, planting endangered tree species, removing vegetation that competes with trees, removing ongoing disturbances that are preventing natural regeneration Under the new PES system, the Ministry of Environment will engage stakeholders in voluntary contracts to provide ecosystem services on a total of 60% of private forest lands and 25% of low productivity cropland over 10 years. The policy specifically intends to implement sustainable forest management on private forest land and afforestation/reforestation activities on cropland. Voluntary contracts aim to promote these types of practices: sustainable harvest regimes, general tree planting, tree planting with endangered species, and natural regeneration, with land owner payments for each practice of USD 500 per hectare, USD 1,000 per hectare, USD 1,500 per hectare, and USD 500 per hectare, respectively. A new tax system will be enacted to fund the ecosystem service payments. Under the new tax system, a national legislative body will enact a new tax for all users of ecosystem services (primarily for water and hydroelectric utilities, but other sectors may be included such as tourism companies). The national taxing agency will collect the tax, which will fund the new PES programme (estimated to be about 1-2% annual revenue) to provide programme incentives, as well as administrative and operational expenses.
Status of the policy	Whether the policy is planned, adopted or implemented	The national government is evaluating whether to implement this policy.
Date of implementation	The date the policy comes into effect (not the date that any supporting legislation is enacted)	Expected 2021
Date of completion (if relevant)	If relevant, the date the policy ceases, such as the date a tax is no longer levied or the end date of an incentive scheme with a limited duration (not the date that the policy no longer has an impact)	Expected 2030
Implementing entity or entities	The entity or entities that implement(s) the policy, including the role of various	National Legislative Body and Ministry of Environment

	local, subnational, national, international or any other entities	
Objectives and intended impacts or benefits of the policy	The impact(s) or benefit(s) the policy intends to achieve (for example, the purpose stated in the legislation or regulation)	The goals for PES programme are to: 1) expand SFM activities, and 2) promote A/R through tree planting or natural regeneration. Specifically to: • Increase forest carbon stocks on private forest land • Increase forest carbon stocks on low productivity crop land • Decrease soil erosion • Increase economic output for ecosystem services, including water retention/runoff and biodiversity • Reduce degradation pressure on private forest lands • Accelerate adoption of improved sustainable forest management on a widespread basis by demonstrating ecosystem service benefits of improving forest carbon stocks
Level of the policy	The level of implementation, such as national level, subnational level, city level, sector level or project level	National
Geographic coverage	The jurisdiction or geographic area where the policy is implemented or enforced, which may be more limited than all the jurisdictions where the policy has an impact	Based on data from the latest national forest census, the total area of privately owned forest land in the country is 250,000 hectares; 60% of this area is 150,000 hectares. From national agriculture statistics it is known that the total area of low productivity cropland is 240,000 hectares; 25% of that is 60,000 hectares.
Sectors targeted	Which sectors or subsectors are targeted	Forest and agriculture - Interventions will target private forest and cropland owners.
Greenhouse gases targeted	Which GHG the policy aims to control, which may be more limited than the set of GHG that the policy affects	Increase CO_2 sequestration in forests
Other related policies or actions	Other policies or actions that may interact with the policy being assessed	The regional Non-Industrial Private Forest programme, funded by a non-profit organization, aims to encourage sustainable harvest practices through capacity building in a region containing 10,000 hectares of private forest land. The Forest Protection Act (FPA) of 2010 improves enforcement of laws preventing illegal logging. Monitoring and evaluation of FPA indicates it has reduced illegal logging by approximately 5%. The FPA has the potential to discourage forest degradation on private forest land.

Table 5.2: Checklist of additional information that may be relevant to describe the policy being assessed

Information	Description	Example
Intended level of mitigation to be achieved and/or target level of other indicators	If relevant and available, the total emissions and removals from the sources and sinks targeted; the target amount of emissions to be reduced or removals to be enhanced as a result of the policy, both annually and cumulatively over the life of the policy (or by stated date); and/or the target level of key indicators (such as hectares of land to conserve)	The goal of the policy is that 150,000 more hectares of forest land be brought into sustainable forest management and 60,000 more hectares of cropland be converted to forest land as a result of the policy: • SFM: 150,000 ha • Tree Planting: 15,000 ha • Natural Regeneration: 40,000 ha • Tree Planting with Endangered Species: 5,000 ha
Title of establishing legislation, regulations, or other founding documents	The name(s) of legislation or regulations authorizing or establishing the policy (or other founding documents if there is no legislative basis)	Pending legislation Ministry of Environment Draft PES contract template
Monitoring, reporting and verification procedures	References to any monitoring, reporting, and verification procedures associated with implementing the policy	Annual forest land and crop land visits conducted by forest and extension specialists to all land owners receiving payment. Specialists to verify implementation of practices according to annual reports submitted by participants. See "enforcement mechanisms" for more information on reporting.
Enforcement mechanisms	Any enforcement or compliance procedures, such as penalties for noncompliance or requirements for reporting	Participation in the programme is voluntary. However, to receive payments, landowners must submit a year-1 and year-10 forest inventory report. Likewise, owners must also submit annual harvesting records. Reports are submitted to the Ministry of Environment and can be filled out and submitted with assistance from extension specialists.
Reference to relevant documents	Information to allow practitioners and other interested parties to access any guidance documents related to the policy (for example, through websites)	Ministry of Environment private land owner forest inventory report template.
The broader context or significance of the policy	Broader context for understanding the policy	The policy is part of the package of actions that is being considered for the purpose of fulfilling the aspirational goal (as described in the NDC submitted to the UNFCCC) to reduce the growth of total national GHG emissions in 2035 from 35% to 17.5% above the 2010 levels. It is anticipated that the policy will account for a minimum of 20% of the total GHG reductions required in order to achieve the NDC goal.
Outline of sustainable development impacts of the policy	Any anticipated sustainable development benefits other than GHG mitigation	Land-use change, water quality, endangered species and biodiversity improvement

Key stakeholders	Key stakeholder groups affected by the policy	Private forest land owners, farmers, users of ecosystem services (primarily water and hydroelectric utilities)
Other relevant information	Any other relevant information (e.g., costs, non-GHG mitigation benefits)	If this policy is successful, there may be a decrease in supply of agricultural products from a decrease in available cropland. A decrease in cropland or a decrease in harvest timber may result in forest degradation on non-participating lands.

5.2 Decide whether to assess an individual policy or a package of policies

If multiple policies are being developed or implemented in the same timeframe, users can assess the policies either individually or together as a package. When making this decision, consider the assessment objectives, the feasibility of assessing impacts individually or as a package, and the degree of interaction between the policies.

In subsequent chapters, users follow the same general steps, whether they choose to assess an individual policy or a package of related policies. Depending on the choice, the impacts estimated in later chapters will either apply to the individual policy assessed or to the package of policies assessed.

5.2.1 Types of policy interactions

Policies can either be independent of each other or they can interact with each other. Policies interact if their total impact, when implemented together, differs from the sum of their individual impacts had they been implemented separately. Policies interact if they affect the same GHG source or carbon pool. For example, national and subnational policies in the same sector are likely to interact since they likely affect the same GHG sources and carbon pools. Two policies implemented at the same level may also interact. Policies do not interact if they do not affect the same GHG sources and carbon pools, either directly or indirectly.

Policies can be independent, overlapping, reinforcing, or both overlapping and reinforcing. Table 5.3 and Figure 5.2 provide an overview of four possible relationships between policies, and further information is available in the *Policy and Action Standard*.

Table 5.3: Types of relationships between policies

Type	Description
Independent	Multiple policies do not interact with each other. The combined effect of implementing the policies together is equal to the sum of the individual effects of implementing them separately.
Overlapping	Multiple policies interact, and the combined effect of implementing the policies together is less than the sum of the individual effects of implementing them separately. This includes policies that have the same or complementary goals (such as national and subnational energy efficiency standards), as well as counteracting policies that have different or opposing goals (such increasing food production and reducing emissions from agriculture).

Reinforcing	Multiple policies interact, and the combined effect of implementing the policies together is greater than the sum of the individual effects of implementing them separately.
Overlapping and reinforcing	Multiple policies interact, and have both overlapping and reinforcing interactions. The combined effect of implementing the policies together may be greater than or less than the sum of the individual effects of implementing them separately.

Source: WRI 2014.

Figure 5.2: Types of relationships between policies

Source: Adapted WRI 2014.

5.2.2 Determining whether to assess an individual policy or package of policies

To assess the extent of policy interactions when deciding whether to assess an individual policy or a package of policies, follow these steps:

- Step 1: Characterize the type and degree of interaction between the policies under consideration
- Step 2: Apply criteria to determine whether to assess an individual policy or a package of policies

Step 1: Characterize the type and degree of interaction between the policies under consideration

Potentially interacting policies can be identified by identifying activities targeted by the policy, then identifying other policies that target the same activities. Once these are identified, assess the relationship between the policies (independent, overlapping or reinforcing) and the degree of interaction (minor, moderate or major). The assessment of interaction can be based on expert judgment, published studies of similar combinations of policies, or consultations with relevant experts. The assessment should be limited to a preliminary qualitative assessment at this stage.

Step 2: Apply criteria to determine whether to assess an individual policy or a package of policies

Where policy interactions exist, there can be advantages and disadvantages to assessing the interacting policies individually or as a package (see Table 5.4). To help decide, apply the criteria in Table 5.5: Criteria for determining whether to assess policies individual or as a package. In some cases, certain criteria may suggest assessing an individual policy, while other criteria suggest assessing a package. Users should exercise judgment based on the specific circumstances of the assessment. For example, related policies may have significant interactions (suggesting a package), but it may not be feasible to model the whole package (suggesting an individual assessment). In this case, a user can undertake an assessment of an individual policy (since a package is not feasible), but acknowledge in a disclaimer that any subsequent aggregation of the results from individual assessments would be inaccurate given the interactions between the policies.

Users can also conduct assessments for both individual policies and packages of policies. Doing so will yield more information than conducting only one option or the other. Undertaking both individual assessments and assessments for combinations of policies should be considered where the end-user requires information on both, resources are available to undertake multiple analyzes and undertaking both is feasible.

Where users choose to assess both an individual policy and a package of policies that includes the individual policy assessed, define each assessment separately and treat each as a discrete application of this methodology in order to avoid confusion of the results.

Table 5.4: Advantages and disadvantages of assessing policies individual or as a package

Approach	Advantages	Disadvantages
Assessing policies individually	Shows the effectiveness of individual policies, which decision makers may require to make decisions about which individual policies to support May be simpler than assessing a package in some cases, since the causal chain and range of impacts for a package may be significantly more complex	The estimated impacts from assessments of individual policies cannot be straightforwardly summed to determine total impacts, if interactions are not accounted for
Assessing policies as a package	Captures the interactions between policies in the package and better reflects the total impacts of the package May be simpler than undertaking individual assessments in some cases, since it avoids the need to disaggregate the effects of individual policies	Does not show the effectiveness of individual policies May be difficult to quantify

Source: Adapted from WRI 2014.

Table 5.5: Criteria for determining whether to assess policies individual or as a package

Criteria	Questions	Recommendation
Objectives and use of results	Do the end users of the assessment results want to know the impact of individual policies, for example, to inform choices on which individual policies to implement or continue supporting?	If "Yes" then undertake an individual assessment
Significant interactions	Are there significant (major or moderate) interactions between the identified policies, either overlapping or reinforcing, that will be difficult to estimate if policies are assessed individually? For example, policies that target other sectors can co-exist and reinforce forest policies that focus on reducing drivers of deforestation and/or degradation. These include policies that: • Promote agricultural intensification • Support the use of alternative fuels • Reform transportation networks	If "Yes" then consider assessing a package of policies
Feasibility	Is it possible (e.g., is data available) to assess a package of policies?	If "No" then undertake an individual assessment
	For ex-post assessments, is it possible to disaggregate the observed impacts of interacting policies?	If "No" then consider assessing a package of policies

Source: Adapted from WRI 2014.

5.3 Choose ex-ante or ex-post assessment

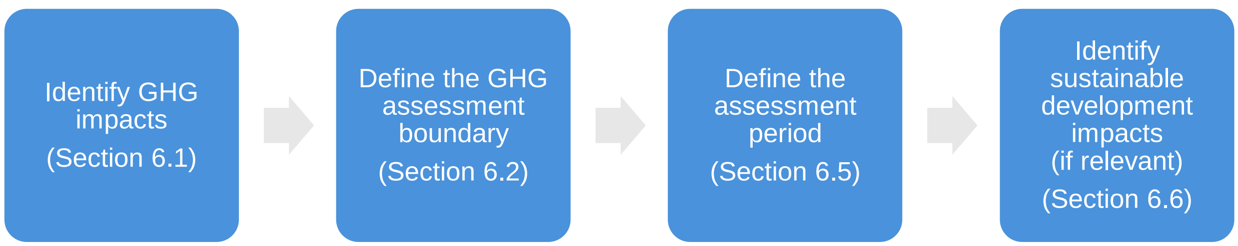
Choose whether to carry out an ex-ante assessment, an ex-post assessment, or a combined ex-ante and ex-post assessment. Choosing between ex-ante or ex-post assessment depends on the status of the policy. Where the policy is planned or adopted, but not yet implemented, the assessment will be ex-ante by definition. Alternatively, where the policy has been implemented, the assessment can be ex-ante, ex-post, or a combination of ex-ante and ex-post. The assessment is an ex-post assessment if the objective is to estimate the impacts of the policy to date; an ex-ante assessment if the objective is to estimate the expected impacts in the future; or a combined ex-ante and ex-post assessment to estimate both the past and future impacts. An ex-ante assessment can include historical data if the policy is already implemented, but it is still an ex-ante (rather than an ex-post) assessment if the objective is to estimate future effects of the policy.

6. Identifying Impacts: How Forest Policies Reduce Emissions or Enhance Removals

To estimate the GHG impacts of a policy, it is important to understand how the policy is intended to be implemented and how it will achieve the desired GHG mitigation outcome. A causal chain is a conceptual diagram representing the sequence of changes that are expected to occur as a result of the policy. Implicitly, these changes are relative to a baseline scenario.

This chapter provides a method to develop a causal chain by considering how the policy will be implemented, who will be affected by the policy, what the potential intermediate effects of the policy will be, and how these effects cause GHG impacts. The intermediate effects are mapped in a causal chain to illustrate the logical model for how the policy leads to the intended GHG impacts. The causal chain serves as the basis for defining the GHG assessment boundary. A method is also provided for defining the assessment period.

Figure 6.1: Overview of steps in the chapter



Checklist of key recommendations

- Identify all stakeholders affected by or with influence on the policy
- Identify the inputs and activities that go into implementing the policy
- Identify all intermediate effects of the policy
- Identify all potential GHG impacts of the policy
- Develop a causal chain
- Include all significant GHG impacts in the GHG assessment boundary
- Define the assessment period

6.1 Identify GHG impacts

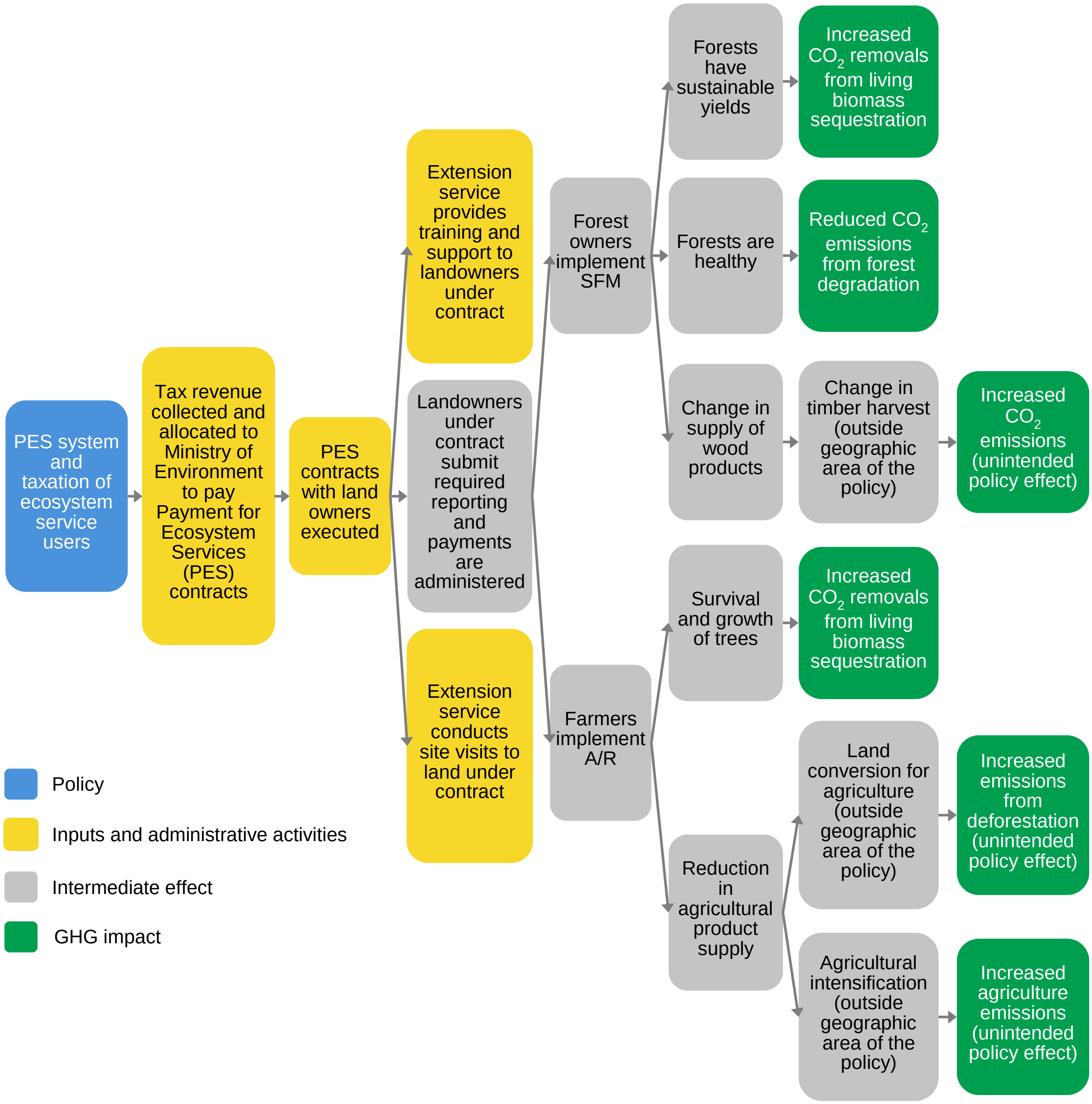
In order to identify the GHG impacts of the policy, it is useful to first identify the stakeholders affected by or with influence on the policy, and the inputs and activities associated with implementing the policy. Inputs are resources that go into implementing the policy, while activities are administrative activities involved in implementing the policy. These inputs and activities lead to intermediate effects, which are changes in behaviour, technology, processes or practices that result from the policy. These intermediate effects then lead to the policy's GHG impacts.

A causal chain approach is used to understand how the policy and its corresponding inputs and activities cause intermediate effects and ultimately result in GHG impacts. A causal chain is a conceptual diagram tracing the process by which the policy leads to GHG impacts through a series of interlinked logical and sequential stages of cause-and-effect relationships. It allows users to visually understand how policies lead to changes in emissions. An example causal chain is provided below in Figure 2.2.

The sections below provide a method for identifying intermediate effects (through identifying stakeholders, and inputs and activities), identifying potential GHG impacts and developing a causal chain. This causal chain then provides the basis for defining the GHG assessment boundary (Section 6.2).

The causal chain is also used to estimate the GHG impacts of the policy ex-ante following the method in Chapter 8. Monitoring the intermediate effects can allow users to evaluate the performance of the policy and to attribute GHG impacts to policy implementation.

Figure 2.2: *Examples of a causal chain*



6.1.1 Identify intermediate effects

In order to identify intermediate effects, first identify the stakeholders of the policy, then the inputs and administrative activities associated with implementing the policy. Following this, identify and describe the intermediate effects of the policy. These three steps are described below.

Step 1: Identify stakeholders

It is a *key recommendation* to identify all of the stakeholders affected by or with influence on the policy. Stakeholders can be people, organizations, communities or individuals. Stakeholders include different agencies and levels of government, as well as civil society and private sector organizations. Stakeholders may be affected by the policy or may influence the policy. Some typical stakeholders for the forestry sector include:

- Communities, indigenous peoples, or marginalised groups that are involved in or affected by forest resources
- Producer associations
- NGOs or civil society organizations
- Farmers and ranchers
- Education and research institutions
- Suppliers of equipment and inputs
- Commercial forest companies
- Other companies
- Informal forest businesses
- National and subnational government agencies
- Government entities responsible for forest and/or agriculture and livestock management
- Financial institutions
- Consumers

Identifying stakeholders is necessary for estimating the likely implementation potential of the policy in Chapter 8, where barriers to implementation and economic implications of a policy from the perspective of stakeholders are evaluated.

It is helpful to use a participatory process to identify a full range of stakeholders and to understand how they may be affected by or influence the policy. The ICAT *Stakeholder Participation Guide* provides information on how to identify stakeholders (Chapter 5), including marginalised people or groups. Users may also identify affected stakeholder from existing stakeholder mapping exercises.

Step 2: Identify inputs and administrative activities

It is a *key recommendation* to identify the inputs and administrative activities that go into implementing the policy. Table 6.1 provides definitions and examples of inputs and administrative activities.

Where feasible, when describing inputs specify the amount of money that goes into implementing the policy and is paid out as part of the administrative activities. Identifying inputs and administrative activities is necessary for conducting the economic feasibility of the policy in Chapter 8.

Table 6.1: Summary of inputs and activities

	Definition	Examples
Inputs	Resources that go into implementing a policy	• Money allocated to training and education programmes • Money allocated to research programmes • A new programme authorized out of the national budget • Private financing secured to co-fund a government programme
Administrative activities	Administrative activities involved in implementing the policy (undertaken by the authority or entity that implements the policy)	• A government agency offers payments for tree planting • A government agency establishes tree nurseries • A government agency pays communities to develop grazing management plans and offers payment for fences for implementation of those grazing management plans. • Grants offered to extend training in new cultivation methods • Additional staff hired to work with farmers on technology transfer • Prohibitions placed on tree cutting for a given size class • Enforcement of forestry standards improved • A government agency eases credit access for technology adoption by farmers and ranchers

Step 3: Identify and describe intermediate effects

It is a *key recommendation* to identify all intermediate effects of the policy. Intermediate effects can be characterised as how stakeholders are expected to respond to the inputs or administrative activities or to other intermediate effects of the policy. Intermediate effects can also include the measures that are enabled or incentivized by the policy. The following are examples for how stakeholders may respond to inputs, administrative activities or other effects:

- Comply with regulations
- Access subsidies or incentives
- Sign up or commit to programmes
- Purchase new equipment in order to comply with a policy
- Plant trees with payments received
- Sign up for training and increase knowledge level regarding technologies or practices
- Change forest management strategies (e.g., increase rotation age or increase harvest efficiency by reducing damage to unfelled trees)

Intermediate effects can also be characterised as land-based or market-based:

- **Land-based effects** occur when a land use shifts from one land category to another. For example, when agriculture expands into forest land.
- **Market-based effects** occur when the policy reduces the production of a commodity causing a change in the supply and market demand equilibrium that results in a shift of production elsewhere to make up for the supply. For example, when the timber production decreases due to a restriction on the minimum age of trees on public lands, timber production may increase on private lands to compensate for the loss of supply.

Intermediate effects can be characterised as intended or unintended. Unintended intermediate effects occur as a result of compensating actions (i.e., rebound effects). Unintended effects can impact other sectors and members of society not targeted by the policy. In particular, forest policies can have unintended effects on the agriculture sector. Users should consider both intended and unintended intermediate effects.

When identifying intermediate effects, it may help to consider this general framing question: If the effect X happens, what do we expect the reactionary effect to be? For completeness, confirm that all types of mitigation practices, technology or land-use changes enabled or incentivized by the policy are included as activities or intermediate effects.

Consultations with all identified stakeholder groups can help to identify a full range of intermediate effects, and can help to identify and address possible unintended or negative impacts early on. Refer to ICAT *Stakeholder Participation Guide* (Chapter 8) for information on designing and conducting consultations.

Users should describe each intermediate effect according to the following characteristics:

- Affected land category
- Affected activities
- Direction and amount of effect
- Geographic location of effect
- Timing of effect

It is useful to create a table of effects to describe these characteristics. Example tables (Table 6.2 and Table 6.3) for describing intermediate effects are provided at the end of this section.

Affected land category

Intermediate effects can be a change in how land is used or how it is managed. When this occurs, describe the affected land area by its size and using the land categories found in the IPCC 2006 GL, Volume 4, Chapter 2.[11] Using the IPCC land categories will help with the estimation of GHG emissions in Chapters 7 and 8. Use the following IPCC land categories to describe land upon which the intermediate effect occurs:

[11] Land categories are set out in the IPCC 2006 GL, Volume 4, Chapter 2. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html.

- Forest land
- Cropland
- Grassland
- Wetlands
- Settlements
- Other land

When intermediate effects are a change in how land is used, described the change in terms of a land category being converted from one type to another, for example:

- Land converted to cropland or, more specifically, forest land converted to cropland and grassland converted to cropland
- Land converted to grassland or, more specifically, forest land converted to grassland
- Land converted to forest land or, more specifically, cropland converted to forest land and grassland converted to forest land
- Land converted to settlements
- Land converted to other land (category)

When intermediate effects are a change in how land is managed, describe the change as a conversion from one type of management to another within a land category (the land category does not change), for example:

- Forest land remaining forest land; more specifically, reducing the impact of logging on land managed for timber

Affected activities

Intermediate effects can also be a change in activity, practice or technology such as a reduction in the amount of timber harvested. For these effects, they should be described by the activity data categories that are used to prepare national GHG inventories according to IPCC guidelines. The activity data categories are used to estimate GHG emissions following the method in Chapters 7 and 8.

Direction and amount of effect

When labelling intermediate effects, identify the direction of the effect. For example, label the activity as "increase" if the policy leads to an increase in an identified activity, such as an increase in area of forest land.

Where known, include the intended amount of the effect in the description of the intermediate effect. The intended amount of the effect may have been determined as part of the policy design process. For example, if a policy aims to incentivize reforestation of 10,000 hectares of cropland land, the intermediate effect can be described as: "increase the amount of cropland converted to forest land by 10,000 hectares." The direction of the effect is to increase. With this example, note the use of IPCC land categories in the description "cropland converted to forest land."

Geographic location

Describe the geographic location where the intended intermediate effects are likely to occur. The geographic location of intended effects is likely to be within the jurisdiction of the policy. For example, in a policy that aims to reforest degraded land, if a specific geographic location is targeted by the policy, the effect can be described as: "increase the amount of degraded land converted to forest land in the tropical dry forest in the north coast region of the jurisdiction by 10,000 hectares."

Information on geographic location will be relevant for collecting activity data and selecting emission factors when estimating GHG emissions, and for monitoring impacts ex-post.

It is possible for unintended intermediate effects to occur outside of the intended jurisdiction of the policy. In cases where the policy causes a shift in activity to outside of the jurisdiction, the effect can be described as out-of-jurisdiction.

Timing of the effect

Effects can occur both in the short- or long-term. Users should describe effects as short-term or long-term. The distinction between short-term and long-term can be defined based on the policy being assessed. Some effects may also be temporary while others are permanent. If known, identify when the effect is likely to occur using specific years or with reference to the start date of a policy. For example, a policy may seek to affect a certain group of stakeholders or actions during the first five years and then a different group during the last five years. This information will be used for estimating of GHG emissions and monitoring implementation ex-post.

To continue with the policy example above, if a specific time frame is targeted by the policy, that characteristic can be added to the description as: "an increase the amount of cropland converted to forest land in the southern tropical region of the jurisdiction by 10,000 hectares by 2030."

Example of describing intermediate effects

Table 6.2 provides an example table for how to describe inputs and administrative activities, and Table 6.3 provides an example table for how to describe intermediate effects.

Table 6.2: Example of how to describe inputs and administrative activities

	Detail/explanation	Geographic location of effect	Timing of effect
Inputs			
Legislation is passed to allow taxation of ecosystem service users	Legislative body enacts a tax for users of ecosystem services (water and hydroelectric utilities, tourism companies and others).	National scale	2021
Tax revenue allocated to Ministry of Environment to pay Payment for Ecosystem Services (PES) contracts	The national government allocates tax revenue to the Ministry of Environment, to make payments to landowners who have executed and complied with PES contract terms.	National scale	Annually 2022-2030
Administrative Activities			

Annual tax revenue from ecosystem service users is generated	Ecosystem users pay taxes.	National scale	Annually 2021-2030
Land owners execute PES contracts	Land owners voluntarily sign contracts to participate in the programme.	Privately owned forestland or low productivity cropland	Rolling enrolment 2021-2030
Extension service provides training and support to landowners under contract	The extension service provides SFM and A/R training and monitoring and reporting support to landowners who are under contract.	Privately owned forestland or low productivity cropland	On-going based on landowner needs 2021-2030
Landowners under contract submit required reporting	Landowners submit a year-1 and year-10 forest inventory report and annual harvest data.	Regions where payments have been dispersed	Annually 2022-2030
Extension service conducts site visits to land under contract	Extension service specialists conduct routine site visits to verify forest inventory and harvest reports submitted by land owners.	Regions where payments have been dispersed	On-going during 2022-2030
Payments administered to landowners who comply with the terms of PES contracts	Ministry of Environment pays contractual rates for SFM and A/R activities. Rates are based on number of hectares that sustainable harvest regimes, general tree planting, tree planting with endangered species, and/or natural regeneration occurs.	Privately owned forest land or low productivity cropland	2022-2030

1 *Table 6.3: Example table to describe intermediate effects*

Intermediate effects	Detail/ explanation	Affected parameter	Direction of effect	Amount of effect	Geographic location of effect	Timing of effect
Forest owners implement SFM	Forest owners implement sustainable harvest regimes on forest land remaining forest land	Forest land remaining forest land under SFM	Increase	150,000 hectares	Contracted land	Contract period
Forests have sustainable yields	Management changes such as increasing the minimum age or tree diameter at cutting will result in increases in merchantable volumes and higher average growth rates	Forest land remaining forest land under SFM	Increase	150,000 hectares	Contracted land	At least one harvest cycle
Forests are healthy	Management changes such as extending the re-entry period for	Forest land remaining	Increase	150,000 hectares	Contracted land	At least one

	selective harvesting and improving the selection of trees for harvesting decrease the chances of degradation from selective harvesting	forest land under SFM				harvest cycle
Change in supply of wood products	SFM leads to decreased harvest rates in the near-term, reducing the supply of wood products	Wood removals	Decrease	Unknown	Contracted land	Contract period
Change in area of timber harvest	Market forces from the decrease in supply of harvested wood products drive increased timber harvesting elsewhere	Wood removals; and forest land converted to another land category	Increase	Unknown	Unknown, outside of areas enrolled in programme	Contract period
Low-productivity cropland owners implement A/R	Low productivity cropland owners implement afforestation and reforestation activities on low-productivity cropland converted to forest land	Cropland converted to forest land	Increase	60,000 hectares	Contracted land	Contract period
Survival and growth of trees	Tree planting, removing competing species and removing ongoing disturbances that prevent natural regeneration result in viable forests that accumulate carbon in forest carbon pools	Cropland converted to forest land	Increase	60,000 hectares	Contracted land	Contract period
Change in agricultural product supply	The conversion of cropland to forest land results in a near-term decrease in supply of agricultural products	Crop and other product output	Decrease	Unknown	Contracted land	Contract period
Land conversion for agriculture	Market forces from the decrease in supply of agricultural products drive increased land conversion for agriculture elsewhere	Land converted to cropland	Increase	Unknown	Unknown, outside of areas enrolled in programme	During and after contract period
Agricultural intensification	Market forces from the decrease in supply of agricultural products drive agricultural intensification on existing cropland	Cropland Remaining cropland	Increase	Unknown	Unknown, outside of areas enrolled in programme	During and after contract period

6.1.2 Identify potential GHG impacts

Intermediate effects can lead to GHG impacts. For example, increasing the area of cropland that is reforested is an intermediate effect that leads to an increase in the amount of carbon sequestered by an area of land.

A/R activities can increase carbon sequestration and/or reduce CO_2 emissions by establishing, increasing or restoring aboveground biomass. SFM activities increase carbon sequestration and/or reduce CO_2 emissions on forest lands managed for wood products (e.g., timber, pulpwood, fuelwood) by increasing biomass carbon stocks through improving forest management practices. Reduced deforestation/degradation activities are those that reduce net CO_2 emissions by avoiding the conversion of forest land to another land-use category with lower carbon stock.

It is *a key recommendation* to identify all potential GHG impacts of the policy. To ensure a complete assessment, users should consider all identified intermediate effects and associate them with specific GHG impacts.

All potential GHG impacts should be identified at this stage so that they can be used to develop the causal chain following the method in Section 6.1.3. A subset of GHG impacts will be identified and included in the GHG assessment boundary following the method in Section 6.2.

6.1.3 Develop a causal chain

It is a *key recommendation* to develop a causal chain. Start by drawing links from the policy to the inputs and activities. Draw links from inputs and activities to affected stakeholders and intermediate effects. There may be a series of intermediate effects in the causal chain until it leads to a GHG impact. All of the detailed information about affected stakeholders, inputs, activities and intermediate effects that was described, following the steps in Sections 6.1.1 and 6.1.2, should be included in the causal chain.

, provides an example causal chain to illustrate the process.

A causal chain represents the sequence of intermediate effects expected to occur as a result of the policy. Implicitly, these changes are relative to a baseline scenario. For example, if an intermediate effect is that 10,000 hectares of cropland will be converted to forest land, this means 10,000 more hectares of cropland will be converted to forest land than in the scenario without the policy intervention (i.e., in the baseline scenario).

Consultations with stakeholders can help with development and/or validation of the causal chain by integrating stakeholder insights on cause-effect relationships between the policy, behaviour change and expected impacts. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for information on designing and conducting consultations.

6.2 Define the GHG assessment boundary

It is a *key recommendation* to include all significant GHG impacts in the GHG assessment boundary. The GHG assessment boundary defines the range of GHG impacts that are included in the policy assessment. Not all GHG sources or carbon pools associated with GHG impacts in the causal chain will need to be included in the GHG assessment boundary. In this step, users determine which GHG sources and/or carbon pools[12] are significant and should be included in the analysis. This is done by evaluating the likelihood and relative magnitudes of each of the GHG impacts identified in Section 6.1, using the following steps:

- Step 1: Assess the likelihood that each GHG impact will occur
- Step 2: Assess the expected magnitude of each GHG impact
- Step 3: Determine the significance of GHG impacts

Step 1: Assess the likelihood that each GHG impact will occur

For each GHG impact identified in Section 6.1, assess the likelihood that it will occur by classifying each impact according to the options in Table 6.4. For ex-ante assessments, this involves predicting the likelihood of each impact occurring in the future as a result of the policy. For ex-post assessments, this involves assessing the likelihood that the impact occurred in the past as a result of the policy, since impacts may have occurred during the assessment period for reasons unrelated to the policy being assessed. If a given impact is unlikely to occur, the subsequent impacts that follow from that impact can also be considered unlikely to occur. Where the likelihood is unknown or cannot be estimated, it should be classified as "possible."

Table 6.4: Assessing likelihood of GHG impacts

Likelihood	Description	Approximate likelihood (rule of thumb)
Very likely	Reason to believe the impact will happen (or did happen) as a result of the policy.	≥90%
Likely	Reason to believe the impact will probably happen (or probably happened) as a result of the policy.	<90% and ≥66%
Possible	Reason to believe the impact may or may not happen (or may or may not have happened) as a result of the policy. About as likely as not. Cases where the likelihood is unknown or cannot be determined should be considered possible.	<66% and ≥33%
Unlikely	Reason to believe the impact probably will not happen (or probably did not happen) as a result of the policy.	<33% and ≥10%
Very unlikely	Reason to believe the impact will not happen (or did not happen) as a result of the policy.	<10%

Source: Adapted from WRI 2014.

The likelihood classification should be based on evidence to the extent possible, such as published literature, prior experience, modelling results, risk management methods, consultation with stakeholders, expert judgment, or other methods.

[12] The term carbon pools is used here instead of sinks because the quantification methods for sinks are based on specific carbon pools and the GHG boundary needs to be identified at the level of the carbon pool.

Users should consult stakeholders when assessing the likelihood of impacts. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for more information on how to consult with stakeholders.

Step 2: Assess the magnitude of each GHG impact

Next, classify the magnitude of each GHG impact as major, moderate or minor according to Table 6.5. This involves approximating the change in GHG emissions and removals resulting from each GHG impact. GHG emissions and removals do not need to be accurately calculated in this step, but the relative magnitude should be categorized.

The relative magnitude of each GHG impact depends on the size of the GHG source or carbon pool affected and the magnitude of the change expected to result. The size of the GHG source or carbon pool can be estimated based on GHG inventories or other sources. The relative magnitude of each GHG impact should be estimated based on the absolute value of total change in GHG emissions and removals, taking into account both increases and decreases in emissions and removals.

This determination requires some level of expert judgment and should be done in consultation with stakeholders. If it is not possible to classify the magnitude of an impact as major, moderate or minor (e.g., due to lack of data or capacity), users can classify a given impact as "uncertain" or "cannot be determined," as appropriate. Users can also estimate changes in activity data rather than changes in emissions to assess the magnitude of the GHG impact, where relevant.

Table 6.5: Estimating relative magnitude of GHG impacts

Relative magnitude	Description	Approximate relative magnitude (rule of thumb)
Major	The change in the GHG source or carbon pool is (or is expected to be) substantial in size (either positive or negative). The impact significantly influences the effectiveness of the policy.	>10%
Moderate	The change in the GHG source or carbon pool is (or is expected to be) moderate in size (either positive or negative). The impact somewhat influences the effectiveness of the policy.	1-10%
Minor	The change in the GHG source or carbon pool is (or is expected to be) insignificant in size (either positive or negative). The impact is inconsequential to the effectiveness of the policy.	<1%

Source: Adapted from WRI 2014

Step 3: Determine the significance of GHG impacts

Once the likelihood and magnitude of each impact has been determined, review the classifications for likelihood and magnitude to determine whether each impact is significant. In general, users should consider impacts to be significant unless they are either minor in size or unlikely or very unlikely to occur (see Figure 6.3). Impacts that were considered to be minor in size or unlikely or very unlikely to occur at the time of an ex-ante assessment should be reevaluated for significance during an ex-poste assessment. Table 6.6 provides additional considerations for evaluating which GHG sources and carbon pools to include in the GHG assessment boundary.

The ICAT *Agriculture Methodology* lists considerations for which GHG sources and carbon pools to include in a GHG assessment boundary for mitigation activities that lead to enhanced CO_2 sequestration and reduced CO_2 emissions in the soil carbon pool in pasture, grazing and croplands

Figure 6.3: Recommended approach for determining significance based on likelihood and magnitude

<table>
<tr><th rowspan="2">Likelihood</th><th colspan="3">Magnitude</th></tr>
<tr><th>Minor</th><th>Moderate</th><th>Major</th></tr>
<tr><td>Very likely</td><td rowspan="5">Insignificant</td><td colspan="2" rowspan="3">Significant</td></tr>
<tr><td>Likely</td></tr>
<tr><td>Possible</td></tr>
<tr><td>Unlikely</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Very unlikely</td></tr>
</table>

Source: Adapted from WRI 2014.

Table 6.6: Considerations for evaluating significance of GHG sources and carbon pools

Source/ Carbon pool	Gas	Considerations
Biomass carbon	CO_2	This source should be considered significant for all policies with interventions that target forest carbon.
Soil carbon	CO_2	Generally, soil carbon stocks will not decline significantly as a result of a forest policy. Consider including this source for forest policies that affect land-use change (reduced deforestation and afforestation/reforestation) because in some cases soil carbon stock gains can occur. For example, soil carbon stocks can increase significantly in reduced deforestation projects when (a) initial forest soil carbon stock is moderately large and (b) the policy helps to avoid a shift to conventional tillage agriculture. However, it is conservative to exclude this pool from the policy assessment.
Dead organic matter (DOM)	CO_2	For most cases, this pool is expected to have a relatively minor effect and can be excluded. Consider including this pool if the policy interventions impact peatland or wetland ecosystems.
Harvested wood products – intended and within the geographic area of the policy	CO_2	Consider including this source when: forest management policies aim to promote more production of long term HWP compared to a baseline of dominant short term HWP; and when afforestation and reforestation result in an increased supply of long term HWP that would not occur in the baseline. In most other forest policy scenarios, it is likely that the relative magnitude of the effect will be small.
Harvested wood products – unintended and outside geographic area of the policy	CO_2	Consider including this source if changes in forest management inside the geographic area of the policy will significantly reduce timber supply and lead to increases in timber harvesting outside the geographic area of the policy.

Biomass burning	CO_2, CH_4, N_2O	Forest policies are not likely to intentionally increase biomass burning compared to baseline. Forest policies may intentionally reduce biomass burning compared to baseline; however, it is conservative to exclude this source in that situation. If unintended land conversions are likely (see below), consider including biomass burning as it may increase as a result of the unintended land-use change.
Fuel combustion	CO_2	There may be some emissions related to site preparation and planting for afforestation and reforestation projects. However, these are likely to be relatively minor in magnitude and can be excluded.
Unintended land conversions to cropland or grassland	CO_2	This may be significant for forest polices that are intended to affect land-use change (i.e., reduced deforestation and afforestation/reforestation). If food supply is decreased as a result of the policy, then unintended land-use change is possible. This may occur when the policy intervention reduces crop outputs compared to baseline. As part of its Jurisdictional and Nested REDD+ programme, the VCS Program provides guidance for quantifying the effective area needed to maintain production[13] and guidance for evaluating the volume of foregone commodity production.[14] Both of these resources can be adapted to assess the significance of a forest policy on food supply or demand. If unintended land conversion is considered to be significant, it is recommended to include the estimation of converted land area within the policy land stratification of affected land categories.

6.3 Define the assessment period

It is a *key recommendation* to define the assessment period. The assessment period is the time period over which impacts resulting from the policy are assessed. The starting date and the duration of the assessment period may vary depending whether or not an ex-ante or ex-post assessment will be conducted.

Where possible, users should align the assessment period with other assessments being conducted using ICAT methodologies. For example, where users are assessing the forest policy's sustainable development impacts using the ICAT *Sustainable Development Methodology* in addition to assessing GHG impacts, the assessment period should be the same for both the sustainable development and GHG impact assessments.

Ex-ante assessment

For ex-ante assessment, users should consider the assessment objectives and stakeholders' needs when determining the assessment period. Where the objective is to understand the expected contribution of the policy toward achieving a country's NDC, it may be most appropriate to align the assessment

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[13] Guidance for quantifying the effective area needed to maintain production is provided in the Verra *Global Commodity Leakage Module: Effective Area Approach*. Available at: http://database.verra.org/methodologies/global-commodity-leakage-module-effective-area-approach-v10

[14] Guidance for evaluating the volume of foregone commodity production in the document is available in the *Global Commodity Leakage Module: Production Approach*. Available at: http://database.verra.org/methodologies/global-commodity-leakage-module-production-approach-v10

period with the NDC implementation period (e.g., ending in 2030). To align with longer-term trends and planning, users should select an end date such as 2040 or 2050.

The ex-ante assessment period is usually determined by the longest-term impact included in the GHG assessment boundary. The assessment period can continue until the policy implementation period ends or it can be longer than the policy implementation period, as some significant GHG impacts can occur after the policy implementation period ends. The assessment period should be defined to include all significant GHG impacts included in the GHG assessment boundary, based on when they are expected to occur (as described in Section 6.1.1, Step 3).

To determine the end of the assessment period, users can choose from the following approaches, among others:

- A timeframe or date that is directly specified in the policy goal or target (e.g., reduce emission by 50% by 2020)
- The length of time for which the policy is funded or expected to be funded
- A period in time that has otherwise been identified as the policy implementation end date
- 20-year assessment period (based on rationale discussed below)

GHG emission and removal dynamics should be considered for GHG impacts that involve carbon sequestration in soils and/or biomass when determining the assessment period. For example, changes in land use or land management can change soil carbon sequestration rates until a new equilibrium is reached. IPCC suggests a default 20-year transition period for soil carbon dynamics to reach a new equilibrium.[15] Generally, when establishing new forests or when forests regrow after harvest and disturbance, the initial rate of carbon gain in the biomass pool is high compared to later when the forest reaches maturity. Also, forest biomass is removed or lost due to multiple factors. Forest harvesting, which occurs in close to 20-year cycles, results in removal of biomass from forest stands, and the end use of the harvested wood determines the amount of carbon loss over time.

Policies that impact carbon sequestration should be evaluated over a sufficiently long assessment period to capture the net impact of gains and losses in carbon pools to the extent possible. Given the IPCC 20-year transition period for soils and an approximate 20-year harvest cycle for forests, it is recommended that users set the assessment period to a minimum of 20 years, even if this extends the assessment period beyond the policy implementation period, if practicable.

Assumptions about baseline and policy scenarios become more uncertain the further forward in time the assumptions are projected. Therefore, it is also recommended that the assessment period is not extended much further than 20 years into the future. Rather, users can define multiple discrete assessment periods that cover the length of the policy implementation period, with each assessment period not to exceed 20 years. For example, where the policy implementation period is 2020-2060, there can be two assessment periods from 2020-2040 and 2041-2060.

[15] IPCC 2006.

Ex-post assessment

For an ex-post assessment, the assessment period can be the period between the date the policy is implemented and the date of the assessment, or it can be a shorter period between those two dates. The assessment period for a combined ex-ante and ex-post assessment should consist of both an ex-ante assessment period and an ex-post assessment period.

In addition, users can separately estimate and report impacts over any other time periods that are relevant. For example, if the assessment period is 2020–2040, a user can separately estimate and report impacts over the periods 2020–2030, 2031–2040, and 2020–2040.

6.4 Identify sustainable development impacts (if relevant)

Forest policies have broader sustainable development impacts in addition to their GHG impacts. Sustainable development impacts are changes in environmental, social or economic conditions that result from a policy, such as changes in air quality, water quality, health, quality of life, employment or income.

Refer to the ICAT *Sustainable Development Methodology* for the method for conducting an assessment of sustainable development impacts. Table 6.7 lists examples of sustainable development impacts that may be associated with forest policies, categorized according to the ICAT *Sustainable Development Methodology*. The Sustainable Development Goals (SDGs) most directly relevant to each impact category are indicated in parentheses.

Table 6.7: Examples of sustainable development impacts and indicators relevant to forest policies

Examples of impact categories	Examples of indicators for each impact category
Environmental impacts	
Biodiversity of terrestrial ecosystems (SDG 15)	• Species diversity (number of species or species richness) • Change in threat status of species (abundance of selected key species, invasive alien species or endangered species) • Proportion of terrestrial area protected • Damage on ecosystem (PDF-Potential affected fraction of species) • Extinction rate • Biodiversity intactness index • Quality of ecosystem services
Land use change, including deforestation, forest degradation, and desertification (SDG 15)	• Annual change in degraded or desertified arable land (% or ha) • Area of forested land as a percentage of original or potential forest cover • Proportion of land area covered by forests • Area of forest under sustainable forest management • Arable and permanent cropland area • Area under organic farming
Soil quality (SDG 2)	• Net emissions of sulphur dioxide (SO2), ammonia (NH3), and nitrogen oxides (NOx) (tonnes/year) • Soil organic matter • Acidity (pH) • Extent of soil erosion

Social impacts	
Access to land (SDG 2)	• Percentage of population with access to land
Indigenous rights (SDG 2, SDG 4, SDG 10)	• Extent of recognition of ancestral land titles • Extent of free, prior and informed consent • Extent of protection of Indigenous traditional knowledge • Extent of empowerment of Indigenous communities
Resilience to dangerous climate change and extreme weather events (SDG 13)	• Reduction of natural disaster risks
Economic impacts	
Economic productivity (SDG 8, SDG 2)	• Agricultural productivity (harvested crop yields per hectare)

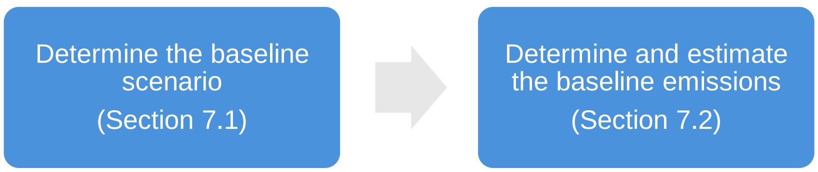
Part III: Assessing Impacts

7. Estimating the Baseline Scenario and Emissions

When using the emissions approach, estimating the GHG impacts of a policy requires a reference case, or baseline scenario, against which impacts are estimated. The baseline scenario represents what would have happened in the absence of the policy intervention. Baseline emissions and removals are estimated according to the most likely baseline scenario that includes credible assumptions on land use, land-use changes and, timber management practices, and the associated emissions and removals that would have occurred without the implementation of the policy.

The method in this chapter can be used for determining the baseline scenario and estimating emissions ex-ante or ex-post. Estimating baseline emissions is optional; users can calculate the GHG impacts of the policy directly, without explicitly determining separate baseline and policy scenarios, using the activity data approach. In such cases, users can skip to Chapter 8.

Figure 7.1: Overview of the steps in the chapter



Checklist of key recommendations

- Identify the intended policy outcomes and target drivers
- Stratify land by land-use category
- Estimate the area of land in each stratum
- Estimate the carbon stock change (e.g., emission factor) for each carbon pool in each land stratum
- Calculate the cumulative GHG emissions and removals for the baseline scenario over the assessment period

7.1 Determine the baseline scenario

The most likely baseline scenario is determined by drivers that are affecting emissions and carbon stocks. This step requires identifying parameters for these drivers and making reasonable assumptions about their most likely values in the absence of the policy.

When determining the baseline scenario, consider how the sector would have developed without the policy. For example:

- What mitigation practices or technologies would be implemented in the absence of the policy?
- Are there existing or planned policies, other than the policy being assessed that would likely have an impact on GHG emissions for the forestry sector?

- Are there non-policy drivers (e.g., market trends or non-anthropogenic processes) or other sectoral trends that should be reflected in the baseline scenario? For example:
  - Changes in the demand for harvested wood products
  - Improvements in timber and forest management practices
  - Land-use change (e.g., natural regeneration)
  - Trends in the agriculture sector
  - Trends in biofuel production
  - Trends in development (e.g., settlements and infrastructure)

To the extent possible, users should identify a single baseline scenario that is considered to be the most likely. In certain cases, multiple baseline options may seem equally plausible. Users can develop multiple baselines, each based on different sets of assumptions, rather than just one set. This approach produces a range of possible emission reductions scenarios. Users can then conduct a sensitivity analysis to see how the results vary depending on the selection of baseline scenario. More guidance about conducting a sensitivity analysis is provided in Chapter 12 of the *Policy and Action Standard*.

Users that are assessing the sustainable development, transformational or other GHG impacts of the policy should use the same underlying assumptions about macroeconomic conditions, demographics and other non-policy drivers. For example, if GDP is a macro-economic condition needed for assessing both the job impacts and economic development impacts of an agriculture policy, users should use the same assumed value for GDP over time for both assessments.

7.1.1 Approaches to determining the baseline scenario

This section describes the various approaches to determining the most likely baseline scenario. There are multiple ways to project the baseline scenario, ranging from simple to complex. Depending on the availability and quality of forecasting data, any of the following of approaches can be used for determining the baseline scenario. Figure 7.2 illustrates the different baseline approaches.

Constant baseline

This approach assumes there will be no change in land use, land cover or forest management practices during the baseline period with respect to the situation prior to policy implementation. It represents the simplest approach as only historical data is required. Either the most recent available data, or an average of the data from at least three years prior to the start of the policy implementation, can be used to quantify the baseline parameters. This approach then assumes the parameters are held constant for the assessment period and the baseline is the continuation of the current or historical situation. For example, land will remain degraded under the baseline scenario. This baseline approach is the easiest to estimate, however assessments based on a constant baseline may be less accurate.

Simple trend baseline

This baseline scenario approach assumes that land use, land cover and forest management practices will evolve in the same way as they have in the past. This approach typically uses a linear or exponential extrapolation of the historical trend for each baseline parameter. Users can employ a statistical regression analysis to estimate trends. This approach can be easy to implement but it does not include any assumptions about future policy measures or future mitigation actions. This approach should use historical data from 5 to 10 years prior to the implementation of the policy. More data points will strengthen the regression analysis. For example, land-use change in the future can be estimated by assuming that the same rate change prior to policy implementation continues in the baseline.

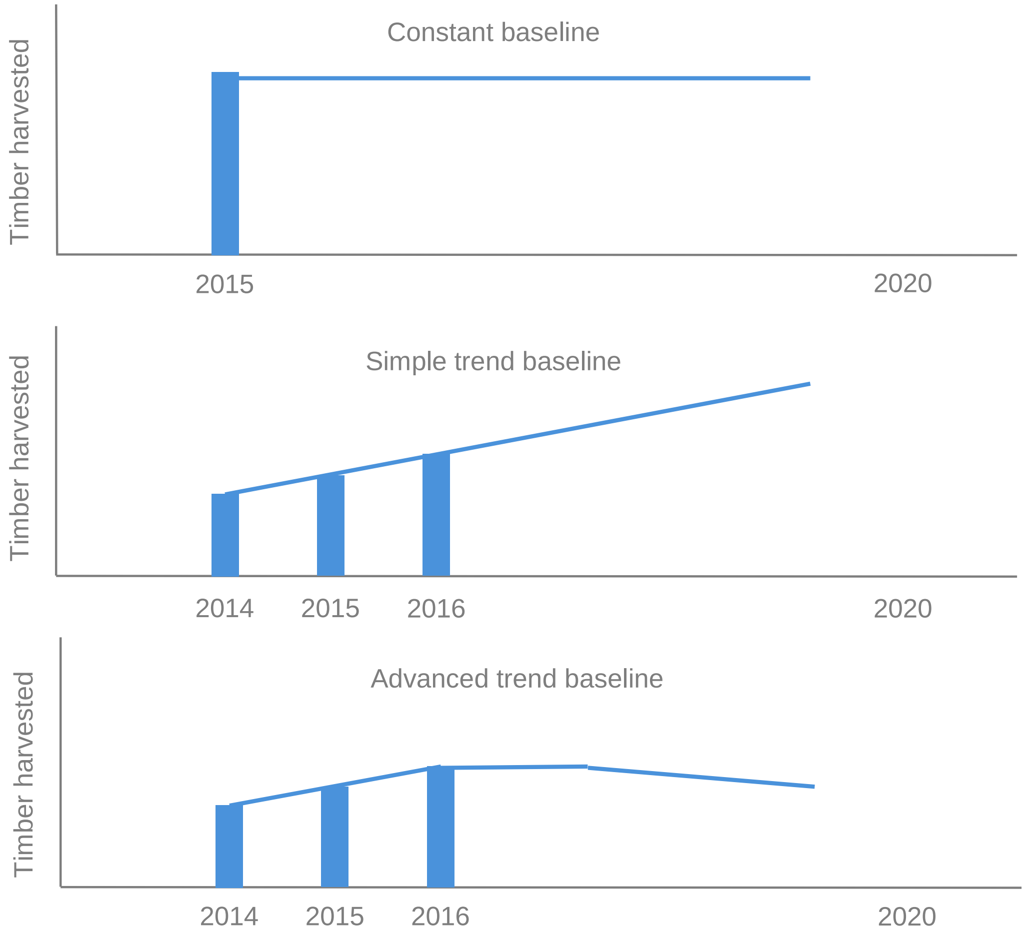
Advanced trend baseline

This approach models the future evolution of the key drivers of emissions and factors in the impact of many interacting elements, including trends in macroeconomic conditions, demographics and other non-policy drivers.

A modeled baseline can be top-down or bottom-up:

- **Top-down model**: This models how the economy or other exogenous factors (e.g., macroeconomic and demographic conditions) will impact the forestry sector. For example, the approach may model how population growth will impact land use and then uses population forecasts to predict baseline land-use change.
- **Bottom-up model**: This approach models the interaction of key drivers on specific land use, land-use change and forest management practices. It can offer a more detailed projection of specific GHG sources and carbon pools. This approach will likely require detailed data such as forest inventory, drivers of land-use change or specific timber or forest management practices. It is suitable in countries where emissions from this sector are small or where their economic output is modest, because the expected trends in macroeconomic and demographic conditions may not be a good indicator of land use or land-use change.

Figure 7.2: Examples of constant, simple trend and advanced trend baselines



A land use, land-use change and forestry (LULUCF) model projects the land use and land-use changes that are expected to occur in the baseline. A comprehensive LULUCF model covers the following dimensions:

- **Sectoral**: There is sufficient detail to identify targeted economic opportunities within and across the sectors (e.g., land-use change, forest management, agricultural management or biofuel production). The model could include a market-clearing price and resource competition to capture the impact of mitigating emissions where forest and agriculture products are affected.
- **Spatial**: The model accounts for the heterogeneity of biophysical and economic conditions within and across regions as they relate to the production of food, fiber and fuel. For example, carbon sequestration rates can vary regionally. A spatial model could also model competition for region-specific resources, such as land and water which effects economic responsiveness in forestry and agriculture.
- **Temporal**: The model has the ability to capture dynamic biophysical processes (e.g., soil and biomass carbon accumulation or fate of harvested wood products). It could also capture dynamic economic processes (e.g., investment, technological progress, demand trends or traditional commodity developments).

LULUCF models can be categorized according to their functional and methodological aspects, as follows:

- Statistical or econometric
- Spatial interaction models
- Optimization models (which include linear, dynamic, hierarchical and non-linear programmes, such as utility maximization models and multi-criteria decision-making models)
- Integrated models (gravity, simulation and entry-exit models)
- Models based on natural sciences
- Models based on GIS
- Models based on the Markov Chain (MAPS, 2015)

There are a number of existing models which can be used to project an advanced trend baseline. For example, the Global Biosphere Management Model (GLOBIOM) is an economic partial equilibrium model of the competition for global land use. In GLOBIOM, the demand for land is modeled based on exogenously specified regional drivers (including gross domestic product (GDP) growth, population growth, evolution of food diets and global bioenergy demand), and local characteristics of the land. Brazil has considered a model that includes the dynamics of land use that will be affected by competition and scale. It provides the results of land allocation to different regions and biomasses in the country, thereby projecting the type of natural vegetation that is converted (deforested) into agricultural land. The projections are based on country level plans up to 2030 (MAPS, 2015).

7.1.2 Data Sources

Multiple types of data can be used to develop baseline scenarios, including top-down and bottom-up:

- **Top-down data:** Macro-level data or statistics collected at the jurisdictional or sectoral level. Examples include economic data on milk or meat consumption, land use maps, population and GDP. In some cases, top-down data are aggregated from bottom-up data sources.
- **Bottom-up data:** Data that are measured, monitored or collected at the facility, entity or project level. Examples include agricultural or livestock census data on current and/or historical livestock population, species, feed intake or land-use categories classified by climate region, soil type and management.

The key parameters for estimating baseline emissions and removals in forests are:

- **Activity data**: Hectares of forest land remaining forest land, non-forest land converted to forest land, forest land converted to non-forest land.
- **Carbon stock change factor**: The net change in carbon stocks per hectare of land, which can also be expressed as CO_2 emissions and removals per hectare of land. The carbon stock change represents the emission factor for a land use or land management.

Existing data that has been collected for other assessments (including from national GHG inventories, National Communications, Biennial Update Reports and Biennial Transparency Reports[16]), which are prepared following IPCC guidelines, can be used for determining the baseline scenario and estimating baseline emissions and removals. Where relevant, it may be important to use data that is consistent with national or sub-national level sectoral baselines. Sources of data for the key parameters include:

- Forest Cover maps and regionally specific data
- Country-level data from NAMA and low carbon development programmes
- Country-level REDD+ reporting or studies (e.g., national or subnational REDD+ forest reference emission levels (FRELs) or forest reference levels (FRLs))
- Global Forest Watch (GFW)[17], US Geological Survey (USGS)[18], FAO databases[19]

7.1.3 Choosing the approach to determine the baseline scenario

The choice of approach to determine the baseline scenario depends on users' resources, capacity, access to data, availability of models and methodologies, and the parameters that are expected to change. A constant baseline is the simplest option and may be appropriate when parameters are considered likely to remain stable over time. A simple trend baseline is most appropriate if the change in baseline parameter values is expected to remain stable over time. Advanced trend baseline approaches may yield more accurate results than other approaches, since they take into account various drivers that affect conditions over time. However, more complex baselines will only be more accurate if the underlying data and methods used to model the impacts of drivers are robust. Users should use methods and data that yield the most accurate results within a given context, based on the resources and data available.

7.2 Estimate baseline emissions

This section provides a method for estimating baseline emissions. It provides suggestions for identifying data sources and methods for projecting key baseline scenario parameters. Figure 7.3 outlines the steps in this section.

The method can also be used to estimate policy scenario emissions for forest policies. To estimate policy scenario emissions, use the same method that was used to estimate baseline emissions with new parameter values derived following the method in Sections 8.2 – 8.5 and, if relevant, new emission factors that represent conditions under the policy scenario. The policy scenario can be estimated ex-ante or ex-post with these methods.

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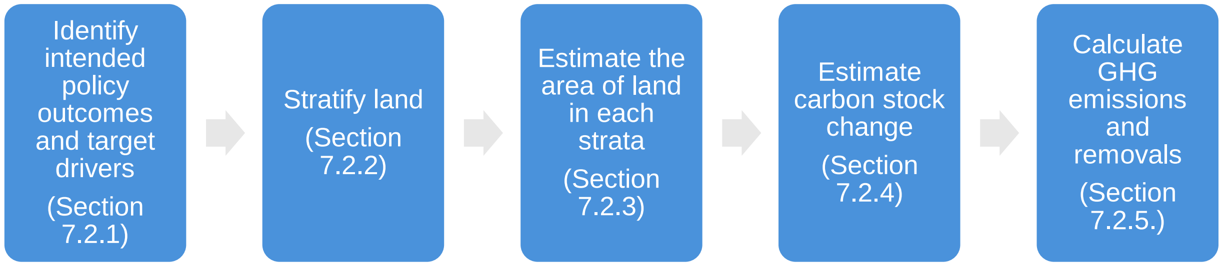
[16] Biennial Transparency Reports (BTRs) will supersede the Biennial Update Report (BUR) requirements from December 2024.

[17] Global Forest Watch data is available at: http://www.globalforestwatch.org/

[18] USGS land cover datasets are available at: https://landcover.usgs.gov/globallandcover.php

[19] FAO databases are available at: http://www.fao.org/faostat/es/

Figure 7.3: Steps for estimating baseline emissions



Changes in land use can lead to an increase or decrease in forest carbon. For example, conversion of cropland to forest land results in a net increase of forest carbon. Conversely, cropland converted to forests land (deforestation) results in net losses of forest carbon. Where land use remains the same over time (e.g., forest land remaining forest land), changes in management (e.g., increasing the minimum age of cutting thresholds) can result in net increases or decreases in forest carbon. Policy impacts on forest carbon are estimated in terms of how the policy changes land use and management.

7.2.1 Identify intended policy outcomes and target drivers

It is a *key recommendation* to identify the intended policy outcomes and target drivers. There are generally four types of policy outcomes in the forestry sector. They include:

- Enhance forest carbon stocks by converting land to forests (afforestation/reforestation)
- Enhance forest carbon stocks in existing forests
- Reduce emissions from deforestation
- Reduce emissions from degradation

Drivers are a categorical description of agents and processes that lead to GHG emissions in the forestry sector in the baseline scenario. Policies enable or incentivize measures that are designed to affect target drivers. Table 7.1 provides examples of target drivers as they relate to intended policy outcomes. The target drivers need to be identified in the baseline scenario because assumptions about them are modified in order to develop the policy scenario.

Drivers that are not affected by the policy do not need to be analyzed, because they are assumed to remain constant between the baseline and policy scenarios. For example, if the policy focuses on afforestation on degraded lands, it can be assumed that logging practices on lands managed for timber will remain the same.

The data for key parameters will vary depending on the intended policy outcome. Table 7.2 provides general descriptions of the key parameters associated with each type of policy outcome.

Table 7.1: Example relationships between intended policy outcomes, target drives and policy measures

Intended policy outcome	Example drivers/barriers	Example policy measures
Enhance forest carbon stocks by converting land to forests	Barriers to natural regeneration	Plant trees Remove barriers to natural regeneration Make sites suitable for natural regeneration
Enhance forest carbon stocks with existing forests	Poor forest management	Encourage implementation of sustainable forest management Reduce the size of logging roads Reduce damage of other trees when logging
Reduce emissions from deforestation	Illegal logging Economic pressure for more agricultural production that requires agricultural land expansion	Introduce and improve systems to effectively enforce existing or new forest protection regulation Agricultural intensification
Reduce emissions from degradation	Unsustainable biomass removals from selective logging and fuelwood gathering Over-frequent burning	Introduce and improve systems to effectively enforce existing or new regulation on fuel wood collection

Table 7.2: Key parameters by policy outcome

Intended policy outcome	Activity data	Carbon stock change
Enhance forest carbon stocks within existing forests	Area of forest land remaining forest land where management can be improved	CO_2 removals/hectare from enhancements
Enhance forest carbon stocks by converting land to forests	Area of land converted to forest land	CO_2 removals/hectare from biomass and soil from land conversion
Reduce emissions from deforestation	Area of forest land converted to non-forest land	CO_2 emissions/hectare of deforestation
Reduce emissions from degradation	Area of forest land remaining forest land where degradation occurs	CO_2 emissions/hectare of degradation

7.2.2 Stratify land

It is a *key recommendation* to stratify land by land-use category. Following the method in Section 6.1.1, Step 3, users should have identified the affected land categories where changes in land use and forest management are expected to occur under the policy scenario. At a high level, the possible affected land categories are:

- Forest land converted to non-forest land
- Forest land remaining forest land
- Non- forest land converted to forest land

For each of the land categories in the GHG assessment boundary, further divide them into subcategories by climate information, forest types and forest management. Where available, country level stratification of forest type and biomass values from the country's national GHG inventory should be used.

The IPCC 2006 GL provide a land categorization for forests that is compatible with Tier 1 estimation methods. To use the IPCC categorization, identify the ecological zones and forest management types that correspond to the forest land in that category. Ecological zones are areas with relatively homogeneous vegetation. The IPCC defines ecological zones based on climate domain and climate region; where climate domain is an area of relatively homogeneous temperature, and climate region is an area with a relatively similar climate in terms of both moisture and temperature. Some ecological zones are, for example: tropical rain forest, subtropical humid forest, temperate oceanic forest and boreal coniferous forest. IPCC definitions of ecological zones according to climate domain and climate region are provided in Table 4.1 of the IPCC 2006 GL, Volume 4, Chapter 4.

Within each ecological zone, further define subcategories of forest land in terms of how the forests are managed. The IPCC provides two categories for this: natural and plantation forest. Natural forests are generally naturally re-growing stands with reduced or minimum human intervention. Plantation forests are intensively managed (including planted, managed, harvested and replanted). The IPCC provides Tier 1 estimated biomass values for natural and plantation forests for all ecological zones (Table 4.12 of the IPCC 2006 GL, Volume 4, Chapter 4). Use the IPCC biomass values and information about forest management and forest biomass in your country to develop criteria for classifying forests into natural and plantation and document the criteria you have used.

The subcategories outlined above (i.e., ecological zone and management type), are recommended because they are compatible with using IPCC Tier 1 emission factors for estimating the carbon in forest biomass. The land categorization can be done differently where Tier 2 emission factors are available or a derived Tier 2 estimate of CO_2 emissions/removals for each land category can be calculated. Where the policy aims to reduce forest degradation, higher approaches and tiers should be used to capture changes. Higher approach and tier methods require more data, but can yield a more accurate GHG impacts assessment. Users should consider the objectives of the policy when selecting which method to use.

7.2.3 Estimate the area of land in each stratum

It is a *key recommendation* to estimate the area of land in each stratum. Land area can be derived from national data sources that are widely accepted among policymakers and endorsed by the government. Potential data sources include remote sensed and aerial imagery, ministry of agriculture or forests, national agricultural or forest research institutes, and international agencies (e.g., FAO). Relevant land area data compiled for the national GHG inventory is also a relevant data source. These data sources will typically provide information on historical and current land area.

There are several resources that detail how to develop land area estimates for forest carbon monitoring:

- IPCC 2003 Good Practice Guidelines for Land Use, Land-Use Change and Forestry[20]
- IPCC 2006 GL for AFOLU, Volume 4[21]
- Global Observation of Forest Cover and Land Dynamics (GOFC GOLD) Sourcebook[22]
- Winrock Standard Operating Procedures for Terrestrial Carbon Measurement 2016[23]
- Global Forest Observation Initiative methods and guidance documentation[24]

These resources can be used to estimate a time series of land area for the baseline assessment. The time series is the number or hectares of land in each land stratum each year of the assessment period. Any of the approaches discussed in Section 7.1 can be used to project the hectares of land over time based on current and historical data.

7.2.4 Estimate carbon stock change

It is a *key recommendation* to estimate the carbon stock change (i.e., emission factor) for each carbon pool in each land stratum. At a minimum, the carbon stock change for the living aboveground and belowground biomass (living biomass) pool should be estimated. For afforestation/reforestation and reduced deforestation activities, carbon stock change for dead organic matter and soil carbon pools can also be estimated where these pools are included in the GHG assessment boundary.

When deciding which pools to estimate the carbon stock change for, users may encounter trade-offs between the principle of accuracy and the cost of collecting data. Conservativeness can serve as a moderator to accuracy in order to balance costs while maintaining the credibility the GHG estimate. Users can rely on existing data and methods for estimating carbon stock change including the following:

- National forest inventories
- Subnational or regional forest inventory datasets
- Independent relevant or regional scientific studies or datasets
- Values published in scientific literature
- Values provided in the IPCC 2006 GL

The method below is for estimating carbon stock change based on the living biomass carbon pool only.

Land-use change

For afforestation/reforestation or reduced deforestation where land-use changes (e.g., non-forest land converted to forest land and vice versa), the carbon stock change is the average change in forest carbon

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[20] Available at: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html

[21] Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

[22] Available at: http://www.gofcgold.wur.nl/redd/

[23] Available at: http://www.leafasia.org/tools/winrock-standard-operating-procedures-terrestrial-carbon-measurementfield-sop-manual

[24] Available at: http://www.gfoi.org/methods-guidance/

stocks per unit area as a result of land being afforested/reforested or deforested. In general, this can be estimated as the difference between the forest carbon stocks per unit area before and after the land conversion, as shown in Equation 7.1 (based on Equation 2.16 in the IPCC 2006 GL). Equation 7.1 includes the area term representing activity data. Executing the equation with the area term yields total emissions and removals in terms of tonnes of carbon per year for all land conversions. Executing the equation without the area term will yield a per area carbon stock change for each type of land conversion.

Equation 7.1: Carbon stock change from land conversion

$$\Delta C_{Conversion} = \sum_{i} \left\{ \left(B_{After,i} - B_{Before,i} \right) * A_{To\_NF,i} \right\} * CF$$

Where,

$\Delta C_{Conversion}$ = Carbon stock change on land type i, tonnes C yr^{-1}

$B_{After,i}$ = biomass stocks* on land type *i* after the conversion, tonnes dry matter ha^{-1}

$B_{Before,i}$ = biomass stocks* on land type *i* before the conversion, tonnes dry matter ha^{-1}

$A_{To\_NF,i}$ = area of land use *i* converted to non-forest land (NF) in a certain year, ha yr^{-1}

CF = carbon fraction of dry matter, tonne C (tones dry matter)$^{-1}$

i = type of land converted to non-forest land

* Note: Biomass stocks x *CF* = Carbon stocks; The carbon fraction converts units of dry matter (a common measure in forestry) to units of carbon with a basic conversion factor that varies by climate region. The IPCC 2006 GL provides default carbon fraction values in Table 4.3.

As noted above, Tier 1 estimated biomass values for natural and plantation forests for all ecological zones are provided in Table 4.12 of the IPCC 2006 GL, Volume 4, Chapter 4. These values can be used to develop Tier 1 carbon stock change factors for afforestation/reforestation and reduced deforestation, with the equation above. Values for biomass stocks in the non-forest land pre- or post-conversion categories can be found in IPCC 2006 GL Table 5.9 (croplands) or Table 6.4 (grassland).

For a rough estimate of a deforestation carbon stock change, use zero for the value of $B_{After,i}$. This will overestimate emissions from deforestation because the biomass gains that occur in the post-conversion land category are not counted (i.e., the loss in biomass as a result of conversion is overestimated). However, this is likely to be a proportionally small overestimation because post conversion biomass stocks are relatively small in magnitude compared to the pre-conversion forests carbon stocks.

For a rough estimate of an afforestation/reforestation carbon stock change, use zero for the value of $B_{Before,i}$. This will overestimate removals from afforestation/reforestation because it does not count the biomass stocks that existed before conversion (i.e., the gain in biomass as a result of conversion is overestimated). This is also likely to be a proportionally small overestimation because pre-conversion biomass stocks are relatively small in magnitude compared to the post-conversion forest carbon stocks.

Forest land remaining forest land

For forest land remaining forest land, the carbon stock change is the average annual change in forest carbon stocks per unit area. This can be estimated in one of two ways according to the IPCC 2006 GL:

- **Stock-difference method**: The average annual change in forest carbon stocks is calculated as the difference in average forest carbon stocks between two points in time, divided by the time period, as shown in Equations 7.2a and 7.2b (adapted the first part of Equation 2.8 in the IPCC 2006 GL). The stock-difference method is most suitable to circumstances where there is good availability of information and/or resources (e.g., Tier 2, Approach 2 or 3), for example national forest inventories/datasets that allow estimates of carbon stocks by forest types, specific to local/regional conditions over time. In most cases, it is not appropriate to use a Tier 1 method for a stock-difference calculation.[25]

- **Gain-loss method**: The average annual change in forest carbon stocks is calculated as a process of gains and losses, where gains result from annual forest growth and losses from processes like wood harvesting, fuel wood extraction and disturbance, as shown in Equation 7.3. The gain-loss method is most suitable for circumstances when countries do not have time series information on activity data and emission factors to assess by stock-difference method.

Both the stock-difference and gain-loss methods are executed with the area term (activity data) in the equations, which yields total change in carbon stocks for all land strata in forest land remaining forest land. Therefore, the carbon stock change is embedded in the quantification of total emissions and removals.

Stock-difference method

Equation 7.2a: Part 1 of stock-difference method for estimating carbon stock change

$$\Delta C = \frac{\left(C_{t,2} - C_{t,1}\right)}{\left(t_2 - t_1\right)}$$

Where:

ΔC = annual forest carbon stock change, tonnes C yr^{-1}

$C_{t,1}$ = forest carbon stock at time t_1, tonnes C

$C_{t,2}$ = forest carbon stock at time t_2, tonnes C

The terms $C_{t,1}$ and $C_{t,2}$ can be estimated with Equation 7.2b (adapted from the second part of Equation 2.8 in the IPCC 2006 GL). Like Equation 7.1, Equation 7.2b includes the area term representing activity data. Executing equation 7.2b without the area term will yield a per area carbon stock value for a given land stratum defined by ecological zone and climate domain.

Equation 7.2b: Part 2 of stock-difference method for estimating carbon stock change

$$C = \sum_{ij} \left\{ A_{i,j} \times V_{i,j} \times BCEF_{S_{i,j}} \times \left(1 + R_{i,j}\right) \times CF_{i,j} \right\}$$

Where:

[25] See IPCC GL, Section 2.3.1.1. Available here: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf

C = total carbon stock in living biomass in all forest land remaining forest land at a given point in time

$A_{i,j}$ = area of forest land remaining forest land (ha), in ecological zone *i*, and climate domain *j*

$V_{i,j}$ = merchantable growing stock volume (m^3 ha^{-1}) for forests in ecological zone *i* and climate domain *j*

$BCEF_{S_{i,j}}$ = biomass conversion and expansion factor for expansion of merchantable growing stock volume to aboveground biomass, tonnes aboveground biomass growth (m3 growing stock volume)$^{-1}$, for forests in ecological zone *i* and climate domain *j*

$R_{i,j}$ = ratio of belowground to aboveground biomass, tonnes dry matter below-ground biomass (tonnes dry matter aboveground biomass)$^{-1}$, for forests in ecological zone *i* and climate domain *j*

$CF_{i,j}$ = carbon fraction of dry matter, tonne C (tonne dry matter)$^{-1}$.

Gain-loss method

Equation 7.3: Gain-loss method for estimating the carbon stock change

$$\Delta C_B = \sum_{i,j} \left[G_{W_{i,j}} * \left(1 + R_{i,j}\right) * A_{i,j} * CF_{i,j} \right] + L_{wood-removals} + L_{fuelwood} + L_{disturbance}$$

Where:

ΔC_B = annual net change in C stocks in living biomass in all forest land remaining forest land, tonnes C yr^{-1}

i = ecological zone (*i* = 1 to *n*)

j = climate domain (*j* = 1 to *m*)

$G_{W_{i,j}}$ = average annual aboveground biomass growth rate for a specific forest type, tonnes dry matter ha^{-1} yr^{-1}

$R_{i,j}$ = ratio of belowground biomass to aboveground biomass of the specific forest type; for Tier 1, $R_{i,j}$ can be set to zero

$A_{i,j}$ = area of forest, hectares (ha)

$CF_{i,j}$ = carbon fraction of dry matter, tonne C (tonne dry matter)$^{-1}$.

$L_{wood-removals}$ = annual aboveground biomass C loss due to wood removals, tonnes C yr^{-1}

$L_{fuelwood}$ = annual aboveground biomass C loss due to fuelwood removals, tonnes C yr^{-1}

$L_{disturbance}$ = annual aboveground biomass carbon losses due to disturbances, tonnes C yr^{-1}

Guidance and equations for estimating $L_{wood-removals}$, $L_{fuelwood}$, and $L_{disturbance}$ are provided in the IPCC 2006 GL, Volume 4, Chapter 4.

With the gain-loss method, there are two options for estimating $G_{W_{i,j}}$ (average annual aboveground biomass growth rate).

- **IPCC default values**: Default values for net biomass growth are available in Table 4.12 of the IPCC 2006 GL, Volume 4, Chapter 4.
- **Mean annual growth**: Mean annual growth is also called mean annual increment (MAI). MAI describes the typical growth rates of trees in forests of a given type and age class. It is a fairly common measure collected by forestry agencies or forest managers. Consult the IPCC 2006 GL from further information on how to use MAI to estimate $G_{W_{i,j}}$.[26]

Further resources

Comprehensive guidance on estimating forest carbon stock changes in all carbon pools can be found in numerous resources.

- IPCC 2003 Good Practice Guidelines for Land Use, Land-Use Change and Forestry
- IPCC 2006 GL for AFOLU, Volume 4
- Global Observation of Forest Cover and Land Dynamics (GOFC GOLD) Sourcebook
- Winrock Standard Operating Procedures for Terrestrial Carbon Measurement 2016
- Global Forest Observation Initiative (GFOI) Methods and Guidance Documentation

The GOFC GOLD Sourcebook and GFOI Methods and Guidance Documentation are particularly relevant resources for estimating carbon stock change for multiple carbon pools for enhancing carbon stocks through afforestation/reforestation, enhancing carbon stocks through management, deforestation, and degradation. Where existing higher-tier data is available (including emission factors, biomass values or land stratification), such data can be used to increase accuracy and completeness of the estimate.

7.2.5 Calculate GHG emissions and removals

It is a *key recommendation* to calculate the cumulative GHG emissions and removals for the baseline scenario over the assessment period. Estimate annual carbon stock change for each land stratum each year in the baseline scenario using area data and carbon stock change equations provided above for land-use change (afforestation/reforestation and reduced deforestation) and forest land remaining forest land. Sum annual carbon stock change by stratum across all land strata to yield net annual carbon stock change on lands in the GHG assessment boundary.

Finally, sum the annual carbon stock changes for all years in the assessment period to yield cumulative carbon stock change in the baseline scenario. Convert the cumulative carbon stock change to GHG emissions expressed as tonnes of CO_2e by multiplying the cumulative carbon stock change by 44/12 and by -1. This yields total cumulative CO_2e emissions (positive) or removals (negative) for the baseline.

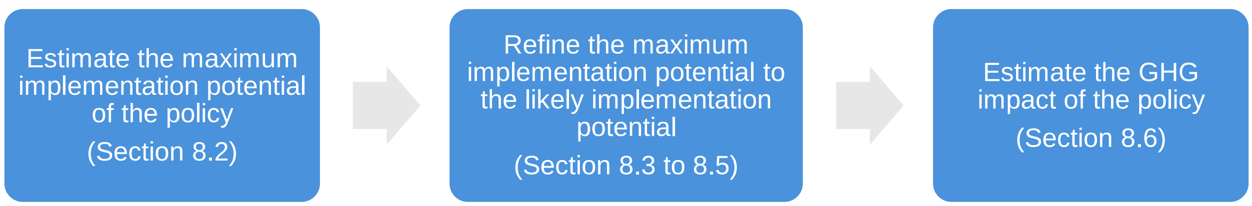
[26] See IPCC 2006 GL, Section 2.3.1.1 sub-section A.1 Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf

8. Estimating GHG Impacts Ex-Ante

This chapter describes how to estimate the expected future GHG impacts of the policy (ex-ante assessment). Users estimate the maximum implementation potential of the policy based on the causal chain that was developed in Chapter 6. Then users evaluate how barriers to implementation and other factors may limit its overall effectiveness, and determine the likely implementation potential of the policy. The likely implementation potential represents the effects that are expected to occur as a result of the policy (most likely policy scenario). Implicitly, these effects are relative to the baseline scenario.

There are two ways that users can estimate the GHG impacts of the policy scenario based on the implementation potential of the policy. Using the emissions approach, the GHG impacts are estimated by subtracting the baseline emissions (as determined in Chapter 7) from policy scenario emissions (as determined in this chapter). Alternatively, users can estimate the relative change in GHG emissions based on the likely implementation potential of the policy, using the activity data approach.

Figure 8.1: Overview of steps in the chapter



Checklist of key recommendations

- Determine the maximum implementation potential of the policy
- Analyze policy design characteristics and national circumstances that may reduce the effectiveness of the policy, and account for their effect on the maximum implementation potential
- Analyze the financial feasibility of the policy for each stakeholder group, and account for the effect on the implementation potential of the policy
- Analyze other barriers that could reduce the effectiveness of the policy and account for their effect on the implementation potential
- Estimate the GHG impacts of the policy

8.1 Introduction to estimating the implementation potential

The policy scenario represents the events or conditions most likely to occur in the presence of the policy being assessed. The method focuses first on estimating the *maximum implementation potential* of the policy. The maximum implementation potential of the policy assumes that all inputs, activities and intermediate effects in the causal chain are highly likely to occur as planned and at the implementation level intended by the policy. It represents the intended policy outcome or policy effectiveness. The maximum implementation potential is then refined to the likely implementation potential (e.g., most plausible policy scenario) by taking into account factors that could reduce the effectiveness of the policy.

Methods are provided in the subsequent sections on how to estimate the implementation potential of the policy based on policy design characteristics and national circumstances (Section 8.3), financial feasibility

(Section 8.4), and other barriers (Section 8.5). Figure 8.2 outlines the steps to this process. Most of the analysis in Sections 8.2 – 8.5 will be qualitative and require expert judgment, expert elicitation and/or stakeholder input. Guidance on expert judgment is provided in Section 4.2.4.

Figure 8.2: Overview of steps for estimating the likely implementation potential of the policy

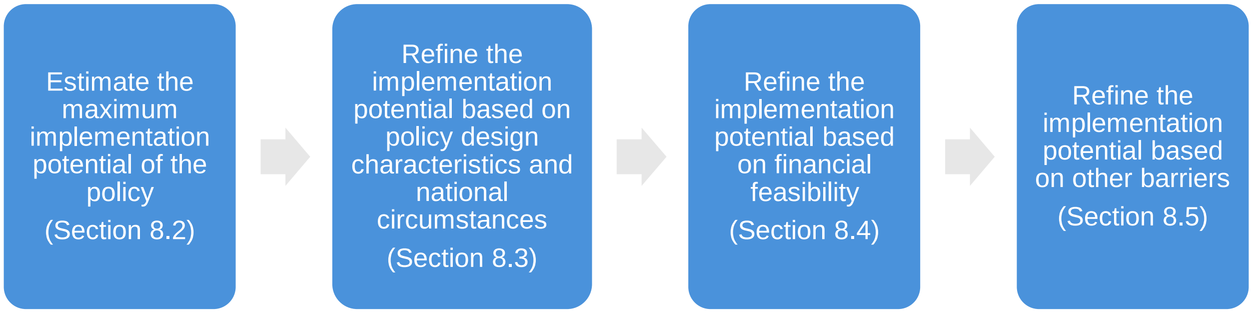
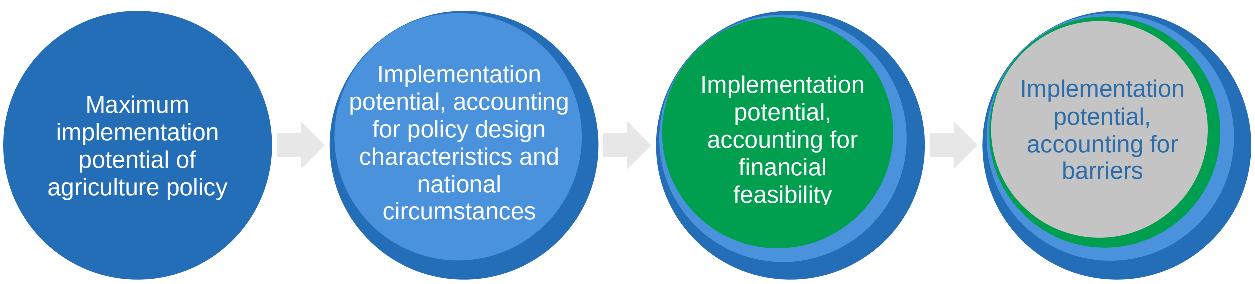


Figure 8.3 illustrates how the maximum implementation potential of the policy is refined after each step to achieve a more realistic estimate of the implementation potential. When determining the likelihood and magnitude of each refinement step, implicitly, assumptions should be applied to the implementation potential quantified in the previous refinement step so that the total reduction from maximum implementation potential to likely implementation potential is calculated in an accurate and step-wise manner. It is possible that the policy's likely implementation potential could exceed the estimated maximum implementation potential. This could occur where policies have a reinforcing effect (as discussed in Section 5.2.1).

Figure 8.3: Refining the maximum implementation potential to the implementation potential



These steps focus on estimating the implementation potential of the policy in terms of activity data rather than GHG emissions. Examples of such activity data are discussed in Section 8.2. The GHG impacts for each GHG source or carbon pool in the GHG assessment boundary will be determined using the final refined estimates of the activity data after completion of the four steps, following the method in Section 8.6.

Where quantitative information about how a factor is likely to impact the implementation potential of the policy is available, it can be used to estimate the effect of the policy. For example, an analysis may indicate that a barrier reduces the effectiveness of the policy intervention by 5%. The reduction of the effectiveness can apply at two different levels:

- **General level**: The barrier affects the entire policy (e.g., barriers that hinder the deployment across all components of the policy). In this case, the 5% reduction applies to the overall policy effect.

- **Component level**: The barrier only affects one specific aspect of the policy (e.g., a barrier may hinder the policy implementation for only a segment of the total population, one of the land-use categories considered, some regions of the country or the adoption rate of one agricultural practice). In this case, the 5% reduction applies only to the specific aspect of the policy affected by the barrier.

To the extent possible, identify a single policy scenario that is considered to be the most likely. In certain cases, multiple policy scenario options may seem equally plausible. Users can develop multiple policy scenarios, each based on different sets of assumptions, rather than just one set. This approach produces a range of possible emission reductions scenarios. Users can then conduct a sensitivity analysis to see how the results vary depending on the selection of policy scenario options. More guidance about conducting a sensitivity analysis is provided in Chapter 12 of the *Policy and Action Standard*.

An example is used to demonstrate how to estimate the implementation potential of a policy. A description of the example is provided in Box 8.1. The implementation potential of the example policy is assessed on the basis of the estimated number of hectares of land on which the policy will be implemented.

Box 8.1: Example of forest policy for national or subnational level GHG mitigation

The government is considering the option of promoting sustainable forest management and afforestation/reforestation through the introduction of a payment for ecosystem services (PES) programme combined with a new tax legislated for users of ecosystem services. Government officials are in the initial phase of the policy development process and need to consider all aspects relating to legislating, designing and implementing the policy intervention. It is expected that the national legislative body will enact a new tax for all users of ecosystem services (primarily for water and hydroelectric utilities, but other sectors may be included such as tourism companies). The national taxing agency will collect the tax, which will fund a new PES programme (estimated to be about 1-2% annual revenue) to provide programme incentives, as well as administrative and operational expenses.

The goals for the PES programme are to 1) expand SFM activities and 2) promote A/R through tree planting or natural regeneration.

Further details on the policy can be found in Section 5.1.

8.2 Determine the maximum implementation potential

It is a *key recommendation* to determine the maximum implementation potential of the policy. For each GHG source or carbon pool in the GHG assessment boundary, choose a type of activity data to assess the implementation potential of the policy. The type of activity data chosen should be a parameter that is expected to change as a result of the policy (e.g., hectares of forest land prevented from being converted to cropland), and be used to estimate GHG impacts. Therefore, the activity data serves as a proxy for the policy outcome. The maximum implementation potential is expressed in terms of activity data. Table 8.1 provides examples of the types of activity data to consider.

Table 8.1: Examples of types of activity data for analyzing implementation potential

GHG source or carbon pool	Policy	Activity Data
Biomass and soil carbon	• Incentives for sustainable forest management • Payments for afforestation/reforestation • Technical assistance to improve management • Introducing and improving systems to effectively enforce existing or new environmental regulation	• Hectares of forest land prevented from being converted to non-forest land • Hectares of forest land remaining forest land where management is improved • Hectares of forest land remaining forest land where sustainable forest management is implemented • Hectares of cropland converted to forest land • Hectares of grassland converted to forest land

The maximum implementation potential can be estimated based on a number of elements. The options include using a mitigation goal, expected adoption of practices or technologies, financial considerations, land area and other resource potential, and expert judgment. Each element is further explained below. The maximum implementation potential is the theoretical intent of the *policy effect* without "friction" created by barriers that limit the policy's efficacy. The maximum implementation potential can be estimated using a single element or a combination of elements. A combination will likely yield a better estimate.

8.2.1 Mitigation goal

When there is an intended level of mitigation and/or an explicit goal for the policy, the goal along with other details of the policy can be used to estimate the maximum implementation potential. A mitigation goal may include, among other things, the target amount of emission reductions to be reduced or carbon stocks enhanced as a result of the policy, the targeted amount of land area or adoption rate, or the total expected emission reductions and removals from a specific GHG source or carbon pool. The mitigation goal may not be in the same units as the activity data, and additional information from surveys and national statistics may be needed to estimate how the goal will translate into actions or land areas. For example, an explicit goal for a forest policy could be to increase the minimum diameter cutting threshold on all publicly managed timber forests by 2020.

Where the results of the assessment will be used to meet the reporting requirements of the transparency framework, users should consider aligning the parameters used for the emissions projections of forest policies with those used to develop sectoral projections. It is recommended to align the timeframe used for the emissions projections of forest policies with the timeframe used for sectoral projections developed to meet the reporting requirements of the transparency framework (i.e., the starting and final year of the assessment period developed for a forest policy should be the same as the starting and final year of the forest sector projections).

Using a stated goal as the main indication of intended policy outcomes or policy effectiveness can be highly uncertain. At a minimum, the mitigation goal needs to be specific enough to reflect an intended level of mitigation.

8.2.2 Adoption of practices or technologies

The expected level of adoption of the practice or technology that is targeted by the policy can be used to estimate the maximum implementation potential. The main assumption would be that targeted stakeholders will fully engage voluntarily, or fully comply where the policy is mandatory.

Information about stakeholders can be identified from the causal chain, policy description, and other sources. It can be used to infer the amount of land area or number of livestock affected by the policy, such as:

- The stakeholders targeted by the policy
- The average sized parcel of land owned or utilized by a stakeholder group
- The typical amount of forest products extracted or crops produced per person
- The number of cattle or other animals managed by stakeholders in a specific region

8.2.3 Financial considerations

Comparing the cost of implementing mitigation practices or using technology (e.g., $/head to provide a feed supplement to livestock) to the total financing available for the policy can be used to estimate the maximum implementation potential. Information on the unit cost of implementing new technologies or practices might be available through studies that have been commissioned and funded by the government, an international organization or academia. Where unit cost information is not available, other sources can be used as a first approximation, including the following:

- Consultations with stakeholders on costs in different parts of the country and for different activities (such information could also be derived from scientific journals)
- Figures obtained from other marginal abatement cost curve models or from articles or studies published in scientific journals

Where unit cost figures are derived from global data, journals or studies relating to other countries, users should ensure that unit cost information is suitable or representative of national circumstances.

Users also need an indication of the financial resources that will be allocated to a specific policy from the national budget and other funding sources (e.g., private sector, national or international donors, or international or regional funds) to estimate implementation potential from financial data. This information may be available from the description of inputs developed in Section 6.1.1, Step 2.

The unit cost combined with total investment level can be used to estimate maximum potential implementation levels. For example, if a policy includes plans to invest USD 1 million in reforestation and it costs USD 100 per hectare to implement, the maximum implementation level of the policy can be estimated as 10,000 hectares of reforestation. Ideally this value would be reconciled with an estimate of maximum available area of land for reforestation using land area data to ensure that it is realistic to assume at least 10,000 hectares could be reforested.

Note that this analysis focuses on policy-level financing (e.g., national and sectoral-level). A method is provided in Section 8.3 for how to assess the financial feasibility of a policy from the perspective of landowners.

8.2.4 Land area and other resource potential

Analyzing the availability of land is another way to estimate maximum implementation potential, meaning identifying the total area of land upon which there is technical potential for a specific mitigation practice or land-use change to occur. The assumption would be that all available land is affected by the change in management or land use as a result of the policy. For example, if a policy aims to convert highly degraded pasture to productive silvopastoral systems, and there are 50,000 hectares of highly degraded pasture within the policy jurisdiction, assume the policy will result in 50,000 hectares of pasture used for silvopasture.

To use this approach for estimating maximum implementation potential, information on current land management and land uses is needed. Such data can be found in or derived from the following sources:

- National land cadastre
- National agricultural census data
- Land-use titles
- Local or regional land registration offices
- Farmer or logger associations
- Logging permits
- Timber-harvesting statistics

Analyzing the technical potential of other resources besides land area can be used to estimate adoption rates for new practices or technologies. For policies that reduce emissions from enteric fermentation, the total number of livestock in the country or the total number of ranchers could be used to analyze the maximum implementation potential. For example, if a policy seeks to increase use of feed supplements in dairy cattle, it can be assumed that all dairy cattle within the policy jurisdiction will receive the feed supplements as a result of the policy.

8.2.5 Expert judgment

Expert judgment can be paired with any of the approaches above to derive an informed estimate of the maximum implementation potential. Sector specialists (e.g., farmers, ranchers, foresters, scientists who study the technologies or practices promoted by a policy, statisticians, and government staff familiar with the policy) can help to fill gaps in available data or provide a range for the maximum implementation potential. Experts can also help users identify suitable values of the policy outcome or policy effectiveness from estimated ranges. When consulting experts, information can be obtained through an expert elicitation process (described in Section 4.2.4).

8.2.6 Example of determining maximum implementation potential

The PES policy has the goal to engage stakeholders in voluntary contracts with the Ministry of Environment to provide ecosystem services on a total of 60% of private forest lands and 25% of low productivity cropland over 10 years. The policy specifically intends to implement sustainable forest management on private forest land and afforestation/reforestation activities on cropland. The maximum implementation potential is determined for the policy activities on each land category.

Based on data from the latest national forest census, the total area of privately owned forest land in the country is 250,000 hectares; 60% of this area is 150,000 hectares. From national agriculture statistics it is known that the total area of low productivity cropland is 240,000 hectares; 25% of that is 60,000 hectares. Therefore, over 10 years, the goal of the policy is for 150,000 more hhectares of forest land remaining forest land be brought into sustainable forest management and 60,000 more hectares of cropland be converted to forest land as a result of the policy. The values can be annualised evenly over 10 years (e.g., 15,000 hectares per year for 10 years), annualised following a non-linear trend based on estimated timing of implementation, or considered cumulatively (i.e., 150,000 hectares total over 10 years). The land areas (150,000 and 60,000 hectares, respectively) are considered as the maximum possible land areas for policy intervention.

Additional information in the policy design indicates that to meet the goal of converting cropland to forest land, the policy aims to promote three types of practices: general tree planting, tree planting with endangered species, and natural regeneration, with land owner payments for each practice of USD 1,000 per hectare, USD 1,500 per hectare, and USD 500 per hectare, respectively. Discussion with programme managers in the Ministry of the Environment indicate that they believe most of the budget should go to funding natural regeneration because of its relatively low cost and comparable benefits to the other practices and only a small share should fund tree planting with endangered species, with the remaining funding going to general tree planting. Based on these priorities, the total amount of land where each practice will be adopted as a result of the policy was estimated. Table 8.2 below provides the maximum potential estimated land areas affected by the policy, by practice, cumulatively for the 20-year assessment period.

Table 8.2: Example of maximum implementation potential

Policy activity	Maximum implementation potential (in ha)
SFM	150,000
Tree planting general	15,000
Natural regeneration	40,000
Tree planting with endangered species	5,000

8.3 Account for policy design characteristics and national circumstances

It is a *key recommendation* to analyze policy design characteristics and national circumstances that may reduce the effectiveness of the policy, and account for their effect on the maximum implementation potential.

Section 8.3.1 provides a method for analyzing policy design characteristics and national circumstance (Step 1) and estimating their effect on maximum implementation potential (Step 2). Section 8.3.2 provides some further considerations to help with this analysis. Section 8.3.3 provides a worked example to illustrate the steps.

8.3.1 Method for accounting for policy design characteristics and national circumstances

Step 1: Analyze policy design characteristics and national circumstances

Compile information on the policy design characteristics and national circumstances using the questions provided in Table 8.3. The questions relate to the effect of policy design characteristics and national circumstances on policy effectiveness. The questions can be revised or further questions can be added, as needed, to ensure that the analysis is relevant to the policy and national circumstances.

Information can be gathered through expert elicitations with administration and government experts that are directly or indirectly involved in the policy under consideration, desk reviews and stakeholder consultations. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for further information on designing and conducting consultations with stakeholders.

Answer each question and score each response based on its potential to have a positive or negative effect on the effectiveness of the policy, on a scale of 1 to 4, as follows:

1 = Likely to have a positive (reinforcing) effect

2 = Likely to have no effect (no discernible positive or negative effect)

3 = Likely to have a negative effect

4 = Unknown

Table 8.3: Questions for identifying policy design characteristics and national circumstances

1. Institutional arrangements and national circumstances	
a.	Can the policy be implemented with existing governance structures, institutional arrangements and legal mechanisms?
b.	Is there corruption in the areas or regions under consideration, and if so, how extensive?
c.	Is there clear title and rights to stakeholders receiving the benefits offered by the policy?
d.	How well will the levels of governance that influence land use be able to coordinate to achieve the intended outcome?
e.	How well can coordination (e.g., resources, enforcement or data sharing) be carried out at subnational levels (e.g., between local municipalities), if necessary, according to the policy?
2. Participation requirements	
a.	Is participation or compliance with the policy voluntary or mandatory?
3. Compliance monitoring and enforcement	
a.	Is there a monitoring programme planned or in place to inspect policy implementation?
b.	Is there an enforcement measure that is part of the policy? If so, to what degree are similar standards, rules and regulations enforced and how?
4. Complementarity and synergies	

a.	To what extent will supporting or complimentary policies and actions in effect during the policy implementation period improve policy effectiveness?
b.	To what extent is the policy part of an interdisciplinary approach linking food security, ecosystem services and/or sustainable development?
c.	Are there supportive measures in place to build the capacity and technical skills in affected stakeholders who will be implementing the policy?
5. Policy implementation risks	
a.	To what extent are the intended policy outcomes vulnerable to risks (including natural events and disasters) that could jeopardize or reverse the policy outcomes?
b.	Have research and pilot studies been conducted in the areas where the policy will be implemented and do they demonstrate that the expected outcomes of the policy are feasible?

Step 2: Evaluate the overall distribution of scores and estimate the effect on maximum implementation potential

Once policy design characteristics and national circumstances have been analyzed and scored, evaluate the overall distribution of scores:

- A distribution with many scores of 1 or 2 indicates less need to refine the estimated maximum implementation potential of the policy.
- A distribution with many scores of 3 or 4 could suggest a downward adjustment of the maximum implementation potential or gathering more information and reassessing the impact, especially for scores of 4.

Carefully review each score of 3. Consider and, if possible, estimate to what extent the factor will decrease policy effectiveness. Describe and justify the reduction. In addition, look for crucial problems that have the potential to render the policy ineffective. If even one crucial problem is identified, it is recommended to reconsider the policy design. It is recommended to identify, where possible, potential corrective action to minimize the negative impacts. For example, after following the method in this section the user may reduce the geographic scope of impact, reduce the expected adoption rates or delay the timing of the implementation of a policy.

For scores of 4, attempt to gather enough information to assess the effect of the factor. If that is not possible, it is conservative to assume it will have a negative effect.

A positive impact may reinforce the implementation of the policy through, for example, synergetic effects between policies. Where a situation may increase policy effectiveness, it is conservative to not estimate any potential positive impact or make any positive adjustments to the expected policy outcomes.

8.3.2 Considerations for accounting for policy design characteristics and national circumstances

This section describes a number of considerations to bear in mind when following the steps in Section 8.3.1.

Institutional arrangements and national circumstances

Institutional arrangements are formal or informal legal and procedural agreements between agencies executing a policy. They can include arrangements between government agencies or with government and non-government or private sector agencies. National circumstances are the conditions present in the country. They include, among others, the government structure, population profile, cultural context, geographic profile, climate profile and the structure of the economy.

Lack of a governance structure, coordination between national and subnational levels or legal basis for providing incentives to stakeholders are critical considerations that can inhibit the successful implementation of the policy if not addressed appropriately. In countries without established institutional arrangements or an effective legal framework to secure the cooperation between different government levels and the involvement of key stakeholders (including private, public or non-governmental), policies will likely be limited in their effectiveness.

Many ministries or other government agencies often have difficulties in hiring and retaining new staff primarily due to budgetary and administrative constraints. Where staff and infrastructure (e.g., offices, equipment, vehicles or fuel) necessary for the policy implementation are not in place prior to policy implementation, policy implementation may not move forward as expected, reducing the effectiveness of the policy.

Corruption in national or subnational government structures can also play a detrimental role in the implementation of the policy. Corrupt practices may involve politicians, local leaders, governmental and/or non-governmental actors and result in implementation problems relating to land concessions, the allocation of contracts (e.g., favouring friends or relatives), allowing illegal practices (e.g., logging without permits), and misuse of funds intended for the policy.

Participation requirements

Participating in the policy, by people or organizations, can be voluntary or mandatory. Voluntary participation relies on the willingness of stakeholders to respond to a policy, offers flexibility in terms of who participates and how, and can involve less oversight and enforcement. In the absence of strong incentives, voluntary participation is unlikely to result in high participation and is more likely to result in a policy whose impacts are indistinguishable from the baseline scenario. Other factors that can help or hamper participation include effective communications and training for target stakeholder groups.

Mandatory participation can be accompanied with specific obligations and can be enforced through strict procedures, including penalties for cases of non-compliance. Mandatory participation works better in cases where the progress of the policy implementation can be effectively monitored and enforced. However, bribery and corruption could reduce the potential impact of the policy.

Compliance monitoring and enforcement

Monitoring and enforcement are mechanisms to compel stakeholders to comply with a policy. Monitoring is the process of inspecting that the policy is being implemented and enforcement is an action taken against those who are not in conformance with the policy. The policy may include measures to monitor and/or enforce policy implementation.

When stakeholders understand that policy implementation will be monitored, it is more likely that implementation will occur. If monitoring procedures are already in place or are planned (e.g., due to the existence of other similar policies or projects in a region), this should be taken into account, as it can help ensure that the policy is implemented effectively. In the absence of monitoring procedures, the policy may not be implemented as effectively as expected.

Local enforcement agencies and other stakeholders should be consulted to determine the likelihood that standards, rules or laws will be enforced. The likelihood of enforcement (e.g., 90% chance of enforcement) should then be used to refine the implementation potential of the policy (e.g., reduce the impact by 10%). If penalties for non-conformance with the policy are minor, enforcement may not be as effective at ensuring compliance.

Complementarity and synergies

GHG mitigation policies that contribute to local sustainable development and promote better local conditions are far more acceptable to local communities and usually have a far better chance of uptake and success (e.g., policies that have health benefits due to reduction of local air pollution, reduce loss of biodiversity, address desertification issues, protect water resources or improve food security for poor communities).

The implementation of GHG mitigation policies can be positively or negatively affected by other complementary policies. For example, a policy to reduce water pollution from agricultural runoff may drive changes in land management that reduce fertilizer use and increase use of cover crops, which are practices that can reduce N_2O emissions from soils and increase soil carbon sequestration.

Interventions that provide education and technical assistance do not reduce GHG emissions directly. However, they may be pivotal in developing the capacity of land managers to implement new technologies and practices that reduce GHG emissions. Therefore, the presence of such interventions can be synergistic with GHG mitigation policies.

Policy implementation risks

Agriculture and forest productivity are greatly impacted by weather conditions, climate and water. Food, forests and wood production are often impacted by natural events and disasters. For example, forest fires, floods, droughts, extreme weather events (e.g., hurricanes and tornadoes), diseases and pests can have negative consequences.

The assessment should consider the effect of natural events and disasters. If areas that are known to be prone to extreme conditions are included in the geographic scope of the policy, the expected implementation potential of the policy should be reduced because the policy will likely be ineffective in those areas. However, even if there is no previous history of disaster risk, users may still consider reducing the implementation potential of the policy to account for unanticipated disasters.

The evaluation should also consider the risk that the policy will not be as successful as anticipated at reducing GHG emissions as a result of limited data and research. For example, where research and pilot studies have not been conducted in the areas where the policy will be implemented there is risk that implementation and/or impacts of the policy will be hampered by lack of experience and proof of concept, and this could reduce policy effectiveness.

8.3.3 Example of accounting for policy design characteristics and national circumstances

The screening questions from Table 8.3 were reviewed and policy design characteristics and national circumstances were analyzed (Step 1). The participation requirements category is evaluated from the perspective of voluntary participants in SFM and A/R, as well as from users of ecosystem services. An additional question was added to reflect this. Extensive consultation with experts resulted in responses and scores shown in Table 8.4.

Table 8.4: Example of accounting for policy design characteristics and national circumstances

1. Institutional arrangements and national circumstances		**Score**
a.	*Can the policy be implemented with existing governance structures, institutional arrangements or legal mechanisms?* Sufficient governance structures are in place to oversee the policy implementation.	2
b.	*Is there corruption in the areas or regions under consideration, and if yes, how extensive?* Corruption is confined to small communities where local leaders are known to receive bribes for favourable treatment of industry. Most of these communities are located in not easily accessible areas. After consulting with experts, it has been decided to assume that participation in the most remote communities will not result in the expected policy outcomes. These communities comprise an estimated 2% of the SFM area and 1.5% of the A/R area considered.	3
c.	*Is there clear title and rights to stakeholders receiving the benefits offered by the policy?* There is no legal basis for the participation of private sector in the PES programme. To address this, the policy defines a legal framework for the participation of private land owners.	2
d.	*How well will the levels of governance that influence land use be able to coordinate to achieve the intended outcome?* With the exception of two regions, the government and local authorities have a good working cooperation.	2
e.	*How well can coordination (e.g., resources, enforcement or data sharing) be carried out at subnational levels (e.g., between local municipalities), if necessary, according to the policy?* There are no subnational technical assistance or incentive programmes that conflict with the national policy.	2
2. Participation requirements		
a.	*Is participation or compliance with the SFM and A/R activities voluntary or mandatory?* Because of voluntary participation, experts believe that 85% of the landowners originally considered will participate. These landowners account for 77% of the SFM area and 96.5% of the A/R area considered, without taking into consideration the area reduction due to aspect 1d above.	3
b.	*Is participation or compliance in the ecosystem service programme voluntary or mandatory?* One out of the two hydroelectric utilities will not participate in the policy implementation because operations will be suspended due to the 5-year drought that has reduced the river flows that power the hydropower station. It was expected that the utility would contribute to about 15% of the total revenue that was to be raised.	3
3. Compliance monitoring and enforcement		
a.	*Is there a monitoring programme planned or in place to inspect policy implementation?* There is sufficient local enforcement capacity in the regions considered.	2

b.	*Is there an enforcement measure that is part of the policy? If so, to what degree are similar standards, rules, and regulations enforced and how?* The Ministry of the Environment will conduct annual audits on a random basis to monitor implementation of, and compliance with, best practice standards for SFM, tree planting and natural regeneration.	2
4. Complementarity and synergies		
a.	*To what extent will supporting or complimentary policies and actions in effect during the policy implementation period improve policy effectiveness?* There are complementary activities to regulate water and reduce the loss of biodiversity in the areas considered.	1
b.	*To what extent is the policy part of an interdisciplinary approach linking food security, ecosystem services and/or sustainable development?* There is a direct link to ecosystem services (PES scheme) and sustainable development as it will provide resources to local communities and will contribute to stopping the degradation of the local environment.	1
c.	*Are there supportive measures in place to build the capacity and technical skills in affected stakeholders who will be implementing the policy?* The policy incorporates educational programmes to raise awareness and enhance technical skills of local foresters.	1
5. Policy implementation risks		
a.	*To what extent are the intended policy outcomes vulnerable to risks (including natural events and disasters) that could jeopardize or reverse the policy outcomes?* About 35% of the areas considered have experienced extreme weather events in the last 5 years.	3
b.	*Have research and pilot studies been conducted in the areas where the policy will be implemented and do they demonstrate that the expected outcomes of the policy are feasible?* Scientific research in the National Study on Decarbonisation Strategies provides evidence that sustainable forest management and tree planting increase carbon sequestration.	1

The distribution of scores was evaluated (Step 2). Out of the 14 factors above, 10 received a score of 1 or 2, indicating that most factors considered are expected to have either a positive or no impact on the implementation potential of the policy. Four factors are likely to have a negative impact and received a score of 3. The 3's were related to corruption (1b), participation (2a and 2b), and policy implementation risks (5a). No factors had a score of 4.

The extent to which policy effectiveness may be reduced as a result of each factor was evaluated (Step 2). None of the factors receiving a 3 appear to be crucial problems that could completely hamper policy effectiveness. The impact on policy effectiveness was adjusted quantitatively[27].

The exclusion of communities with corruption problems (1b), the expectation of lower than planned voluntary participation of landowners (2a), and the potential risk of disasters (5a) will all result in an overall reduction in the amount of land area where the policy is effectively implemented. Table 8.5 below summarizes the estimated extent to which these aspects will reduce policy outcomes.

[27] In cases where quantifiable information is not available, estimates of the impact on policy effectiveness may be made using expert judgment based on the best available information. While it may be subjective, this is more conservative than not making an adjustment where the aspect considered is likely to have a negative impact.

Table 8.5: Example description and justification for reducing expected policy effectiveness

Description and justification for reducing expected policy effectiveness	Percent reduction in policy effectiveness	
	SFM	A/R
Participation in remote communities comprising 2% and 1.5% of the land areas for SFM and A/R targeted by the policy, respectively, will not yield expected policy outcomes because of corruption.	2%	1.5%
Experts estimate that only 85% of landowners offered the opportunity will participate because it is voluntary (77% of SFM; and 96.5% of A/R).	23%	0.50%
35% of the area target by the policy has experienced extreme weather events in the last 5 years. Using information on the impacts of these past events, experts estimate that about 5% of land enrolled in the programme will experience catastrophic weather during the assessment period that could prevent achievement of the expected policy outcomes in those areas.	5%	5%
Total potential adjustment (percent reduction in policy effectiveness)	30%	7%

The withdrawal of one hydroelectric utility (factor 2b) will reduce the expected tax revenue by 15% over 10 years. This reduction, however, is not expected to create a measureable impact as the overall SFM and A/R areas enrolled are also likely to be lower than expected (based on score for 2a). In any case, it would be desirable that other sources of revenue are identified to ensure that there will be no shortage of funding for the PES programme in the long-term.

Complementarity and synergy factors 4a, 4b and 4c could create interest and possibly increase support from stakeholders and participation from landowners who see the benefits of the policy. However, the potential positive impact is not quantified.

At the end of the analysis, the maximum area affected by the policy has been adjusted to reflect the quantifiable impacts of lower than originally designed participation and expected policy outcomes. The results are shown in Table 8.6 below.

Table 8.6: Example of refined implementation potential

Policy activity	Maximum implementation potential (in ha)	Refined implementation potential based on policy design and national circumstances (in ha)
SFM	150,000	105,000
Tree planting general	15,000	13,950
Natural regeneration	40,000	37,200
Tree planting with endangered species	5,000	4,650
Total	210,000	160,800

8.4 Account for financial feasibility

It is a *key recommendation* to analyze the financial feasibility of the policy for each stakeholder group and account for the effect on the implementation potential of the policy.

Financial feasibility analysis determines whether enough money is being invested in the policy to ensure that stakeholders will participate or otherwise respond to the policy. Where the policy's implementation costs outweigh its benefits for a given stakeholder critical to the implementation of the policy, its effectiveness can be affected.

There is no one single way to perform a financial feasibility analysis. It may take the form of a complex and rigorous assessment (e.g., a detailed financial return on investment model) or a simple analysis (e.g., a checklist of financial costs and benefits). Determine the specific type of analysis based on the data available.

Sources of information for conducting financial feasibility are, in order of preference:

- Existing calculations of the costs and benefits of policies for an individual stakeholder that were done during the policy design phase (as long as these are deemed reliable)
- Implementation cost analyzes
- Exiting national cost studies
- Global cost studies
- Expert judgment based on assessments or desk review

In the absence of other available resources, a method is provided in the sections below for performing a basic cost analysis. Section 8.4.1 provides a method for analyzing financial feasibility. Section 8.4.2 provides some further considerations to help with this analysis. Section 8.4.3 provides a worked example to illustrate the steps.

Before starting the cost analysis, some questions to consider are:

- Do some stakeholders bear significant new net costs under the proposed policy? If so, which ones and what are the costs?
- Do some stakeholders realize significant new net financial gain under the proposed policy? If so, which ones and what are the gains?
- What goods and services are produced commercially from lands that are the target of the policy, both before and after policy implementation? Is production likely to increase or decrease as a result of the policy?
- Is the policy potentially in conflict with economic development?
- Will the policy strengthen important supply chains?

8.4.1 Method for accounting for financial feasibility

Step 1: Identify stakeholder groups to analyze

In Section 6.1.1, users identified the stakeholders of the policy. Those stakeholders are the focus of this analysis, in particular stakeholders that implement changes in practices, technologies or land use in response to the policy. Each stakeholder group should be included in the financial feasibility analysis and the net costs and benefits for each group considered separately. Where there is not sufficient data and information to analyze all stakeholder groups separately, at minimum include the following groups in the analysis:

- Stakeholders with official land tenure rights or de facto control of lands addressed by the policy
- Stakeholders that use the lands addressed by the policy but have limited actual control over the lands

It can be difficult to distinguish between stakeholders with official tenure to land and stakeholders that use the lands affected by the policy without tenure. In such cases, focus on the main stakeholder group that expected to implement the mitigation measures.

Step 2: Calculate net cash flows for each stakeholder group

In a basic implementation cost analysis, net cash flows are estimated for a typical stakeholder in each stakeholder group under baseline and policy scenarios. It is best if the financial feasibility analysis is done in the local currency. If foreign investment is required or if loans are denominated in a foreign currency, it is still best to do the analysis in the local currency and then convert the results to the foreign currency. Often some factors will be in foreign currency. In this case, the exchange rate should be entered in only one location in the analysis calculations, allowing updating of the entire analysis upon changing the exchange rate at that one location. Then if the exchange rate changes, the quantification can be easily updated. If the analysis is done in a foreign currency, there is a risk of currency fluctuations altering the conclusions of the analysis.

Where inflation is likely (e.g., over longer periods of time) apply a discount rate and calculate a net present value for the cash flows to take into account the future value of money. Non-discounted values can be used if inflation is not likely during the analysis period (e.g., five years or less). Table 8.7 provides more for information on metrics for financial analysis.

Different stakeholders should have different discount rates. For example, the discount rate for a government is generally much lower than a discount rate for a corporation, and the discount rate for a corporation that has access to capital is often much lower than the discount rate of a smallholder farmer. Appendix B provides additional information on discount rates. To enable comparison between stakeholder groups, the costs should be normalized, for example per hectare, per operation or per head of livestock or per person.

Table 8.7: Definitions of common terms used in financial analysis

Term	Definition
Cash flows	The net amount of cash and cash-equivalents moving into and out of a business. Positive cash flow indicates that a company's liquid assets are increasing, enabling it to settle debts, reinvest in its business, return money to shareholders, pay expenses and provide a buffer against future financial challenges. Negative cash flow indicates that a company's liquid assets are decreasing. Some stakeholders will not implement an action that has a negative net cash flow at any time.
Discount rate	The interest rate you need to earn on a given amount of money today to end up with a given amount of money in the future. The discount rate accounts for the time value

	of money, which is the idea that a dollar today is worth more than a dollar tomorrow given that the dollar today has the capacity to earn interest.
Present value	The current worth of a future sum of money or stream of cash flows given a specified discount rate. Future cash flows are discounted at the discount rate, and the higher the discount rate, the lower the present value of the future cash flows.
Rate of return	The gain or loss on an investment over a specified time period, expressed as a percentage of the investment's cost. Gains on investments are defined as income received plus any capital gains realized on the sale of the investment. The general equation of the rate of return is: (Gain of Investment – Cost of Investment) / Cost of Investment

Source: Adapted from Investopedia.

To estimate net cash flows:

1. Estimate baseline scenario costs and revenues using present day data for a typical stakeholder that will take part in the policy, repeating this separately for each stakeholder group. Taking into account how the land area under consideration would be used without the policy (e.g., what is produced on the land and how much, considering for example, animal farming, croplands, set asides or logging)

   Average cost and revenue figures can be used for groups of land categories. For example, use average expense and income from all cropland areas (irrespective of the type of the crop); group together fallow land and set asides and derive average values for those lands; or use national average timber harvest statistics and prices.

   Include costs of inputs and costs of production, in addition to revenues from sale of goods. Key input costs include raw materials, equipment, labour, permits to operate, and other costs entailed in producing and selling the goods. For example, in agriculture costs include fertilizer and seed for crops, cost of fencing for cattle, feed, feed additives and medications. Input costs may include taxes on operations or land that must be paid from revenues from the sale of goods.[28]

2. Estimate the baseline scenario net cash flow (i.e., revenues minus costs) over the assessment period, separately for each stakeholder group.

3. Estimate the policy scenario costs and revenues over the assessment period, separately for each stakeholder group. This includes determining:

   - The amount and type of government or private funding committed to implementing the policy
   - The cost to the stakeholder to implement the policy
   - The revenues that the stakeholder will gain from the policy

[28] The European Commission Guide to Cost-Benefit Analysis of Investment Projects can be a useful resource for how to identify costs and revenues, calculate discounted cash flows, and implement other aspects of financial and economic feasibility analysis. Available at: http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

4. Estimate the net cash flow for a typical stakeholder in the policy scenario, separately for each stakeholder group

Step 3: Assess financial feasibility

Compare the net cash flow for the baseline scenario with that for the policy scenario to assess financial feasibility, as follows:

1. Determine whether the total net cash flow for the policy scenario exceeds the net cash flow for the baseline scenario. This must be the case for the policy to be financially feasible.
2. Determine whether the total net cash flow for the policy scenario is positive. This must be the case for the policy to be financially feasible.
3. When the net cash flow for the policy scenario is positive, compare the discounted cash flow (net present value) and rate of return (for the general formula see Table 8.7) in the baseline and policy cases. For the policy to be financially feasible, the rate of return on the policy case must be higher than the baseline rate of return by more than three percentage points.

Repeat this analysis for each stakeholder group identified and all activities covered by the policy.

Step 4: Estimate the extent to which financial aspects will limit policy outcomes

Based on the results of the financial feasibility assessment, decide how the implementation potential of the policy will be affected, as follows:

- Where the policy does not appear to provide sufficient incentive for stakeholders to participate or otherwise respond to the policy, either reconsider the design of the policy (or the relevant component of the policy) or refine the implementation potential of the policy.
- Where the policy appears to provide sufficient incentive for stakeholders to participation or otherwise respond to the policy, continue to the next step without revising the implementation potential of the policy.

8.4.2 Considerations for accounting for financial feasibility

Below are additional considerations when deciding how the implementation potential of the policy will be affected.

- In addition to discounted costs and revenues, the financial analysis should consider the relative timing of costs and revenues, and the capital needed to achieve these cash flows. If costs occur before revenues, stakeholders must have access to funds to pay the costs or they may not behave as expected.

  Shifts in timing of returns can be large for afforestation and reforestation. There are considerable costs in establishing stands of trees, but there may be negligible revenues for years while the trees grow to have commercial value. As a result, many forestry projects are only financially feasible with low discount rates. For entities with high discount rates, such as most smallholder farmers, even modest seasonal delays in revenue relative to expenditures can create a significant barrier to implementation. Delaying the harvest season can be a barrier to food insecure households that do not have other crops to eat during the delay.

- In general, unless the policy increases net revenue to stakeholders, or reduces their risks, the policy is unlikely to be adopted voluntarily.

  Policies that provide a net financial benefit may have little incentive for adoption if the net gain is small relative to overall cash flows.

  Investors, farmers, landowners and other stakeholders are often risk averse. Some policies offer stakeholders a positive financial return, yet still fail to be adopted, because stakeholder's view returns as too uncertain or risky. For example, they may not be confident payments in the future will be made, contracts will be honoured, or the policy will have ongoing political and budgetary support. As a result, assessing simple return on investment alone may not give a reliable indication of the likelihood of policy adoption. Financial risk can be quantitatively incorporated into the analysis by increasing stakeholder's discount rate, or qualitatively considered by consulting stakeholders on their likely response to specific real-world policy incentives.

- Some changes may have non-obvious costs. For example, a change may involve significant management labour costs to revise organizational processes or training new workers that are needed to provide different skills into the organization.

- It may be important to identify other financial considerations and sectoral policies and trends that may affect the outcome of the financial feasibility of the policy, and to consider whether these sectoral policies or trends reinforce or counteract the intended implementation (e.g., through price signals and consumer behaviour).

When a government is considering what policies to adopt, it may also want to consider the financial effects on society as a whole. However, such an evaluation is beyond the scope of this methodology.[29]

8.4.3 Example of accounting for financial feasibility

To estimate net cash flows, data on a per-hectare basis are used for annual costs and benefits for land areas affected by the policy, from the perspective of stakeholders managing the land. For this example, a cost analysis is conducted for tree planting activities on cropland. This example considers the first 10 years of implementation after the conversion of agricultural land into forest land, representing enough time to complete a harvest cycle and realize the value of timber from the planted trees.

The costs and revenues for the baseline scenario are estimated in Table 8.8. The baseline scenario assumes that there will be a continuation of current agricultural production for the next 10 years (constant baseline). The tables present annual data for Year 1, Years 2-9 and Year 10 of the policy. Negative numbers represent costs (expenses) and positive numbers represent revenues (income).

Table 8.8: Example calculation of baseline costs and revenues for continuation of agricultural production

	Annual costs and revenues for Year (USD/ha):			**Total**
Baseline	**1**	**2-9***	**10**	
Costs				
Farming labour	-100	-100	-100	

[29] A variety of sources are available that provide guidance on estimating net economic effects on society, including EC 2008.

Crop inputs (seed, fertilizer, equipment, fuel)	-100	-100	-100	
Land cost, taxes and concession fees	0	0	0	
Total cost	-200	-200	-200	
Revenues				
Crop revenues	250	250	250	
Net farming revenue, undiscounted	50	50	50	500
Net farming revenue, present value	50	[43 – 16]	14	289

* Years 2-9 are not shown for simplicity. Square brackets indicate the range of values during that time period. For example, [43 -16] means values range from USD 43/ha in Year 2 to USD 16/ha in Year 9

Table 8.8 provides average present day estimates for costs and revenues per hectare under the baseline scenario. The costs identified were farming labour, crop inputs (seed, fertilizer, equipment, fuel), and land cost, taxes and concession fees. The revenues identified include all income from selling the crops. The cost and revenue were kept constant for all 10 years. Based on these assumptions, a typical farmer has net annual revenues (or cash flow) of USD 50 per hectare. Applying a discount rate of 15% reduces the annual revenue from USD 50/ha in Year 1 to USD 14/ha by Year 10.

Next the costs and revenues for the policy scenario are estimated (Table 8.9). Under the policy scenario, the same cropland area is converted to forest land through general tree planting.

Table 8.9: Example calculation of policy scenario costs and revenues for general tree planting

	Annual costs and revenues for Year (USD/ha):			**Total**
Policy Scenario: Tree planting general	**1**	**2-9***	**10**	
Costs				
Planting cost	-1,000	0	0	
Land costs, taxes and concession fees	0	0	0	
Stand management and harvest cost	0	-10	-12,500	
Total cost	-1,000	-10	-12,500	
Revenues				
Timber	0	0	15,000	
Government payments for planting	1,000	0	0	
Government livelihood support	0	0	0	
Total revenue	1,000	0	15,000	
Net tree planting revenue, $/ha, undiscounted	0	-10	2,500	2,420
Net tree planting revenue, $/ha, present value	0	[-9 – -3]	711	665

* Years 2-9 are not shown for simplicity. Square brackets indicate the range of values during that time period.

Table 8.9 provides average present day estimates for costs and revenues per hectare under the policy scenario. The costs identified are planting cost for trees, land costs, taxes and concession fees, and stand management and harvest cost. It is anticipated that the farmer would have planting costs for Year 1 (USD 1,000/ha), stand management costs for Years 2-9 (USD 10/ha), and harvest costs for Year 10 (USD 12,000/ha, assuming a harvest of 50 m^3/ha, a harvest cost of USD 100/m^3, a processing cost of USD 50/m^3, and transport and tax cost of USD 100/m^3)

The revenues identified include government support for the planting of all trees in Year 1 (USD 1,000/ha), and income from selling the harvested timber in Year 10 (assuming a harvest of 50 m^3/ha, and a price of USD 300/m^3).

Comparison of discounted net revenues between the baseline (USD 289/ha) and policy (USD 665/ha) scenarios indicates that general tree planting activities may be profitable for farmers (Table 8.8 and Table 8.9). The net cash flow in the policy scenario is positive and exceeds the net cash flow for the baseline scenario. In both cases, the net revenue after 10 years of tree planting would be significantly higher than the net farming revenue.

However, yearly cash flow trends in the policy scenario show a net loss of income for 9 out of the 10 years of policy implementation. Because of this, some farmers may decide not to participate. Other farmers may be able to wait until Year 10 for the revenue from selling the harvested timber and would be more likely to participate. Without more information or refining of the policy design, participation is likely to be highly situational and difficult to predict.

Given this uncertainty, the policy design is reconsidered and an alternative scenario explored. The alternative scenario would be for the government to provide a low-interest rate (e.g., 4%) annual loan payment to compensate for the lost revenue (USD 50/ha/year) (see Table 8.10). The loan provides the farmer with annual income (although less than the baseline case) and the total loan value can be repaid from timber sale revenues in Year 10. If the policy is modified this way, broad participation in the programme is more likely. Table 8.10 demonstrates the costs and revenues of the redesigned policy for general tree planting with a low-interest rate loan.

Table 8.10: Calculation of policy scenario costs and revenues for general tree planting with a low-interest rate loan

	Annual costs and revenues for Year (USD/ha):			**Total**
Policy Scenario: Tree planting general	**1**	**2-9***	**10**	
Costs				
Planting cost	-1,000	0	0	
Land costs, taxes, concession fees	0	0	0	
Stand management & harvest cost	0	-10	-12,500	
Total cost	-1,000	-10	-12,500	
Revenues (with government support)				
Timber	0	0	15,000	
Government payments for planting	1,000	0	0	
Government livelihood support	50	50	-1,300	
Total revenue	1,050	50	13,700	
Net tree planting revenue, undiscounted	50	40	1,200	1,570

Net tree planting revenue, present value	50	[35 – 13]	341	571

* Years 2-9 are not shown for simplicity. Square brackets indicate the range of values during that time period.

Net cash flow estimates were made for natural regeneration and tree planting with endangered species for the A/R policy scenario (not shown), using the same constant baseline scenario as in Table 8.8 (continuation of current agricultural production for the next 10 years). Net cash flow estimate were also made for implementing SFM on privately owned forest land, where the constant baseline is the continuation of current forest management practices (not shown).

After considering all proposed activities, and adjusting some policy design aspects as described above, the policy was determined to be financially feasible for general tree planting and tree planting with endangered species. For SFM and natural regeneration, the policy scenario does not generate more revenue for landowners. Therefore, the policy design was modified further to increase payments for SFM and natural regeneration maintaining the overall budget level. To achieve this, the area of land targeted for SFM and natural regeneration will be reduced by 10%. This would result in the total land areas shown in Table 8.11.

Table 8.11: Refined implementation potential after financial feasibility analysis

Policy activity	Maximum implementation potential (in ha)	Refined implementation potential based on policy design and national circumstances (in ha)	Refined implementation potential based on financial feasibility (in ha)
SFM	150,000	105,000	94,500
Tree planting general	15,000	13,950	14,250
Natural regeneration	40,000	37,200	33,480
Tree planting with endangered species	5,000	4,650	4,750
Total	210,000	160,800	146,580

8.5 Account for other barriers

It is a *key recommendation* to analyze other barriers that could reduce the effectiveness of the policy and account for their effect on the implementation potential. This analysis is similar to that in Section 8.3 but focuses on institutional, cultural and physical barriers that may limit effectiveness of the policy.

Section 8.5.1 provides a method for analyzing these barriers and estimating their effect on implementation potential of the policy. Section 8.5.2 provides some further considerations to help with this analysis. Section 8.5.3 provides a worked example to illustrate the steps.

8.5.1 Method for accounting for other barriers

Step 1: Analyze institutional, cultural and physical barriers

Compile information on the barriers identified in Table 8.12 and consider how these barriers may affect the implementation potential using the questions provided. The questions can be adapted or further barriers and questions can be added as needed, to ensure that the analysis is relevant to national circumstances.

Information can be gathered through expert elicitations with administration and government experts that are directly or indirectly involved in the policy under consideration, as well as through desk reviews and additional stakeholder consultations. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for further information on designing and conducting consultations.

Answer each question and score each response based on its potential to limit the effectiveness of the policy, on a scale of 1 to 4, as follows:

1 = Likely to have no effect

2 = Likely to limit effectiveness

3 = Likely to prevent implementation

4 = Unknown

Table 8.12: Other barriers to policy implementation

1. Institutional barriers	
a.	Are there any conflicting goals or jurisdictions between ministries or other agencies with respect to the implementation of the policy?
b.	Is there the potential for institutional racism, gender bias or age discrimination that could limit the policy effectiveness, for example by limiting participation of certain stakeholders based on their race, religion, gender or age?
2. Cultural barriers	
a.	Are different languages used in the region where the policy will be implemented?
b.	Is the policy congruent with cultural norms and values?
c.	Are there gender issues in access to resources or communication?
d.	Are there generational differences in work ethics and work approaches that can result in conflicts or disputes among stakeholders that limit ability to effectively implement the policy?
e.	Are there any areas or landmarks with religious significance of the region under consideration?
f.	Is there a group that has very strong opposition to the policy?
3. Physical barriers	
a.	Are land areas proposed for intervention easily accessible?
b.	Is the necessary physical infrastructure in place for the proposed policy?
c.	Are there any war conflicts in the country that would limit access to certain land areas?

Step 2: Evaluate the overall distribution of scores and estimate the effect on implementation potential

Once each barrier has been analyzed and scored, evaluate the overall distribution of scores:

- A distribution with many scores of 1 indicates less of a need to refine the implementation potential of the policy.
- A distribution with many scores of 2, 3 or 4 could suggest a downward adjustment of the implementation potential or gathering more information and reassessing the impact, especially for scores of 4.

Carefully review each score of 2 and 3. For a score of 2 consider and, if possible, estimate to what extent the barrier will decrease policy effectiveness. Describe and justify the reduction. For a score of 3, the barrier is considered crucial and has the potential to render the policy ineffective. If even one crucial barrier is identified, it is recommended to reconsider the policy design and discontinue the impacts assessment. For scores of 4, attempt to gather enough information to assess the effect of the barrier. If that is not possible, it is conservative to assume it limits effectiveness.

Consider and determine to what extent the effects of the barriers overlap. An overlapping effect occurs where one barrier limits implementation in one area and another barrier also limits implementation in the same area. These overlapping effects should be appropriately accounted for when calculating the potential effect of all barriers. The combined effect of the barriers together may be greater than or less than the sum of the individual barriers. If information is available, uncertainty ranges should also be incorporated in the final results.

During the data-gathering phase, it is recommended that information also be collected on any other relevant policies in the country that might help overcome specific barriers. Where such policies exist, the scoring of the barrier effect should be changed accordingly (most likely to a score of 1).

8.5.2 Considerations for accounting for other barriers

Institutional barriers

Conflicting goals between different ministries and other government agencies could result in overlapping regulation and ambiguous roles and responsibilities of the stakeholders involved. For example, proposed areas for the policy may overlap with other existing types of area protection (e.g., based on national policies or international conventions), which could lead to confusing regulations for specific sites.

Institutional barriers relating to discrimination often include racism, gender bias, age discrimination, favouritism and other selection approaches that are not based on the actual performance of individual workers. Where discrimination is present, certain stakeholders may not have equal access to the opportunities afforded by a policy (e.g., incentive payments, technical assistance or education) and this can limit overall effectiveness. Often such barriers are linked to corrupt practices (addressed in Section 8.3). Safeguards to prevent discrimination can be built into policies. For example, it can be required that enrolment in programmes such as education opportunities must be diverse in terms of race and gender. If safeguards against discrimination do not exist, either as part of the policy being analyzed or in institutions involved in implementing the policy, it is possible that discrimination will be a barrier to policy implementation.

Cultural barriers

The use of language and terminology that is not widely understood by the target stakeholders could be a crucial cultural barrier as it could result in communications problems causing misunderstandings, mistrust and non-participation/compliance among the local population. Where language barriers exist and there is no mechanism in place to overcome them, the effectiveness of the policy is likely to be reduced.

In many countries, the successful implementation of mitigation policies may require consideration of gender or social class sensitivities to reduce resistance of local communities to the proposed intervention. Cultural preferences may have more potential for change than physical limits, but change may take time and almost certainly will benefit from considering existing mechanisms of social influence. There may also be generational differences in work ethics and work approaches that have the potential to result in conflicts between older and younger workers. If the policy is sensitive to such factors, including potential language barriers, age distribution and cultural norms of stakeholders, they may not present a barrier to implementation.

In some countries, gender considerations can have a very important effect on the success or failure of implementation of the policy. It is important to consider who makes decisions about land use actions, and who has access to information and money. For a policy to be implemented effectively the person who is responsible for managing land will also need to have the ability to access information and financing to implement management changes. If they do not, this will likely limit policy effectiveness.

Certain land areas or landmarks have important religious significance for local communities. Policies that may affect ancestral homes or sacred grounds would be more likely to face resistance from indigenous peoples and local communities.

Strong opposition to a policy, for example from a particular stakeholder group or political party, could hamper efforts to secure financing, gain trust, and otherwise implement policy interventions, especially if that group is influential.

Failure to identify and address cultural barriers will more than likely have detrimental impacts on the policy implementation. Effective stakeholder participation from early in policy design is important to identify and address cultural barriers. Refer to the ICAT *Stakeholder Participation Guide* for further information about all elements of effective stakeholder participation for policy design, implementation and evaluation.

Physical barriers

In mountainous countries or countries with inaccessible regions, policies relating to agriculture and forests should take into account whether certain land areas are remote or are difficult to access. Minimal existing road networks or insufficient transportation infrastructure would be expected to limit the implementation potential.

Conflicts in a country (such as civil war or territorial disputes with a neighbouring country) could limit access to areas that could be considered for policy intervention. Depending on the severity of the conflict, and to safeguard the welfare of the people involved, certain parts of the country may be excluded until the conflict is resolved. This would reduce the impact of the policy at least through the time period during which conflicts remain active, and possibly longer.

8.5.3 Example of accounting for other barriers

The screening questions from Table 8.12 were reviewed (Step 1). Not all of the screening questions were identified to be relevant and a few of the questions were modified to suit national circumstances. The barriers under the cultural barriers category related to cultural norms and values (2b), gender issues (2c), generational differences (2d), and areas of religious significance (2e) were considered collectively. The barriers under the physical barrier category related accessibility of land area (3a) and availability of infrastructure (3b) were also considered jointly. With these modifications a total of seven barriers were considered. In consultation with experts, responses were tabulated and scored in Table 8.13 below.

Table 8.13: Example of accounting for other barriers

1. Institutional barriers		**Score**
a.	*Are there any conflicting goals or jurisdictions between ministries or other agencies?* The Ministry of Natural Resources has recently initiated a project, as a result of national legislation, in a land area covering about 25,000 hectares to address loss of biodiversity concerns. The same area is also considered for this project.	4
b.	*Is there the potential for institutional racism, gender bias or age discrimination that could limit the policy effectiveness, for example by limiting participation of certain stakeholders based on their race, religion, gender or age?* The policy is in accordance with recent national legislation that has been put in place to eliminate discrimination in the work place.	1
2. Cultural barriers		
a.	*Are different languages used in the region where the policy will be implemented?* French and English are the two most spoken languages. However, several local isolated communities use their own dialects. Most local offices have sufficient capacity to communicate in these dialects.	1
b.	*Is the policy congruent with cultural norms and values?* Several local communities rely on hierarchical authority to make decisions on the use of their forest land. This is made possible in part by the age distribution of the communities. In most rural areas, the population is rather aged (average age of farmers: 45 years). Most young people move to urban areas in search of work due to lack of job opportunities in the countryside. As a result, there is very little conflict about how to manage natural resources, with decisions made by elders largely carried out by the community leaders without question. Therefore there are no cultural barriers related to generational differences.	1
c.	*Are there gender issues in access to resources or communication?* See b above.	N/A
d.	*Are there generational differences in work ethics and work approaches that can result in conflicts or disputes among stakeholders that limit ability to effectively implement the policy?* See b above.	N/A
e.	*Are there any areas or landmarks with religious significance of the region under consideration?* See b above.	N/A
f.	*Is there a group that has very strong opposition to the policy?* No indications of groups that oppose the policy; however, information is very limited.	4

3. Physical barriers		
a.	*Are land areas proposed for intervention easily accessible?* About 96% of the land area targeted by the policy is accessible. However, due to recent floods and soil erosion in the northern part of the country (accounting for about 35% of the land are under consideration), some roads will need to be inspected and repaired. According to expert judgment, it is too expensive, and there is currently no budget, to build roads. Therefore, about 6,400 hectares of land originally targeted by the policy will not be accessible. Based on current land use in the impacted areas, it is estimated that half would have been used for natural regeneration and the other half for SFM under the PES programme.	2
b.	*Is the necessary physical infrastructure in place for the proposed policy?* See a above.	N/A
c.	*Are there any war conflicts in the country that would limit access to certain land areas?* There are no conflicts in the country.	1

The distribution of scores was evaluated (Step 2). Four barriers received a score of 1. One barrier received a score of 2. Two barriers received a score of 4. None of the barriers received a score of 3.

The extent to which policy effectiveness may be reduced as a result of each barrier was evaluated. Five of the barriers are not expected to limit policy effectiveness. None of the barriers received a 3 (e.g., appear to be crucial problems that could completely hamper policy effectiveness). Physical barrier 3a will reduce the area of land available for SFM and natural regeneration by 3,200 hectares each. Any potential conflicts with the biodiversity project are unknown at this point because there are no details yet available on how the project will be implemented and what sort of criteria it will have for management and land use.

Based on the above assessment, the land area of the policy will be adjusted as shown in Table 8.14 below.

Table 8.14: Example of refined implementation potential

Policy activity	**Maximum implementation potential (in ha)**	**Refined implementation potential based on policy design and national circumstances (in ha)**	**Refined implementation potential based on financial feasibility (in ha)**	**Refined implementation potential based on barriers (in ha)**
SFM	150,000	105,000	94,500	91,300
Tree planting general	15,000	13,950	14,250	13,950
Natural regeneration	40,000	37,200	33,480	30,280
Tree planting with endangered species	5,000	4,650	4,750	4,750
Total	210,000	160,800	146,580	140,280

The table illustrates how land area was refined after each step. The refined values in the last column are considered the likely implementation potential of the policy, which are the values that should be used to estimate the GHG impacts of the policy.

8.6 Estimate GHG impacts

It is a *key recommendation* to estimate the GHG impacts of the policy. There are two ways to estimate GHG impacts: the emissions approach or activity data approach. Where baseline emissions were estimated, users can calculate the change in emissions between the baseline and policy scenarios (emissions approach). Where baseline emissions were not estimated, the GHG impacts can be estimated by calculating the net GHG emission reductions and removals directly from the likely implementation potential of the policy (activity data approach). A method for estimating the GHG impacts for each approach is given below.

8.6.1 Emissions approach

Use the likely implementation potential of the policy (derived following the method in Sections 8.2 – 8.5) to determine the most-likely policy scenario. Derive new parameter values and, if relevant, new emission factors that reflect conditions under the policy scenario. Box 8.2 provides an example of how emission factors were selected in the impact assessment of a NAMA.

Use the adjusted values and emission factors to estimate GHG emissions of the policy scenario. Subtract the policy scenario emissions and removals from the baseline emissions and removals to estimate net change in GHG emissions and removals resulting from the policy.

Box 8.2: Example of selecting emission factors for estimating GHG impacts

The Grupo Ecológico Sierra Gorda, a national NGO in Mexico, is coordinating the implementation of the NAMA - *Subnational Mitigation Actions for the Regeneration of Landscapes*. The NAMA includes state-led policies and actions for the regeneration of forests and the implementation of planned grazing in 12 states.

One of the subnational actions for the regeneration of forests is to provide payments for ecosystem services to forest owners in exchange for the removal of cattle and other degradation factors from their forests. To assess the GHG impacts of pilot activities utilizing the activity data approach described in the ICAT *Forest Methodology*, the Grupo Ecológico initiated local studies in conjunction with the Postgraduate College of Agricultural Sciences with the support of the U.S. Forest Service and the State Secretariat of Sustainable Development. The studies include sampling of forest parcels that are regenerating following the removal of cattle and of control sites still subject to cattle grazing. The studies seek to develop local emission factors for forest carbon capture resulting from natural regeneration. Initial results from these studies were used for the assessment of GHG impacts in the forest understory and it is expected that the studies will provide emission factors for other strata in the future.

In order to be consistent with national reports, data from the local study were complemented by the use of emission factors from Mexico's most recent national communication and biennial update report submitted to the UNFCCC. In some cases, emission factors were also extrapolated from annual growth increments reported in state forest inventories or by state forestry departments.

8.6.2 Activity data approach

The likely implementation potential of the policy represents the effects that are expected to occur as a result of the policy. Implicitly, these effects are relative to the baseline scenario. Use the method below to calculate the impact of the policy on each GHG source and carbon pool in the GHG assessment boundary. Sum the GHG impacts for all GHG sources and carbon pools to yield total policy impact on GHGs.

Estimate carbon stock change

Using the estimates of how much the policy will increase or decrease the area of land (hectares) in land categories affected by the policy (determined following the method in Section 8.2 – 8.5), subdivide the land categories into strata according to method in Section 7.2.2. These are the policy scenario strata.

Determine the policy impact on each GHG source and carbon pool included in the GHG assessment boundary for each policy scenario stratum. A method for estimating the GHG impacts of the living biomass carbon pool are provided in the relevant section below. Repeat the steps for each policy scenario stratum.

Forest land remaining forest land

- Step 1: Estimate the hectares of land in the policy scenario stratum for each year of the assessment period. Unless the policy design indicates otherwise, assume the area of land changes following a linear trend. For example, in the forest policy example, the implementation potential for SFM is estimated as 97,400 hectares over 15 years. A linear trend assumes 6,300 hectares of forest are affected by the policy each year for 15 years (i.e., management changes to sustainable forestry on 6,300 hectares per year for 15 years). The assessment period is 20 years long; therefore, for the last 5 years of the time series, no further hectares of forest are affected by the policy. Table 8.15 provides an example land area time series.

Table 8.15: Example land area time series

Year	1	2	3	4-13*	14	15	16	17	18	19	20
Area (hectares)	6,300	12,600	18,900	[25,200-81,900]	88,200	94,500	94,500	94,500	94,500	94,500	94,500

* Years 4-13 are not shown for simplicity. Square brackets indicate the range of values during that time period.

- Step 2: Calculate the annual carbon stock change for living biomass for the policy scenario stratum based on the land area time series estimated in Step 1 and the method in Section 7.2.4 for forest land remaining forest land. Call this term $\Delta C_{Biomass\_with\ policy}$ (units are tonnes C/year).

- Step 3: Determine the baseline scenario stratum, which is the most likely stratum if the policy were not enacted (without policy). The ecological zone in the baseline stratum should be the same as in the policy scenario stratum. The baseline management category should be different from the policy scenario stratum. In order to use this equation for the activity data approach the user assumes the baseline land area time series is identical to the policy scenario land area time series developed in Step 1 because it represents the same land as the policy scenario under an alternative scenario. Calculate the annual carbon stock change in living biomass for the baseline stratum based on the land area time series estimated in Step 1 and following the method in

Section 7.2.4 for forest land remaining forest land. Call this term $\Delta C_{Biomass\_without\ policy}$ (units are tonnes C/year).

- Step 4: Calculate the cumulative carbon stock change over all years of the assessment period, separately for the baseline and policy strata.
- Step 5: Subtract the baseline cumulative carbon stock change from the policy cumulative carbon stock change to yield the policy impact on the living biomass carbon pool for the land strata.

Non-forest land converted to forest land

- Step 1: Estimate the cumulative hectares of land in the policy scenario stratum for the assessment period. For example, in the forest policy example, it is estimated that 14,250 hectares of cropland will be converted to forest land through general tree planting as a result of the policy. Therefore, the cumulative hectares of land in the policy scenario stratum for non-forest land converted to forest land is 14,250 hectares.
- Step 2: Calculate the change in forest carbon stocks from land conversion using Equation 7.1 in Section 7.2.4. Set the area term in Equation 7.1 equal to the hectares of land from Step 1. This yields the policy impact on the living biomass carbon pool for the land stratum.

Reduced forest land conversion to non-forest land

- Step 1: Estimate the cumulative hectares of land in the policy scenario stratum for the assessment period. For reduced deforestation, this will be the estimated amount of forest land not converted to non-forest land as a result of the policy.
- Step 2: Calculate the change in forest carbon stocks from land conversion using Equation 7.1 in Section 7.2.4. Set the area term in Equation 7.1 equal to the hectares of land from Step 1.

  The result of Equation 7.1 will be the estimated carbon stock loss that would have occurred if those hectares were deforested. Multiply the result of Equation 7.1 by -1 to convert the outcome to carbon stock gain because the policy reduced this amount of forest carbon stock loss. This yields the policy impact on the living biomass carbon pool for the land stratum.

8.6.3 Calculate GHG impacts

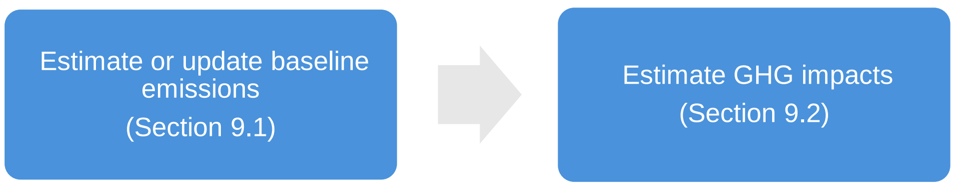
Calculate the total policy impact on the living biomass carbon pool by summing the results for all policy scenario strata. Convert the net carbon stock change to GHG emission reductions or removals, expressed as tonnes of CO_2e, by multiplying by 44/12 and -1. This generates the cumulative policy impact in terms of tonnes CO_2e emissions (positive) or removals (negative). Divide the cumulative policy impact by the number of years in the assessment period for the annual GHG impacts of the policy.

Where other GHG sources and carbon pools are included in the GHG assessment boundary, calculate their impact in terms of CO_2e emissions and add to the policy impact on the living biomass carbon pool.

9. Estimating GHG Impacts Ex-Post

Ex-post impact assessment is a backward-looking assessment of the GHG impacts achieved by a policy to date. The GHG impacts can be assessed during the policy implementation period or in the years after implementation. Ex-post assessment involves evaluating the performance of the policy, and estimating the impact of the policy by comparing observed policy scenario values (based on monitored data) to ex-post baseline values. In contrast to ex-ante assessment, which is based on forecasted values, ex-post assessment involves monitored or observed data collected during the policy implementation period. The impact of the policy (ex-post) is estimated by subtracting baseline estimates from policy scenario estimates. Users that are estimating GHG impacts ex-ante only can skip this chapter.

Figure 9.1: Overview of steps in the chapter



Checklist of key recommendations

- Estimate or update baseline emissions using observed values for parameters that are not affected by the policy and estimated values for parameters that are affected by the policy
- Ascertain whether the inputs, activities and intermediate effects that were expected to occur according to the causal chain, actually occurred (if relevant)
- Estimate the GHG impacts of the policy over the assessment period for each GHG source and carbon pool included in the GHG assessment boundary

9.1 Estimate or update baseline emissions

It is a *key recommendation* to estimate or update baseline emissions using observed values for parameters that are not affected by the policy and estimated values for parameters that are affected by the policy. The baseline emissions can be estimated following the method in Section 7.2. Further guidance on monitoring parameters is provided in Chapter 10. The baseline and policy scenarios have the same GHG assessment boundary.

Where the baseline scenario was determined and baseline emissions estimated in a previous ex-ante impact assessment, this should be updated by replacing estimated values with observed data for non-policy drivers.

Where the results of the assessment will be used to inform the GHG accounting and reporting of progress made towards implementation and achievement of NDCs and meet the reporting requirements of the transparency framework, users should consider aligning the input parameters (e.g., activity data, emission factors, socio-economic data) used for the estimation of GHG impact of forest policies with similar parameters used for GHG accounting and reporting under the Paris Agreement. Some parameters used for the projection of GHG impacts of forest policies can also be used as key indicators for projections developed to meet reporting requirements of the transparency framework.

9.2 Estimate GHG impacts

Evaluate performance of the policy (if relevant)

The performance of the policy should be evaluated to ensure that the GHG impacts calculated ex-post can be attributed to policy. To do this, it is a *key recommendation* to ascertain whether the inputs, activities and intermediate effects that were expected to occur according to the causal chain, actually occurred. For ex-post impact assessments where no previous ex-ante assessment has been conducted this step can be skipped.

Chapter 10 provides examples of the inputs and activities that should be monitored to evaluate the performance of the policy. If the user cannot ascertain that the inputs or activities occurred, it is not possible to attribute GHG impacts to policy implementation.

Users should also examine whether the intermediate effects in the causal chain occurred. It may not be feasible to monitor all intermediate effects. At minimum, each of the intermediate effects linked to GHG sources and carbon pools included in the GHG assessment boundary should be monitored with at least one parameter. Table 6.2 and Table 6.3 in Chapter 6 provide examples of intermediate effects that should be monitored. If the user cannot confirm that these intermediate effects occurred, it is not possible to attribute GHG impacts to policy implementation.

Note that inputs, activities and/or intermediate effects may be lower or higher in magnitude than expected but this does not mean that GHG impacts cannot be attributed to the policy.

Estimate the GHG impact of the policy

It is a *key recommendation* to estimate the GHG impacts of the policy over the assessment period for each GHG source and carbon pool included in the GHG assessment boundary. The same methods used to estimate baseline emissions should be used to estimate policy scenario emissions to allow for meaningful tracking of performance over time.

Calculate policy scenario emissions using the estimation methods provided in Section 7.2. Use observed, measured or recently collected activity data, and measured or re-estimated emission factors. Further guidance on monitoring parameters is provided in Chapter 10.

If using the emissions approach, calculate the GHG impacts of the policy by subtracting baseline emissions (estimated in Section 9.1) from the ex-post policy scenario emissions for each GHG source and carbon pool included in the GHG assessment boundary.

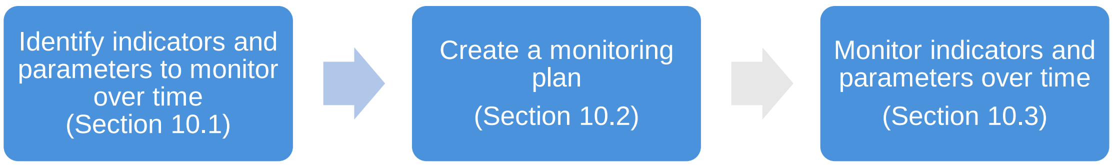
If using the activity data approach, calculate the GHG impact of the policy directly, by determining the actual implementation level using observed, measured, or recently collected data and measure or re-estimate emission factors. It is not necessary to estimate the GHG emissions of the baseline scenario when using this approach. Rather, users should follow the method in Section 8.6.2using ex-post activity data and emission factors. Under this approach, users should carefully consider the policy's inputs, activities and intermediate effects that occurred ex-post as a result of policy. Users should report and justify that the actual implementation level (e.g., the observed change in activity data) is the result of the policy.

Part IV: Monitoring and Reporting

10. Monitoring Performance Over Time

Monitoring during the policy implementation period serves two objectives. It allows the user to evaluate the performance of a policy my monitoring trends in performance to understand whether the policy is on track and being implemented as planned. Monitoring also allows the user to collect the information needed for the quantification of the GHG impacts during or after policy implementation. This chapter identifies data and parameters to monitor over time and provides a method to develop a monitoring plan.

Figure 10.1: Overview of steps in the chapter



Checklist of key recommendations

- Identify the key performance indicators that will be used to track performance of the policy over time and define the parameters necessary to estimate GHG emissions ex-post
- Create a plan for monitoring key performance indicators and parameters
- Monitor each of the indicators and parameters over time, in accordance with the monitoring plan

10.1 Identify indicators and parameters to monitor over time

This section describes the key performance indicators and parameters to monitor. A *key performance indicator* is a metric that indicates the performance of a policy (such as tracking changes in targeted outcomes). A *parameter* is a variable such as activity data or an emission factor that is needed to estimate emissions. Data are collected for indicators and parameters during or after the monitoring period. It is a *key recommendation* to identify the key performance indicators that will be used to track performance of the policy over time and define the parameters necessary to estimate GHG emission ex-post.

Where the results of the assessment will be used to inform the GHG accounting and reporting of progress made towards implementation and achievement of NDCs and meet the reporting requirements of the transparency framework, the indicators and parameters listed in the following tables to monitor progress towards achieving GHG emission reductions from the implementation of forest policies can also serve as inputs to monitor progress towards achieving national GHG reduction targets, such as NDCs.

Key performance indicators

The following table defines and provides examples of the types of key performance indicators: inputs, activities, intermediate effects, barriers, GHG impacts and sustainable development impacts.

Table 10.1: Key performance indicators to monitor

Key performance indicators	Definition	Example key performance indicator
Inputs	Resources that go into implementing a policy	Taxation of ecosystem service users
Administrative activities	Administrative activities involved in implementing the policy	Number of contracts executed with land owners
Intermediate effects	Changes in behaviour, technology, processes or practices	Survival and growth of trees
Barriers	Activities which may limit the effectiveness of the policy	Degree corruption rules and regulations were enforced
GHG impacts	Changes in greenhouse gas emissions by sources or removals by sinks that result from the intermediate effects of the policy	Increased sequestration from biomass accumulation
Sustainable development impacts	Changes in relevant environmental, social or economic conditions that result from the policy	Number of endangered species planted

Parameters

Table 10.2 defines and describes the three types of parameters: assumptions, activity data and carbon stock change factor.

Table 10.2: Parameters to monitor

Parameters	Definition	Data Example
Assumptions	Data that influence estimation of parameters	GDP
Activity data	A quantitative measure of a level of activity that results in GHG emissions. Activity data is multiplied by an emissions factor to derive the GHG emissions associated with a process or an operation.	Non-forest land converted to forest land
Carbon stock change factors	The average emission rate of a given GHG for a given source, relative to units of activity and the data needed to choose or derive emission factors.	CO_2 removals per hectare

Table 10.3 further elaborates specific parameters for afforestation/reforestation, sustainable forest management and reduced deforestation. In some cases, parameters may also be used as key performance indicators, as noted in the table. Parameters are organized by those needed for estimating GHG impacts of land-use change or of land management change. Those that are relevant to land management change on forest land remaining forest land (FLrFL) are organized by the stock-difference

method or the gain-loss method. Parameters that are needed regardless of land use or land management change are listed under "All." Parameters needed to estimate GHG impacts that can also be used to monitor policy performance are also designated as key performance indicators. The data needed to monitor these parameters may be measured, modeled or estimated. A suggested monitoring frequency is also provided. For parameters that are suggested to be monitored periodically, users can monitor annually, every 5 years or every 10 years, depending on data availability and desired level of certainty.

Table 10.3: Monitoring parameters

Parameter and unit	Potential sources of data	Parameter type	Suggested monitoring frequency
All			
Land use classification (by ecological domain and climate zone) (unitless)	Remotely sensed and aerial imagery Land cover maps National forest inventory GHG inventory reports IPCC 2006 GL* Table 4.1	Assumption	Once Can be updated in conjunction with collecting data on the area of land in each strata
Carbon fraction of dry matter $CF_{i,j}$ (tonnes C per tonnes dry matter)	IPCC 2006 GL* Table 4.3 Published data	Carbon stock change calculation	Once per type
Land-Use Change			
Area of forest land converted to non-forest land (ha)	Remotely sensed and aerial imagery Land cover maps National forest inventory GHG inventory reports	Activity data Key performance indicator	At least twice, at beginning and end of policy implementation period Or, periodically during the policy implementation period
Area of land converted to forest land (ha)	Remotely sensed and aerial imagery Land cover maps National forest inventory GHG inventory reports	Activity data Key performance indicator	At least twice, at beginning and end of policy implementation period Or, periodically during the policy implementation period
Biomass carbon stocks on land type *i*, after the conversion $B_{After,i}$ (tonnes dry matter per ha)	Measured samples for tree attributes, such as diameters and heights, and applying species-specific allometric equations or biomass tables, from: national forest inventory or country-specific research studies GHG Inventory Reports	Carbon stock change calculation Key performance indicator	Once

	IPCC 2006 GL* Table 4.7, 4.8, and 4.12 for aboveground biomass carbon stocks in forests IPCC 2006 GL* Table 5.9 for default biomass carbon stocks on cropland (tonnes C ha $^{-1}$) IPCC 2006 GL* Table 6.4 for default biomass stocks on grassland		
Biomass carbon stocks on land type *i*, before the conversion $B_{Before,i}$ (tonnes dry matter per ha)	Measured samples for tree attributes, such as diameters and heights, and applying species-specific allometric equations or biomass tables, from: national forest inventory or country-specific research studies GHG inventory reports IPCC 2006 GL* Table 4.7, 4.8, and 4.12 for aboveground biomass carbon stocks in forests IPCC 2006 GL* Table 5.9 for default biomass carbon stocks on cropland (tonnes C ha $^{-1}$) IPCC 2006 GL* Table 6.4 on default biomass stocks on grassland	Carbon stock change calculation	Once
FLrFL: All			
Area of forest land remaining forest land (ha)	Remotely sensed and aerial imagery Land cover maps National forest inventory GHG inventory reports	Activity data Key performance indicator	At least twice, at beginning and end of policy implementation period Or, periodically during the policy implementation period
Ratio of belowground to aboveground biomass $R_{i,j}$ (tonnes dry matter belowground biomass per tonnes dry matter aboveground biomass)	IPCC 2006 GL* Table 4.4	Carbon stock change calculation	Once per type
FLrFL: Stock-Difference Method			

Forest carbon stock at time t_1 $C_{t,1}$ (tonnes C)	Measured samples for tree attributes, such as diameters and heights, and applying species-specific allometric equations or biomass tables, from: national forest inventory or country-specific research studies Estimated with IPCC 2006 GL* Equation 2.8	Carbon stock change calculation Key performance indicator	Once at the beginning of a time interval The time interval may correspond to the policy implementation period or a shorter interval within the policy implementation period
Forest carbon stock at time t_2 $C_{t,2}$ (tonnes C)	Measured samples for tree attributes, such as diameters and heights, and applying species-specific allometric equations or biomass tables, from: national forest inventory or country-specific research studies Estimated with IPCC 2006 GL* Equation 2.8	Carbon stock change calculation Key performance indicator	Once at the end of a time interval The time interval may correspond to the policy implementation period or a shorter interval within the policy implementation period
Merchantable growing stock volume $V_{i,j}$ (m^3 per hectare)	National forest inventory GHG inventory reports Harvest or timber sale records	Carbon stock change calculation (parameter in IPCC 2006 GL* Equation 2.8) Key performance indicator	Twice, in conjunction with estimating $C_{t,1}$ and $C_{t,2}$ One or more time intervals may be monitored within the policy implementation period
Biomass conversion and expansion factor $BCEF_{S_{i,j}}$ (tonnes aboveground biomass grown per m^3 of growing stock volume)	IPCC 2006 GL* Table 4.5	Carbon stock change calculation (parameter in IPCC 2006 GL* Equation 2.8)	Once per type
FLrFL: Gain-loss method			
Aboveground biomass growth rate $G_{W_{i,j}}$ (tonnes dry matter per ha)	Measured samples for tree attributes, such as diameters and heights, and applying species-specific allometric equations or biomass tables, from: national forest inventory or country-specific research studies GHG inventory reports IPCC 2006 GL* Table 4.12 Derived from mean annual increment (default values available in IPCC 2006 GL* Table 4.11A and 4.11B) and IPCC 2006 GL* Equation 2.10	Carbon stock change calculation Key performance indicator	Periodically
Annual aboveground biomass C loss due to wood removals	Estimated with IPCC 2006 GL* Equation 2.12 National forest inventory	Carbon stock change calculation	Periodically

$L_{wood-removals}$ (tonnes C per year)	Harvest or timber sale records	Key performance indicator	
Annual aboveground biomass C loss due to fuelwood removals $L_{fuelwood}$ (tonnes C per year)	Estimated with IPCC 2006 GL* Equation 2.13 National forest inventory	Carbon stock change calculation Key performance indicator	Periodically
Annual aboveground biomass carbon losses due to disturbances $L_{disturbance}$ (tonnes C per year)	Estimated with IPCC 2006 GL* Equation 2.14 National forest inventory	Carbon stock change calculation Key performance indicator	Periodically

* IPCC 2006 GL, Volume 4, AFOLU

10.2 Create a monitoring plan

A monitoring plan is important to ensure that the necessary data are collected and analyzed. It is a *key recommendation* to create a plan for monitoring key performance indicators and parameters. A monitoring plan is the system for obtaining, recording, compiling and analyzing data and information important for tracking performance and estimating GHG impacts. Where possible, a monitoring plan should be developed before policy implementation. Doing so can ensure that the data needed to assess the effectiveness of the policy are collected.

In some reporting or decision-making cases, assessment objectives may require an estimate or description of assessment uncertainty. This could include documentation of the method or approach used to assess uncertainty and/or sensitivity of the results as a function of parameters, scenarios, or models used. Qualifying or quantifying uncertainty can be a helpful tool for users in choosing assessment methods, prioritizing data collection efforts, interpreting or comparing estimation results, and/or identifying estimation improvement efforts overtime. Methodological guidance for qualifying or quantifying uncertainty of a policy GHG impact estimation can be found in Chapter 12 of the *Policy and Action Standard*.

The elements below should be described in the monitoring plan.

Monitoring period

The policy implementation period is the time period during which the policy is in effect. The assessment period is the time period over which the GHG impacts resulting from the policy are assessed. The monitoring period is the time period over which the policy is monitored.

At minimum the monitoring period should include the policy implementation period. Users can have multiple monitoring periods for separate assessment periods. A monitoring period can also include monitoring of relevant activities prior to implementation of the policy and after the policy implementation period.

Users should strive to align the monitoring period with those of other assessments being conducted using other ICAT methodologies. For example, if assessing sustainable development impacts using the ICAT

Sustainable Development Guide in addition to assessing GHG impacts, the monitoring periods should be the same.

Institutional arrangements for coordinated monitoring

Information on key performance indicators and parameters can be dispersed among a number of different institutions. Given the wide variety of data needed for impact assessment and a range of different stakeholders involved, strong institutional arrangements serve an important function. They play a central role in coordinating monitoring. A technical coordinator, coordinating team or body is often assigned to lead MRV processes in which responsibilities have been delegated to different institutions. Since data can be widely dispersed between institutions, the coordinating body oversees the procedures for data collection, management and reporting.

Countries may already have institutions in place as part of the national MRV system. Where this is the case, users can consider expanding the national MRV system to also monitor the impact of the policy. Where strong institutional arrangements do not yet exist, users can determine the governmental body with the adequate capacity and authority to be responsible for the MRV system and to establish the necessary legal arrangements. Institutional mandates help to strengthen the procedures and the system, and may also help secure funding from the government to ensure the continuity of the process.

Refer to the UNFCCC *Toolkit on Establishing Institutional Arrangements for National Communications and Biennial Update Reports*, as well as other sources, for support on establishing or improving the institutional arrangements for a robust MRV system.[30]

Considerations for a robust monitoring plan

To ensure that the monitoring plan is robust, consider including the following elements in the plan.

- **Roles and responsibilities**: Identify the entity or person that is responsible for monitoring key performance indicators and parameters, and clarify the roles and responsibilities of the personnel conducting the monitoring.
- **Competencies**: Include information about any required competencies and any training needed to ensure that personnel have necessary skills.
- **Methods**: Explain the methods for generating, storing, collating and reporting data on monitored parameters.
- **Frequency**: Key performance indicators and parameters can be monitored at various frequencies, such as monthly, quarterly or annually. Determine the appropriate frequency of monitoring based on the needs of decision makers and stakeholders, cost and data availability. In general, the more frequent that data is collected, the more robust the assessment will be. Frequency of monitoring can be consistent with measurement conducted under the national MRV system.
- **Collecting and managing data**: Identify the databases, tools or software systems that are used for collecting and managing data and information.

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[30] Available at: http://unfccc.int/files/national_reports/non-annex_i_natcom/training_material/methodological_documents/application/pdf/unfccc_mda-toolkit_131108_ly.pdf

- **Quality assurance and quality control (QA/QC)**: Define the methods for QA/QC to ensure the quality of data enhance the confidence of the assessment results. Quality assurance is a planned review process conducted by personnel who are not directly involved in the data collection and processing. Quality control is a procedure or routine set of steps that are performed by the personnel compiling the data to ensure the quality of the data.
- **Record keeping and internal documentation**: Define procedures for clearly documenting the procedures and approaches for data collection as well as the data and information collected. This information is beneficial for improving the availability of information for subsequent monitoring events, documenting improvements over time and creating a robust historical record for archiving.
- **Continual improvement**: Include a process for improving the methods for collecting data, taking measurements, running surveys, monitoring impacts, and modelling or analyzing data. Continual improvement of monitoring can help reduce uncertainty in GHG estimates over time.
- **Financial resources**: Identify the cost of monitoring and sources of funds.

10.3 Monitor indicators and parameters over time

It is a *key recommendation* to monitor each of the indicators and parameters over time, according to the monitoring plan. The frequency of monitoring is dependent on stakeholder resources, data availability, feasibility, and the uncertainty requirement of reporting or estimation needs. The monitoring plan should include an iterative process for balancing these dependencies.

11. Reporting

Reporting the results, methodology and assumptions used is important to ensure the GHG impacts assessment is transparent and gives decision-makers and stakeholders the information they need to properly interpret the results. This chapter presents a list of information that is recommended for inclusion in an assessment report.

Checklist of key recommendations

- Report information about the assessment process and the GHG impacts resulting from the policy (including the information listed in Section 11.1)

11.1 Recommended information to report

It is a *key recommendation* to report information about the assessment process and the GHG impacts resulting from the policy (including the information listed below[31]). Where two or more guidance documents are applied to the policy, the general information and policy description only need to be reported once. For guidance on providing information to stakeholders, refer to the *ICAT Stakeholder Participation Guide* (Chapter 7).

General information

- The name of the policy assessed
- The person(s)/organization(s) that did the assessment
- The date of the assessment
- Whether the assessment is an update of a previous assessment, and if so, links to any previous assessments

Chapter 2: Objectives of estimating GHG impacts

- The objective(s) and intended audience(s) of the assessment

Chapter 4: Steps and assessment principles

- Opportunities for stakeholders to participate in the assessment

Chapter 5: Describing the policy

- A description of the policy including the recommended information in Table 5.1 and the additional information in Table 5.2
- Whether the assessment applies to an individual policy or a package of related policies, and if a package is assessed, which policies are included in the package

[31] The list does not cover all chapters in this document because some chapters provide information or guidance not relevant to reporting.

- Whether the assessment is ex-ante, ex-post or a combination of ex-ante and ex-post

Chapter 6: Identifying impacts: How forest policies reduce emissions or enhance removals

- A causal chain, including a table describing all intermediate effects
- A list of all GHG sources and carbon pools that are included in the GHG assessment boundary
- A list of potential GHG sources and carbon pools that are excluded from the GHG assessment boundary, with justification for their exclusion
- The assessment period

Chapter 7: Estimating the baseline scenario and emissions

- The method chosen, emissions approach or activity data approach, for estimating the policy's expected GHG impacts
- A description of the baseline scenario and justification for why it is considered the most likely scenario
- A list of the intended policy outcomes and associated target drivers
- Total annual and cumulative baseline emissions and removals over the GHG assessment period
- The methodology and assumptions used to estimate baseline emissions, including the emissions estimation methods (including any models) used
- Justification for the choice of whether to develop new baseline assumptions and data or to use published baseline assumptions and data
- A list of policies, actions and projects included in the baseline scenario
- A list of implemented or adopted policies, actions, or projects that are expected to affect the GHG sources or carbon pools included in the GHG assessment boundary but are excluded from the baseline scenario, with justification for their exclusion
- Whether the baseline scenario includes any planned policies and if so, which planned policies are included
- A list of non-policy drivers included in the baseline scenario
- A list of non-policy drivers that are considered for inclusion but are excluded from the baseline scenario, with justification for their exclusion
- The baseline values for key parameters (such as activity data, emission factors and GWP values) in the baseline emissions estimation method(s)
- The methodology and assumptions used to estimate baseline values for key parameters, including whether each parameter is assumed to be static or dynamic, and assumptions regarding other policies/actions and non-policy drivers that are included in the baseline and affect each parameter

- All sources of data used to estimate key parameters, including activity data, emission factors, GWP values and assumptions
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results in order to help users of the information properly interpret the results

Chapter 8: Estimating GHG impacts ex-ante

- An estimate of the maximum implementation potential of the policy and a description of how it was estimated
- A description and justification for how policy design and national circumstances affect the maximum implementation potential of the policy and a refined estimate of the implementation potential after accounting for policy design and national circumstances
- A description and justification for how financial feasibility affects the implementation potential of the policy and a refined estimate of the implementation potential after accounting for the financial feasibility of the policy
- A description and justification for how other barriers affect the implementation potential of the policy and a refined estimate of the implementation potential accounting for other barriers
- Total annual and cumulative policy scenario emissions and removals over the GHG assessment period, if feasible based on the method used
- Documentation of year of expected fully realized GHG impact, if the policy implementation period or assessment period is shorter than the policy impact period.
- An ex-ante estimate of the total net GHG impacts of the policy over the assessment period, and an estimate disaggregated by each GHG source and carbon pool included in the GHG assessment boundary
- Any methodologies and assumptions used to estimate policy scenario emissions, including the emissions estimation methods (including any models) used
- The policy scenario values for key parameters (such as activity data, emission factors and GWP values) in the emissions estimation method(s)
- The methodology and assumptions used to estimate policy scenario values for key parameters, including whether each parameter is assumed to be static or dynamic
- All sources of data used to estimate key parameters, including activity data, emission factors, GWP values and assumptions
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results in order to help users of the information properly interpret the results

Chapter 9: Estimating GHG impacts ex-post

- The performance of the policy, including whether the inputs, activities and intermediate effects that were expected to occur according to the causal chain, actually occurred
- Total annual and cumulative policy scenario emissions and removals over the GHG assessment period
- Documentation of year of expected fully realized GHG impact, if the policy implementation period or assessment period is shorter than the policy impact period.
- The methodology and assumptions used to estimate policy scenario emissions, including the emissions estimation methods (including any models) used
- All sources of data to estimate key parameters, including activity data, emission factors, GWP values and assumptions
- An estimate of the total cumulative GHG impacts of the policy over the assessment period, and disaggregated by each GHG source and carbon pool included in the GHG assessment boundary
- The method or approach used to assess uncertainty
- An estimate or description of the uncertainty and/or sensitivity of the results in order to help users of the information properly interpret the results

Chapter 10: Monitoring performance over time

- A list of the key performance indicators used to track performance over time and the rationale for their selection
- Sources of key performance indicator data and monitoring frequency

Additional information to report (if relevant)

- How the policy is modifying longer-term trends in GHG emissions and removals.
- The economic, social and environmental (sustainable development) impacts of the policy.
- The type of technical review undertaken (first-, second-, or third-party), the qualifications of the reviewers and the review conclusions. More guidance on reporting information related to technical review is provided in Chapter 9 of the ICAT *Technical Review Guide*.

Appendix A: Stakeholder Participation During the Assessment Process

This appendix provides an overview of the ways that stakeholder participation can enhance the process for assessment of GHG impacts of forest policies. Table A.1 provides a summary of the steps in the assessment process where stakeholder participation is recommended and why it is important, explaining where relevant guidance can be found in the ICAT *Stakeholder Participation Guide*.

Table A.1 List of steps where stakeholder participation is recommended in the impact assessment

Chapter/step in this document	**Why stakeholder participation is important at this step**	**Relevant chapters in *Stakeholder Participation Guide***
Chapter 2 – Objectives of estimating GHG impacts	• Ensure that the objectives of the assessment respond to the needs and interests of the stakeholders	Chapter 5 – Identifying and understanding stakeholders
Chapter 4 – Using the methodology • Section 4.2.5 Planning stakeholder participation	• Build understanding, participation and support for the policy among stakeholders • Ensure conformity with national and international laws and norms, as well as donor requirements related to stakeholder participation • Identify and plan how to engage stakeholder groups who may be affected or may influence the policy • Coordinate participation at multiple steps for this assessment with participation in other stages of the policy design and implementation cycle and other assessments	Chapter 4 – Planning effective stakeholder participation Chapter 5 – Identifying and understanding stakeholders Chapter 6 – Establishing multi-stakeholder bodies Chapter 9 – Establishing grievance redress mechanisms
Chapter 6 – Identifying impacts: How forest policies reduce GHG emissions or enhance removals	• Identify the full range of stakeholder groups affected by or with influence on the policy • Enhance completeness by identifying expected intermediate effects and impacts for all stakeholder groups • Identify and address possible unintended or negative impacts early on • Improve and validate causal chain with stakeholder insights on cause-effect relationships between the policy, behaviour change and expected impacts	Chapter 8 – Designing and conducting consultations
Chapter 7 – Estimating the baseline scenario and emissions	• Inform assumptions on existing and planned policies	Chapter 8 – Designing and conducting consultations

Chapter 8 – Estimating GHG impacts ex-ante	• Inform estimates of the policy's implementation potential • Gain insights into a policy's specific local context and impacts • Identify and address potential cultural and other barriers to policy implementation	Chapter 8 – Designing and conducting consultations
Chapters 10 – Monitoring performance over time	• Ensure monitoring frequency addresses the needs of decision makers and other stakeholders	Chapter 8 – Designing and conducting consultations
Chapter 11 – Reporting	• Raise awareness of the GHG benefits and build support for the policy • Inform decision makers and other stakeholders about impacts to facilitate adaptive management • Increase accountability and transparency and thereby credibility and acceptance of the assessment	Chapter 7 – Providing information to stakeholders

APPENDIX B: GUIDANCE ON DISCOUNT RATES

Different kinds of entities have different discount rates. To understand the likely implementation potential of a proposed policy, it is useful to analyze the policy from the perspective of the stakeholders that use and manage land. Where the policy requires investments that are not provided by the government, it is useful to analyze the policy from the perspective of the investors. Where a private land manager will use its own capital for the investment, analyze from the perspective of the land manger. Where land managers need to borrow capital from others, it is useful to analyze the policy from the perspective of potential investors.

The discount rate used to analyze private investments, from the perspective of private firms (e.g., timber companies), will be different from the discount rate used to analyze government spending. The best discount rate to use is the rate a bank would charge to provide a loan to the typical actor for the activity being analyzed. For private, multiyear investments in developing countries, discount rates may be greater than 15% per year.

For government investments and costs, the best discount rate for the analysis is the rate that government pays to borrow money, with the term of the borrowing roughly matching the time span of the financial analysis. For example, if one is analyzing an investment in equipment for improving logging practices where the equipment has a 5-year payback period, the rate the government pays for bonds that mature five years after issuance might be the appropriate discount rate for the analysis. That said, a 10-year rate is often more appropriate than a 5-year rate. While discount rates for stable governments may be 3%, rates for less stable governments may be 5-10% or even more.

Imputing a discount rate for smallholders who do not have access to credit can be difficult. Rates provided by informal lenders may be the best option for estimating rates for smallholders. These rates can be extremely high – 30% to 100% per year. Subsidized rates are not appropriate. For example, if an NGO provides subsidized loans for development or other social reasons, these loan rates may be quite different from the smallholders' discount rates.

To understand the likely behaviour of smallholders, the analysis should be done using observed interest rates or discount rates imputed from observing what activities the smallholder will or will not participate in. For example, if the smallholder does not buy available, reliable, high-yielding seed that would grow a crop that is harvested and sold one year after seed purchase, even when the net returns from farming would be 30% higher, the smallholder has an imputed discount rate of 30%. However, this discount rate may be high because of barriers such as seasonal food insecurity or lack of access to capital. If the policy can address these barriers, the appropriate discount rate for the analysis may be much lower.

Discount rates of investors include the risk that the investor will not be repaid, repayments will be delayed or repayments may be partial. Typically, an analysis of a policy will not include a financial risk analysis, but instead will look at rates required by banks for similar policies. Hurdle rates of return required by private entities investing in similar policies can be used as the discount rate for private investors. However, private investors may not be willing to reveal their internal rates for analysis, and it can be hard to tell if risk factors of the proposed policy would be like the risk factors of investments proposed as comparisons.

Appendix C: Selecting the Scope of the Methodology

The forestry activities included in the scope of this methodology (i.e., afforestation/reforestation, sustainable forest management and reduced deforestation/degradation) were selected using a set of criteria developed with the Technical Working Group:

- The role of the activity in countries' NDCs
- The role of the activity in proposed NAMAs
- Gaps in available guidance
- Contribution of the activity to staying under a 1.5-2°C temperature goal
- Contribution of the activity to a large percentage of countries' emissions

ABBREVIATIONS AND ACRONYMS

AFOLU	agriculture, forestry and other land use
A/R	afforestation/reforestation
C	carbon
CBA	cost benefit analysis
CDM	Clean Development Mechanism
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GHG	greenhouse gas
GWP	global warming potential
ha	hectares
ICAT	Initiative for Climate Action Transparency
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
m^3	cubic meters
MJ	megajoules
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NGO	non-governmental organization
N_2O	nitrous oxide
PES	payments for ecosystem services
REDD	reduced emissions from deforestation and degradation
SDG	Sustainable Development Goals
SFM	sustainable forest management
SPLP	Sustainable Pastures and Livestock Production
UNFCCC	United Nations Framework Convention on Climate Change
USD	US dollar
VCS	Verified Carbon Standard
WRI	World Resources Institute

GLOSSARY

Assessment period The time period over which GHG impacts resulting from a policy are assessed

Assessment report A report, completed by the user, that documents the assessment process and the GHG, sustainable development and/or transformational impacts of the policy

Baseline scenario A reference case that represents the events or conditions most likely to occur in the absence of a policy (or package of policies) being assessed

Causal chain A conceptual diagram tracing the process by which the policy leads to impacts through a series of interlinked logical and sequential stages of cause-and-effect relationships

Emission factor A factor that converts activity data into GHG emissions data

Ex-ante assessment The process of estimating expected future GHG impacts of a policy (i.e., a forward-looking assessment)

Ex-post assessment The process of estimating historical GHG impacts of a policy (i.e., a backward-looing assessment)

Expert judgment A carefully considered, well-documented qualitative or quantitative judgment made in the absence of unequivocal observational evidence by a person or persons who have a demonstrable expertise in the given field (IPCC 2006). Users can apply their own expert judgment or can consult experts.

GHG assessment boundary The scope of the assessment in terms of the range of GHG impacts that is included in the assessment

GHG impacts Changes in GHG emissions by GHG sources and carbon pools that result from a policy

Impact assessment The estimation of changes in GHG emissions or removals resulting from a policy, either ex-ante or ex-post

Independent policies Policies that do not interact with each other, such that the combined effect of implementing the policies together is equal to the sum of the individual effects of implementing them separately

Inputs Resources that go into implementing the policy, such as financing

Interacting policies Policies that produce total effects, when implemented together, that differ from the sum of the individual effects had they been implemented separately

Intermediate effects Changes in behaviour, technology, processes or practices that result from the policy, which lead to GHG impacts

Jurisdiction The geographic area within which an entity's (such as a government's) authority is exercised

Key performance indicator	A metric that indicates the performance of a policy
Monitoring period	The time over which the policy is monitored, which may include pre-policy monitoring and post-policy monitoring in addition to the policy implementation period
Negative impacts	Impacts that are perceived as unfavourable from the perspective of decision makers and stakeholders
Overlapping policies	Policies that interact with each other and that, when implemented together, have a combined effect less than the sum of their individual effects when implemented separately. This includes both policies that have the same or complementary goals, as well as counteracting or countervailing policies that have different or opposing goals
Parameter	A variable such as activity data or emission factors that are needed to estimate GHG impacts
Policy or action or policy and measures	An intervention taken or mandated by a government, institution, or other entity, which may include laws, regulations, and standards; taxes, charges, subsidies, and incentives; information instruments; voluntary agreements; implementation of new technologies, processes, or practices; and public or private sector financing and investment, among others.
Policy implementation period	The time period during which the policy is in effect
Policy scenario	A scenario that represents the events or conditions most likely to occur in the presence of the policy (or package of policies) being assessed. The policy scenario is the same as the baseline scenario except that it includes the policy (or package of policies) being assessed
Positive impacts	Impacts that are perceived as favourable from the perspectives of decision makers and stakeholders
Rebound effect	Increased consumption that results from actions that increase efficiency and reduce consumer costs
Stakeholders	People, organizations, communities or individuals who are affected by and/or who have influence or power over the policy
Sustainable development impacts	Changes in environmental, social or economic conditions that result from a policy, such as changes in economic activity, employment, public health, air quality and energy security
Uncertainty	1. Quantitative definition: Measurement that characterizes the dispersion of values that could reasonably be attributed to a parameter. 2. Qualitative definition: A general term that refers to the lack of certainty in data and methodological choices, such as the application of non-representative factors or methods, incomplete data, or lack of transparency.

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