INITIATIVE FOR Climate Action Transparency

Greenhouse Gas Management Institute, VCS

Agriculture Guidance

Guidance for assessing the greenhouse gas impacts of agriculture policies

First Draft, 26 July 2017

Part I: Introduction, Objectives, Key Steps and Overview of Agriculture Policies ... 2
1. Introduction ... 2
2. Objectives of Estimating GHG Impacts ... 6
3. Overview of Agriculture Policies ... 8
4. Steps and Assessment Principles ... 11
Part II: Defining the Assessment ... 18
5. Describing the Policy ... 18
6. Identifying Impacts: How Agriculture Policies Reduce or Remove Emissions ... 26
Part III: Assessing Impacts ... 49
7. Estimating the Baseline Scenario and Emissions ... 49
8. Estimating GHG Impacts Ex-Ante ... 65
9. Estimating GHG Impacts Ex-Post ... 93
Part V: Monitoring and Reporting ... 95
10. Monitoring Performance Over Time ... 95
11. Reporting ... 103

Appendix A: Stakeholder Participation During the Assessment Process ... 107
Appendix B: Guidance on Discount Rates ... 109
Abbreviations and Acronyms ... 110
Glossary ... 111
References ... 113
Contributors ... 114

PART I: INTRODUCTION, OBJECTIVES, KEY STEPS AND OVERVIEW OF AGRICULTURE 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.[1] In the agriculture sector, emissions are mainly from soil, livestock and nutrient management. Cost effective mitigation options in agriculture are cropland management, grazing land management and restoration of organic soils. There is an increasing need to assess and communicate the impacts of agriculture policies to ensure they are effective in delivering GHG mitigation and helping countries meet their sectoral targets and commitments.

Purpose of the guidance

This document provides methodological guidance for assessing the GHG impacts of agriculture policies that enable or incentivise mitigation practices or technologies that reduce emissions from enteric fermentation and increase soil carbon sequestration in pasture, grazing lands and croplands.

This guidance is part of the Initiative for Climate Action Transparency (ICAT) series of guidance 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 ICAT guidance 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 guidance 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 agriculture policies. Throughout the guidance, the term “user” refers to the entity implementing the guidance.

The main emphasis of the guidance 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 agriculture policies, strategies, NDCs or NAMAs, including research institutions, businesses and non-governmental organisations.

[1] IPCC 2014.

Scope and applicability of the guidance

This guidance provides general principles, concepts and procedures for estimating GHG impacts of agricultural policies[2] that mitigate GHG emissions from the following GHG sources and carbon pools (which are further described in Chapter 4):

- **Enteric fermentation**: Reduce methane (CH_4) emissions in ruminant livestock through activities such as improving feeding strategies, improving herd management and breeding, or implementing silvopastoral systems.
- **Soil carbon pool**: Increase carbon sequestration in soils in pasture, grazing lands or croplands through activities such as switching to no-till or conservation tillage agriculture, agricultural residue management or agroforestry.

This guidance details a process for users to follow when conducting GHG assessment of agriculture 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 [*to be developed*] are provided to illustrate how to apply the guidance.

This guidance is applicable to users that have defined the individual policy instruments and mitigation practices and/or technologies that will 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.

This guidance is designed for countries that have a GHG inventory for the agriculture sector that is relevant to the jurisdiction of the policy under consideration. The steps for estimating emission reductions and removals are based on the IPCC 2006 *Guidelines for National Greenhouse Gas Inventories*, referred to throughout this guidance as IPCC 2006 GL.[3]

The guidance 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

When to use the guidance

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

---

[2] Throughout this guidance, where the word “policy” is used without “action,” it is used as shorthand to refer to both policies and actions. See Glossary for definition of “policies or actions”.

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

- **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 guidance 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 guidance first before implementation, regularly during policy implementation, and again after implementation.

Key recommendations

The guidance 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.

In keeping with ICAT guidance being non-prescriptive, the key recommendations focus on the key steps that users are recommended to follow, rather than on any specific methods, models or tools they should use. Key recommendations focus more on "what" users should do than "how" they should do it. The guidance that accompanies each key recommendation provides the "how."

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.

Key recommendations are provided as an option to users that want to assess and report impacts according to a consistent set of steps and approaches. Users that want to follow a more flexible approach can choose to use the guidance 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 guidance. Refer to the *Introductory Guide* before deciding on which approach to follow.

Relationship to other guidance and resources

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

The guidance is consistent with 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.[5] The guidance adapts

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

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

the structure and some of the tables, figures and text from the *Policy and Action Standard* where relevant. Figures and tables adapted from the *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

Process for developing the guidance

This guidance is being 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 VCS (co-lead) which serves as the Secretariat and guide the development process. The draft was developed by drafting teams, which are a subset of a broader Technical Working Group and the Secretariat. The Technical Working Group (TWG) consists of experts and stakeholders from a range of countries identified through a public call for expressions of interest. The TWG contributes to the development of the technical content for the guidance through participation in regular meetings and written comments.

The two GHG sources and carbon pools that are the focus of this guidance (enteric fermentation and soil carbon pool) were selected based on a set of criteria compiled with input from the TWG. The selection was reached after all options were ranked against a set of criteria which included:

- The role of the GHG source and/or carbon pool in country's NDCs
- The role of the GHG source and/or carbon pool in proposed NAMAs
- Gaps in available guidance
- Contribution of the GHG source and/or carbon pool to staying under a 1.5-2°C temperature goal
- Contribution of the GHG source and/or carbon pool to a large percentage of a country's emissions.

A Review Group will provide written feedback on multiple drafts of the guidance. The drafts will also be circulated for public consultation more broadly. The draft guidance will be tested with ICAT participating countries and other interested countries to ensure that it can be practically implemented, gather feedback for its improvement and provide case studies in the final publication.

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

All contributors are listed in the "Contributors" section.

2. Objectives of Estimating GHG Impacts

This chapter provides an overview of objectives users may have in assessing the GHG impacts of agriculture 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 developing 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 Guidance* can be used to assess the broader sustainable development impacts of agriculture policies and users should refer to that guidance 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
- **Inform future policy design** and decide whether to continue current actions, enhance current actions or implement additional actions
- **Learn from experience** and share best practices about the impacts of policies
- **Track progress toward national goals** such as NDCs and SDGs and understand the contribution of policies toward achieving them
- **Report** on the multiple impacts of policies achieved to date, domestically and/or internationally
- **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 Guidance* (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 AGRICULTURE POLICIES

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

3.1 Agriculture policy instruments

This guidance can be used to assess the GHG impacts of a range of policy instruments that enable or incentivise adoption of mitigation practices or technologies in agriculture. Table 3.1 presents examples of common policy instruments to which this guidance can be applied to. Further information about types of policies and actions is provided in the ICAT *Introductory Guide*.

Table 3.1: Common policy instruments applicable to the agriculture sector

Type of policy Instrument	Description	Examples of policy instruments
Regulations and standards	Rules or standards that specify abatement technologies (technology standard) or minimum requirements for pesticide application, pollution output, or other activities (performance standard). They typically include legal penalties for noncompliance.	• Standards for management practices for livestock health and reproduction • Standards for implementing silvopastoral systems • Conservation mandates requiring landowners to place an area equivalent to 10% of cultivated lands into conservation reserve • Laws that promote connectivity between natural ecosystems
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.	• Tax reductions for setting aside agricultural land • Payments for changing agricultural practices • 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 • 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	• Programmes requiring standardised labeling on environmental attributes of agricultural

	reporting programmes, rating and certification systems, benchmarking, and information or education campaigns aimed at changing behaviour by increasing awareness.	products
Trading programmes	Programmes that establish 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 farmers, provide training and introduce new technologies or practices to farmers, 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 to agricultural producers
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 farmers that implement sustainable livestock production practices

3.2 Mitigation practices or technologies

This guidance can be used to assess a range of mitigation practices or technologies in the agriculture sector that reduce and/or remove emission from enteric fermentation and the soil carbon pool. Box 3.1 lists common mitigation practices or technologies in the agriculture sector that reduce and/or remove emissions from enteric fermentation and the soil carbon pool, and to which this guidance is applicable. These mitigation practices or technologies are enabled or incentivised by the policy instruments described in Section 3.1.

Box 3.1: Common mitigation practices or technologies that reduce emissions in enteric fermentation

Common mitigation practices or technologies that reduce emission from enteric fermentation

- Livestock feeding strategies (e.g., improving the quality forage, processing feeds to improve digestibility, adding grain-based concentrates, providing dietary supplements and feed additives)
- Improved herd management strategies (e.g., changing breed type, reducing herd size and reducing herd age)

- Optimising health and reproductive capacity (e.g., veterinary visits, disease prevention, shelter for animals and following best practices for husbandry)
- Improved pasture management (e.g., maintaining growth of preferred grazing species, removing weed invasions and bare ground, reducing areas where animals do not graze, restoring compacted areas and livestock paths, improving ground water absorption and reducing runoff)
- Improved silvopastoral systems (e.g., intensive silvopastoral systems)
- Improving efficiency in production systems (e.g., reducing herd size while increasing productivity)

Common mitigation practices or technologies that reduce and remove emission from the soil pool

- Switching to no-till or conservation tillage agriculture
- Improving agricultural residues management (e.g., mulching and/or avoiding residues burning)
- Increasing soil stability and reducing erosion (e.g., terracing, contour strips, cover crops and retaining residues on croplands)
- Increasing vegetation cover and/or biomass (e.g., increasing the use of perennial crops)
- Improving agroforestry and/or silvopastoral systems
- Rotational grazing practices to allow pastures to grow stronger and increase soil carbon sequestration
- Changing pasture species selection (e.g., selecting species with higher productivity)
- Increasing sustainable agricultural intensification (i.e., emission reduction per unit of output)
- Establishing conservation of, or restoration of, natural ecosystems
- Rewetting of wetland mineral soils or organic soils previously drained for crop production or grazing

4. Steps and Assessment Principles

This chapter provides an overview of the steps involved in assessing the GHG impacts of agriculture 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

4.1.1 General overview of steps

This guidance is organised according to the steps a user follows in assessing the GHG impacts of a policy (see Figure 4.1). Depending on when the guidance 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 8.

Figure 4.1: Overview of steps

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

Understand the purpose and applicability of the guidance (Chapter 1)
Determine the objectives of the assessment (Chapter 2)
Understand agriculture 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)

4.1.2 Steps for assessing the GHG impacts of agriculture policies

This guidance provides two approaches for estimating the GHG impacts of agricultural policies ex-ante:

- **Scenario approach**: This compares the difference in GHG emissions and removals between the policy and baseline scenarios. The difference between policy and baseline scenario emissions and removals is the net change in GHG impact resulting from the policy.
- **Deemed estimates 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.

Scenario approach

In this approach, users determine the most likely baseline scenario for land use, land-use change and/or livestock and soil 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.

Deemed estimates approach

In this approach, users estimate the maximum implementation potential of the policy (following the guidance 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. 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 cropland that will switch to no-till) or the expected adoption of a mitigation practice (e.g., the number of livestock under a new feeding strategy). 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 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.

4.1.3 Expert judgment

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.[6] The user can apply their own expert judgment or consult experts.

When consulting experts, 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.

Assumptions or expert judgment will likely be required in order to complete the assessment where information is not available to make a reasonable assumption about the value of a parameter. When doing so, it is important to document the reason that no data sources are available and the rationale for the value chosen.

4.1.4 Planning for the assessment

Users should review this guidance and plan the steps, responsibilities and resources needed to meet their objectives for assessing GHG impacts of agriculture policies in advance. The time and human resources required to implement the guidance 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.

Planning stakeholder participation

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

- Providing a mechanism through which people who are likely to be affected by a given policy or who can influence the policy are provided with an opportunity to raise issues and to have these issues considered before, during and after the 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

[6] IPCC 2000.

- 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 guidance 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 Guidance* for more information, such as how to plan effective stakeholder participation (Chapter 4), identify and analyse 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: Stakeholder Participation During the Assessment Process summarises the steps in this guidance where stakeholder participation is recommended along with specific references to relevant guidance in the ICAT *Stakeholder Participation Guidance*.

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 Guidance* for more information on the technical review process.

4.2 Assessment principles

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

- **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. Transparently 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 internal and external reviewers 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 process to derive the same results if provided with the same source data.
- **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 4.1 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 4.2).

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

Box 4.1: 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 prioritised 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 4.2: 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 organisation assesses and compares multiple policies using the same methodology. If the objective is to compare the results of unrelated assessments carried out independently, users should exercise caution in comparing the results, since differences in reported impacts may be a result of differences in methods.

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.

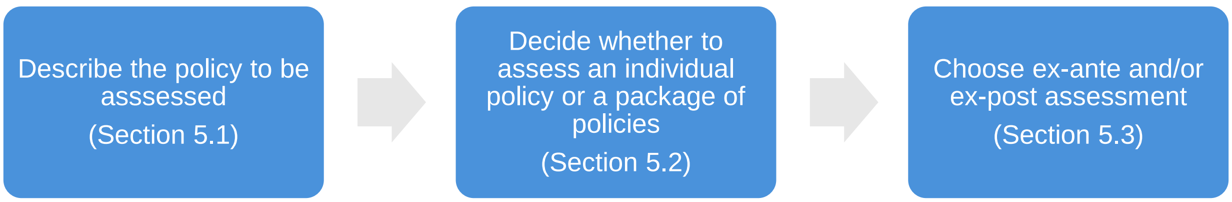
In practice, users may encounter trade-offs between principles when developing an assessment. For example, a user may find that achieving the most complete assessment requires using less accurate data for a portion of the assessment, which could compromise overall accuracy. Users should balance trade-offs 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 outlines additional information that may be relevant depending on the context.

Users that assess a package of policies should use these tables to either document the package as a whole or document each policy within the package separately. If assessing a package of policies, it may be easiest to do the first two steps in this chapter (Sections 5.1 and 5.2) together or iteratively. Users that are assessing the sustainable development and/or transformational impacts of the policy 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	National programme for Sustainable Pastures and Livestock Production (SPLP)
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 Research, development and deployment
Description of specific interventions	The specific mitigation practice and/or technology carried out as part of the policy, such as those presented in Box 3.1.	Livestock feeding strategies: improve the quality of forage for livestock on pasture, through: (a) Improved herd management strategies: adjusting stocking density, avoiding overgrazing (including through fencing), and optimising grazing rotations.

		(b) Improved pasture management: maintaining growth of preferred grazing species, removing weed invasions and bare ground, restoring livestock paths to control soil compaction, improving ground water absorption and reducing runoff, fertiliser management to promote quality forage) (c) Improved silvopastoral systems: planting shrubs and trees in pastures or alleys interspersed with food crops to provide additional sources of high quality forage and improve animal nutrition. Under the SPLP, the national government will pay participating pastoralists annual fees for five years to improve management of grasslands and, increase funding to the agriculture extension service by USD 2 million per year for 15 years to provide training and support to participating pastoralists. Agriculture extension specialists will develop a training programme in herd and pasture management and silvopastoral systems for participants, and assist participants with developing management plans appropriate for their land and livestock. Management plans must consist of a combination of practices/ technologies listed above. Upon approval of management plans, participants will receive a start-up payment dispersed annually over five years to cover costs of capital and labour needed to implement the management plan and offset the potential risks involved in changing management. Total value of payments will range from USD 50/ha to USD 100/ha, an estimated increase in income of about 5-10%. Participation will be capped to keep the programme costs under USD 400 million over 15 years. Agriculture extension specialists will conduct routine site visits to assist with and monitor implementation of management plans.
Status of the policy	Whether the policy is planned, adopted or implemented	Budget increase for the agriculture extension service was authorised in the National Agriculture Policy Act of 2015 to start in 2020. The federal government is currently seeking financial assistance to support payment programme for pastoralists.
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 2035
Implementing entity or entities	The entity or entities that implement(s) the policy, including the role of various local, subnational, national, international or any other	National Agriculture Agency

	entities	
Objectives and intended impacts or benefits of the policy	The intended impact(s) or benefit(s) the policy intends to achieve (for example, the purpose stated in the legislation or regulation)	Introduce and promote adoption of sustainable livestock production methods to pastoralists to improve the environment, economy, and food security of the nation. Specifically: • Reduce GHG emission from livestock production. • Increase economic output for pastoralists by improving livestock productivity and possibly adding revenue sources (e.g., from wood cutting in silvopastoral systems). • Halt expansion of land degradation through agricultural intensification, which may also reduce deforestation pressure in some regions. • Improve water quality as a result of better water retentions and reduced runoff. • Accelerate adoption of improved pasture management on a widespread basis (i.e., by non-participating pastoralists) by demonstrating economic benefits of improving pasture management practices.
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	All non-federally owned pasture in the country are eligible (approximately 34 million hectares)
Sectors targeted	Which sectors or subsectors are targeted	Interventions will target small to medium scale beef and dairy producers, where herds are managed on <500 hectares (small) or 500-2500 hectares (medium)
Greenhouse gases targeted	Which GHG the policy aims to control, which may be more limited than the set of GHG that the policy affects	Reduce CH_4 emissions from enteric fermentation
Other related policies or actions	Other policies or actions that may interact with the policy being assessed	The regional Climate-Smart Agriculture programme, funded by a non-profit organisation, aims to reduce GHGs emissions from agriculture and deforestation through capacity building in a region containing 5 million hectares of pasture land eligible for the SPLP programme. 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 expansion of pasture land through deforestation.

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)	If relevant and available, the total emissions and removals from the sources and carbon pools 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)	Improve pasture management on 3.5% of eligible land under the programme (approximately 1,200,000 hectares). Improve animal feed intake in terms of gross energy (e.g., megajoules (MJ) per day per animal) or dry matter (e.g., kilograms (kg) per day per animal) of herds managed by participating pastoralists Increase output (kg of meat or milk/animal unit or per year) of herds managed by participating pastoralists Slow or cease the rate of pasture land degradation
Title of establishing legislation, regulations, or other founding documents	The name(s) of legislation or regulations authorising or establishing the policy (or other founding documents if there is no legislative basis)	The National Agriculture Policy Act of 2015
Monitoring, reporting and verification procedures	References to any monitoring, reporting and verification procedures associated with implementing the policy	Annual farm visits conducted by agricultural extension specialists to all ranches 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	Participation in the programme is voluntary. However, to continue receiving payments, pastoralists must submit an annual report providing at a minimum data on average stocking density (# animals/ha), forage species abundance estimates (percent cover), and average annual output of milk and/or beef. Reports are submitted to the Agriculture Agency and can be filled out and submitted with assistance from agriculture 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)	
The broader context or significance of the policy	Broader context for understanding the policy	Livestock production makes up <2% of national GDP. Twenty-five percent of all land in the country is pasture land used for livestock (beef and dairy) production. In general, livestock productivity is low compared to neighboring countries and land degradation as a result of overgrazing and mismanagement is prominent and spreading. These trends contribute to 35% of national total annual GHG emissions.
Outline of sustainable development impacts of the policy	Any anticipated sustainable development benefits other than GHG mitigation	Economic productivity, land-use change, water quality, food security
Key stakeholders	Key stakeholder groups affected by the policy	Pastoralists, agricultural extension services
Other relevant information	Any other relevant information	If this policy is successful, the number of livestock will increase overall (# of head will increase nationally) and more intensively (# head/hectare will increase). Net

		GHG benefits are expected to occur as a result of reducing GHG intensity (i.e., kg CH_4/ kg of beef or milk) relative to continuing with current common pasture management practices to meet demand for beef and milk. This may result in increasing absolute CH_4 emissions trend in the national GHG inventory.

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	Multiple policies interact, and have both overlapping and reinforcing interactions.

reinforcing	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: Characterise 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: Characterise 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. 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 analyses 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 guidance in order to avoid confusion of the results.

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

Criteria	Questions	Guidance
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? Policies that target other sectors can co-exist and reinforce agriculture policies. For example, these can include policies that that focus on: • Reducing drivers of deforestation and/or degradation • Improving food security • Expanding the use of biofuels	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

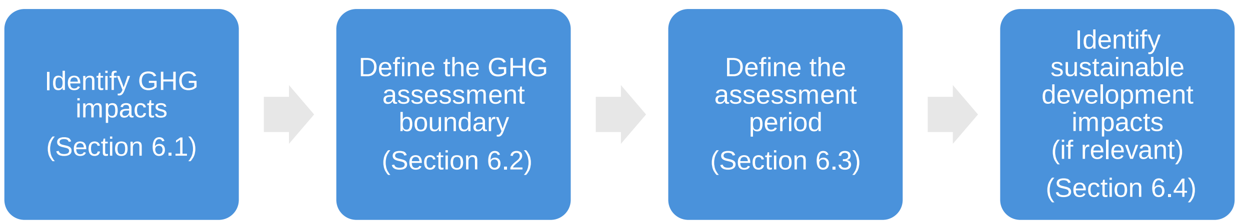
Choose whether to carry out an ex-ante assessment, an ex-post assessment, or a combined ex-ante and ex-post assessment. Choosing between ex-ante or ex-post assessment depends on the status of the policy. Where the policy is planned or adopted, but not yet implemented, the assessment will be ex-ante by 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. In this case, users would carry out 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 Agriculture Policies Reduce or Remove Emissions

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 guidance for how 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. Guidance 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

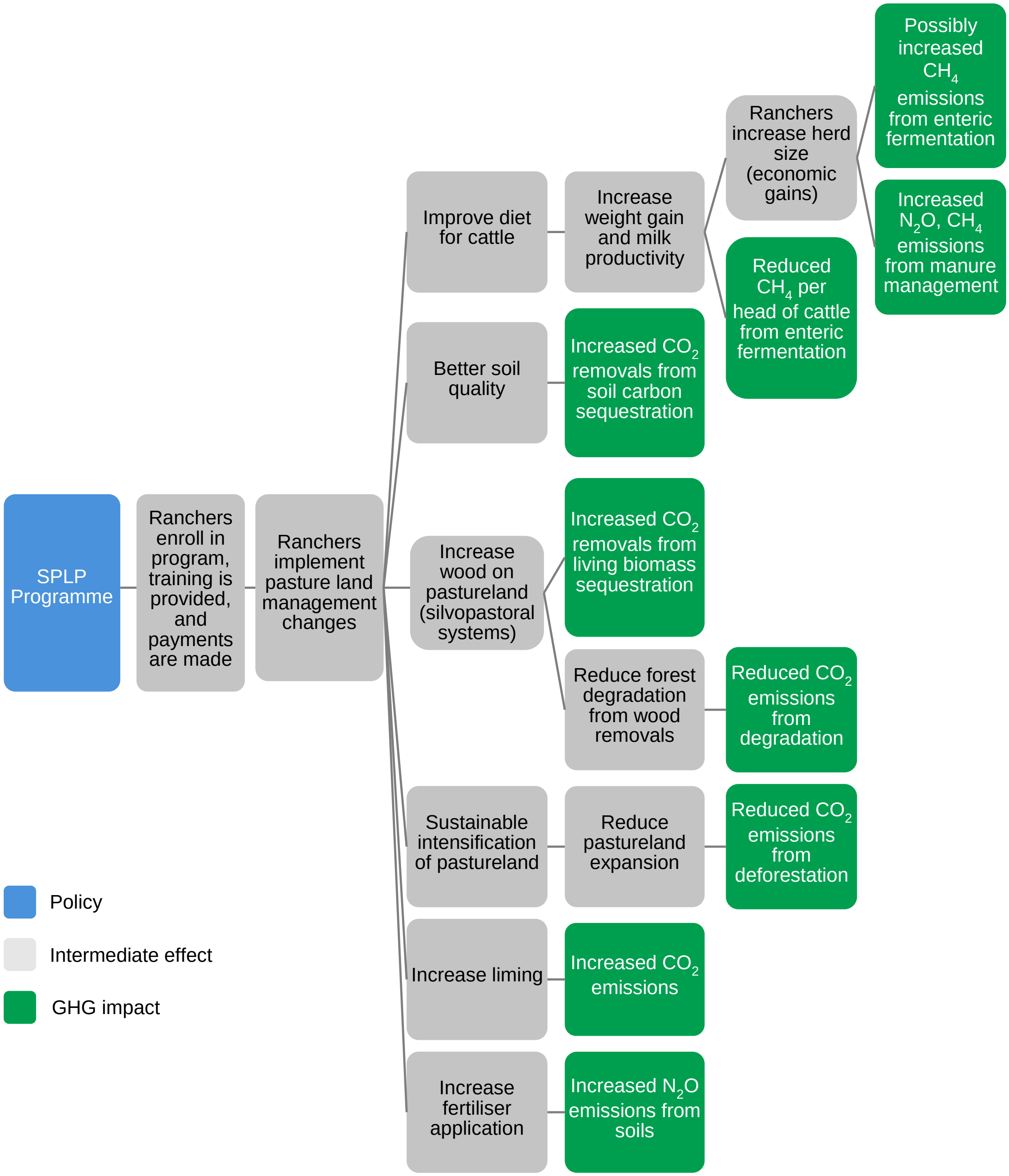
In order to identify the GHG impacts of the policy, it is useful to first identify the stakeholders affected by or with influence on the policy, and the inputs and activities associated with implementing the policy. Inputs are resources that go into implementing the policy, while activities are administrative 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. An example causal chain is provided in Figure 6.2.

The sections below provide guidance on identifying intermediate effects (through identifying stakeholders, and inputs and activities), identifying potential GHG impacts, and developing a causal chain. This 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 guidance 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 6.2: Example of a causal chain



6.1.1 Identify intermediate effects

In order to identifying intermediate effects, first identify the stakeholders of the policy, then the inputs and 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 stakeholders affected by, or with influence on, the policy. Stakeholders can be people, organisations, communities or individuals. Stakeholders include different agencies and levels of government, as well as civil society and private sector organisations. Stakeholders may be affected by the policy or may influence the policy. Some typical stakeholders for the agriculture sector include:

- Farmers and ranchers
- Producer associations
- NGOs or civil society organisations
- Communities, indigenous peoples, or marginalised groups that are involved in or are affected by agriculture
- 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 Guidance* provides information on how to identify stakeholders (Chapter 5), including marginalised people or groups.

Step 2: Identify inputs and activities

It is a *key recommendation* to identify the inputs and activities that go into implementing the policy. Table 6.1 provides definitions and examples of inputs and 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 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 authorised out of the national budget • Private financing secured to co-fund a government programme
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 activities or to other intermediate effects of the policy. Intermediate effects can also include the measures that are enabled or incentivised by the policy. The following are examples for how stakeholders may respond to inputs, 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 for payments received
- Sign up for training and increase knowledge level regarding technologies or practices
- Change livestock feeding strategies
- Change herd management strategies
- Change pasture management

- Change livestock population sizes
- Change soil management practices (e.g., improve degraded grazing lands by implementing rotational grazing, implement no-till practices)

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 production of livestock decreases due to decreasing stocking rates on grazing lands, livestock production on feedlots may increase to compensate for a 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, agriculture policies can have unintended effects on the forestry 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 incentivised 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 Guidance* (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.[7] 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:

- 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:

- Cropland remaining cropland; more specifically, annual cropland converted to perennial cropland

Affected activities

Intermediate effects can also be a change in activity, practice or technology such as amounts of fertiliser applied to fields or population of animals in each livestock population category. 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 guidance 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 or an increase in numbers of livestock receiving a particular type of diet.

[7] 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.

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 incentivise 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 increase agricultural production on degraded lands in one region of the country, the effect can be described as: "increase the amount of degraded land converted to crop land in the Cerrado ecoregion 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 intermediate effects of inputs and activities, and Table 6.3 provides an example table for how to describe other intermediate effects.

Table 6.2: Example of how to describe intermediate effects of inputs and activities

	Detail/explanation	Geographic location of effect	Timing of effect
Inputs			
Incentive payments made to ranchers for improved pasture management	Participants receive a start-up payment dispersed annually over five years to cover costs of capital and labour. Total value of payments will range from USD 50/ha to USD 100/ha. Participation will be capped to keep the programme	National scale, all non-federal pasture land eligible	2021 - 2035

	costs under USD 400 million over 15 years.		
Budget deployed for technical assistance and programme operations	The national government will increase funding to the agriculture extension service by USD 2 million per year for 15 years to provide training and support to participating pastoralists.	Funding will be coordinated centrally in the headquarters office and dispersed to regional agriculture extension centers, where training and support services will be provided. Funding allocations will be based on demand for participation in the programme.	2021 - 2035
Activities			
Ranchers enroll	Ranchers voluntarily sign up to participate in the programme	Eligible non-federal pasture land	Rolling enrollment throughout duration (2021-2035) based on demand.
Agriculture extension provides training to participants	The agriculture extension service will provide training to ranches in improved pasture management through regional agriculture extension offices. Training culminates in preparation of an individualised plan for participants for implementing improved pasture management.	Regions where enrollment meets minimum threshold for launching training and support programmes at regional agriculture extension offices (Thresholds are to be determined).	On-going during 2022-2035 (training starts next year after first enrollment period)
Payments administered to participants	Ranchers enter voluntary five-year contracts with the Ministry of Agriculture to receive annualised payments for five years for implementing sustainable intensification practices.	Regions where training and support services have been provided, and where participants have completed training and developed a management plan.	On-going during 2023-2035 (payments dispersed only after first year of training is completed provided)
Agriculture extension conducts site visits	Agriculture extension specialists will conduct routine site visits to assist with and monitor implementation of management plans. Specialists will use visits to verify implementation of practices according to annual reports submitted by participants.	Regions where payments have been dispersed	On-going during 2023 - 2035
Participants submit annual reports	Participants submit annual report providing at a minimum data on average stocking density (# animals/ha), forage species abundance estimates (percent cover), and average annual output of milk and/or beef.	Regions where payments have been dispersed	Annually starting in 2024 - 2035
Pastureland management changes	Participants implement management plans	Regions where payments have been dispersed	Annually starting in 2024 - 2035

Table 6.3: Example table to describe other intermediate effects

Intermediate effects	Detail/ explanation	Affected parameter	Direction of effect	Amount of effect	Geographic location of effect	Timing of effect
Improved diets for grazing cattle	Management changes result in improved quality of forage on pasture.	Feed intake in terms of gross energy (MJ per day or kg dry matter per day)	Increase	Approximately 1.08 million head (1.2 million hectares of land targeted by the policy with an average of 0.9 head/hectare)	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Cattle gain weight faster	Higher quality diet causes animals to grow faster	Average annual weight gain (kg/head/yr)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Dairy cattle produce more milk	Higher quality diet causes animals to produce more milk	Average daily milk production for human consumption (kg per head per day)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Improved soil quality	Pasture species selection, rotational grazing, and other interventions have the potential to increase soil quality, leading to increased soil carbon stocks.	Soil carbon density (tonnes C/ha in soils)	Increase	On approximately 1.2 million hectares	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
More carbon stored in woody biomass	Trees planted for silvopastoral systems can result in increased carbon stocks in living biomass.	Biomass carbon density (tonnes C/ha in biomass)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Increased wood supply	Trees in silvopastoral systems provide more wood, reduces demand/pressure on wood removals from forest, which cause forest degradation.	Wood removals from pastureland (volume/ha)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict

Reduced pastureland expansion	Sustainable intensification of existing pastureland reduces demand for new pastureland, reducing rates of land conversion to grassland (including deforestation)	Amount of land converted to grassland (hectares)	Decrease	Unknown	Forest Land and non-grazed grassland (e.g., woodland), particularly forest edges close to pasture land enrolled in the programme	Sometime after 2024, difficult to predict
Herd size increase	Economic gains for ranchers leads to ranchers using additional revenue to expand herds. This effect may be partially offset by increased meat supply impacting local meat price.	Livestock population numbers (average annual # of head)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Liming	Farmers may apply liming practices to neutralise soil acidity and promote growth of pasture for forage on acidic soils.	Limestone or dolomite applied to soils (mass/year)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict
Nitrogen Fertilisation	Farmers may apply synthetic or natural fertilisers to promote growth of pasture for forage.	Nitrogen applied to soils (mass/year)	Increase	Unknown	Regions where incentive payments are dispersed	Sometime after 2024, difficult to predict

6.1.2 Identify potential GHG impacts

Intermediate effects can lead to GHG impacts. For example, improving livestock feed digestibility is an intermediate effect that leads to a decrease in methane emissions from enteric fermentation.

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. Table 6.4 provides a list of common intermediate effects from mitigation practices and technologies that reduce emissions from enteric fermentation. Similarly, Table 6.5 provides for enhanced removals with soil carbon.

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

Enteric fermentation

GHG emission reductions from enteric fermentation are often achieved with practices and technologies that improve the efficiency and reduce the GHG intensity of production. GHG intensity is the emissions per unit of animal produced or per unit of product (milk and/or meat) produced.

For enteric fermentation, methane (CH_4) is the main GHGs targeted. Enteric fermentation policies can also reduce carbon dioxide (CO_2) from fossil fuel combustion or remove CO_2 emissions through soil sequestration. Table 6.4 lists common intermediate effects of mitigation practices and/or technologies that reduce enteric fermentation emissions.

Table 6.4: Potential activities and effects for main types of mitigation practices/technologies and policies for enteric fermentation

Activity, practice or technology	Intermediate effects			Potential GHG Impact
	Effect 1	Effect 2	Effect 3	
Intended effect				
Feeding strategies such as improving quality of forage, processing feeds to improve digestibility, adding grain-based concentrates to feed, or providing dietary supplements and feed additives	Digestibility improved	Livestock heath improve and livestock grow faster	Production efficiency improves	Decreased CH_4 per unit of production
Changing herd management practices such as changing breed type, reducing herd size, and reducing herd age	Herds are more suited to conditions or livestock are slaughtered earlier	Production efficiency improves		Decreased CH_4 per unit of production
Optimising health and reproductive capacity, such as having veterinary visits, preventing disease, providing shelter for animals, and following best practices for husbandry	Livestock health and reproductive capacity improves	Production efficiency improves		Decreased CH_4 per unit of production
Pasture management, such as maintaining growth of preferred grazing species, removing weed invasions on bare ground, reducing areas where animals do not graze, restoring compacted areas and livestock paths, improving ground water absorption and reducing runoff	Quality of forage improves	Livestock heath improves and livestock grow faster	Production efficiency improves	Decreased CH_4 per unit of production
	Pasture conditions improve	Pasture productivity increases		Impact on soil sequestration, as described in Table 6.5
Silvopastoral systems adopted and trees planted	Quality of forage improves	Livestock health and reproductive capacity improves	Production efficiency improves	Decreased CH_4 per unit of production
	Pasture conditions improve	Pasture productivity increases		Impact on soil sequestration are provided in

				Table 6.5
Rotational grazing	Quality of forage improves	Livestock health and reproductive capacity improves	Production efficiency improves	Decreased CH_4 per unit of production
	Pasture conditions improve	Pasture productivity increases		Impact on soil sequestration are provided in Table 6.5
Unintended effect				
Feeding strategies	Production of supplements and feed additives	Fossil fuel usage for manufacturing increases		Increased CO_2 emissions
Increased pasture management and adoption of silvopastoral systems	Synthetic fertiliser application (e.g., nitrogen fertiliser)	Nitrogen leaches into the environment because not all of it is absorbed by plants	Denitrification and volatilisation occur	Increased N_2O emissions
	Production of synthetic fertiliser increases	Fossil fuel usage for manufacturing increases		Increased CO_2 emissions
Rotational grazing	Use of machinery increases to install or maintain rotational grazing	Fossil fuel usage increases		Increased CO_2 emissions

Soil Carbon Management

Changes in management or land use of cropland and grassland can reduce or remove CO_2 emissions from carbon stored in soil and/or biomass. Mitigation practices or technologies to improve pasture, grazing lands or cropland management can also impact N_2O emissions from fertiliser and other nitrogen inputs, CO_2 from fossil fuel combustion, or CH_4 emissions from livestock. Table 6.5 provides common intermediate effects that occur as a result mitigation practices and/or technologies that reduce emissions or enhance removals from soil carbon.

Table 6.5: Potential intermediate effects for mitigation practices or technologies to reduce emissions from, and enhance removals in, soil

Activity, practice or technology	**Intermediate effect**			**Potential GHG Impact**
	Effect 1	Effect 2	Effect 3	
Intended effect				
Minimal or no tillage	Soils are less disturbed or undisturbed; crop residues are not incorporated or are less incorporated	Organic matter decomposition is slowed compared to disturbed soils (due to reduced aeration and oxidation)	Soil organic carbon content increases; soil quality and resilience is enhanced; formation of more stable humus is increase	increased CO_2 sequestration
	Mechanical tilling decreases	Fossil fuel consumption		Decreased CO_2 emissions

		decreases		
Retain crop residue	Soil organic matter is retained	Soil organic content increases from residue input to soils		Increased CO_2 sequestration
Organic fertiliser application	Productivity increases	Soil organic matter increases		Increased CO_2 sequestration Possible increased N_2O
Increase the use of perennial crops (e.g., perennial crops planted.)	Aboveground biomass increases (e.g., trees)			Increased CO_2 sequestration
	Root systems increase	Soil erosion reduces and soil organic matter is maintained		Increased CO_2 sequestration
Mulching	Soil stability increases	Soil organic matter is maintained		Increased CO_2 sequestration
	Soil moisture retention increases	Productivity increases	Soil organic matter increases	Increased CO_2 sequestration
Synthetic fertiliser application	Productivity increases	Soil organic matter increases		Increased CO_2 sequestration Increased N_2O emissions
Rotational grazing or cultivation	Soil stability increases	Soil organic matter is maintained		Increased CO_2 sequestration
Rotational grazing	Pasture productivity increases	Soil organic matter increases		Increased CO_2 sequestration
		Livestock health improves		Impacts on enteric fermentation, as described in Table 6.4
Agroforestry or silvopastoral systems	Number of trees planted increases	Aboveground biomass increases (e.g., trees)		Increased CO_2 sequestration
		Soil organic matter is maintained		Increased CO_2 sequestration
Unintended effect				
Minimal or no tillage in waterlogged soils				Increased N_2O emissions
Organic and Synthetic fertiliser application (e.g., N fertiliser)	Nitrogen leaching into the environment increases because not all of it is absorbed by plants	Denitrification and volatilisation increases		Increased N_2O emissions
	Production of synthetic fertiliser increases	Emissions from production increase		Increased CO_2 emissions
Liming to address soil acidity and improve productivity	Carbonate limes dissolve and release extra bicarbonate	Additional chemical reactions occur, depending on soil		Increased CO_2 emissions

	(HCO_3) into soils	factors and climate regime		
Rotational grazing or cultivation	Use of machinery to install or maintain rotational grazing or cultivation increases	Fossil fuel usage increases		Increased CO_2 emissions

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 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 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. Figure 6.2 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 forest land will be converted to cropland, this means 10,000 more hectares of forest will be converted to cropland than 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 Guidance* (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[8] 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

[8] 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.

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 6.6. 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 6.6: 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.

Users should consult stakeholders when assessing the likelihood of impacts. Refer to the ICAT *Stakeholder Participation Guidance* (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 6.7. 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 categorised.

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 6.7: 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). Table 6.8 and Table 6.9 provide additional guidance on what to consider when evaluating which GHG sources and carbon pools to include in the GHG assessment boundary. The tables cover enteric fermentation and soil carbon sequestration, respectively.

The ICAT *Forestry Guidance* 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 avoided CO_2 emissions in forests.

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

Likelihood	Magnitude		
	Minor	Moderate	Major
Very likely	Insignificant	Significant	Significant
Likely	Insignificant	Significant	Significant
Possible	Insignificant	Significant	Significant
Unlikely	Insignificant	Insignificant	Insignificant
Very unlikely	Insignificant	Insignificant	Insignificant

Source: Adapted from WRI 2014.

Table 6.8: Considerations for evaluating significance of GHG sources and carbon pools for policies targeting enteric fermentation

Source/ Carbon pool	Gas	Considerations
Enteric fermentation	CH_4	This source should be considered significant for all livestock policies with interventions that target enteric fermentation
Soil carbon sequestration	CO_2	This source may be significant when policy interventions include improved pasture management and adoption of silvopastoral systems because, in general, adoption of improved pasture management and/or silvopastoral systems will increase plant production and thus inputs to soil carbon pools. The magnitude of the effect varies considerably.
Biomass carbon sequestration	CO_2	This source may be significant when the policy intervention increases adoption of silvopastoral systems with trees resulting in increased density of trees on affected land compared to baseline. The magnitude of the effect varies considerably.
Nutrient management	N_2O	This source may be significant when the policy intervention leads to changes in nitrogen inputs to soils relative to baseline soil management practices. However, the net direction and magnitude of effects can vary greatly. For example, when improved pasture management and silvopastoral systems are part of the policy (a) more fertiliser may be added to promote growth of high quality forage species and this will increase N_2O emissions; and (b) livestock productivity may improve such that more can be produced on the same or less area of pasture, reducing expansion of and overall demand for fertilisers pastures compared to baseline and this will reduce N_2O emissions. In addition, changes in herd management (i.e., adoption of rotational grazing) may alter nitrogen inputs from urine and dung deposited on pasture, range, and paddock, which can affect this source.
Manure management	N_2O, CH_4	This source may be significant when the policy intervention impacts the amount of time or the number of animals stall-fed and managed in housing. The method of manure collection and storage, and separation

		of solids and liquid animal wastes can have a significant impact on GHG emissions from animal facilities.
Electricity/heat/fuel combustion	CO_2	Electricity emissions are expected to be insignificant for most policy interventions and can be excluded from the GHG assessment boundary. There may be some situations where this source needs to be considered more carefully before excluding, for example when construction of new facilities (e.g., for livestock research/breeding/health) are included in the policy interventions.
Emissions from land-use change	CO_2	Generally, where supply is increased as a result of the policy, negative land-use change effects will likely be insignificant and can be excluded from the GHG assessment boundary. This source may be significant in terms of avoiding CO_2 emissions from deforestation when the policy intervention leads to increases in productivity on pasture and grazing land. When more can be produced on less area, relative to the baseline, the need to expand pasture and grazing land is reduced. The likelihood and magnitude of the effect is difficult to assess.

Table 6.9: Considerations for evaluating significance of GHG sources and carbon pools for policies targeting soil carbon sequestration

Source/ Carbon pool	**Gas**	**Considerations**
Soil carbon	CO_2	This source should be considered significant for all policies with interventions that target soil carbon sequestration.
Biomass carbon	CO_2	This source may be significant when the policy intervention involves increasing the density of trees on affected lands relative to baseline. The magnitude of the effect varies considerably.
Biomass burning	CO_2, CH_4, N_2O	If controlled burning occurs in the baseline, this source is likely not going to change significantly. In addition, overall this source has a relatively small magnitude of effect.
Nutrient management	N_2O	This source may be significant when the policy intervention involves increasing or decreasing nitrogen inputs to soils relative to baseline management practices. However, the net direction and magnitude of effects can vary greatly.
Manure management	CH_4, N_2O	This source is not likely to be significant for soil carbon policies.
Fuel combustion	CO_2	An increase in this source is likely to occur when policy interventions require increased use of machinery, such as moving earth to construct terraces and contour strips. A decrease can occur when the policy intervention leads to switching from conventional tillage to no-till or conservation tillage agriculture. However, the magnitude of the effect is probably minor.
Emissions from land-use change	CO_2	Generally, where supply is increased as a result of the policy, negative land-use change effects will likely be insignificant and can be excluded from the GHG assessment boundary. Where supply is decreased as a result of the policy, then negative land use effects are possible. This may occur when the policy intervention reduces crop outputs or access to

		land for grazing cattle, compared to baseline. Where the policy reduces supply such that supply is unable to meet demand, users should evaluate the potential significance of the effect (e.g., how much has supply decreased). In this case users can estimate the volume of goods displaced. Where supply is significantly impacted (e.g., more than five percent of the country's total production), the estimated volume of goods displaced can be used to estimate the hectares land where activities are shifted to compensate for the decrease in supply. Changes in GHG sources and/or carbon pools on those land areas should be included in the GHG boundary. As part of its Jurisdictional and Nested REDD+ programme, the VCS Program provides guidance for quantifying the effective area needed to maintain production[9] and guidance for evaluating the volume of foregone commodity production.[10] Both of these resources can be adapted to assess the significance of an agricultural policy on supply or demand.

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 guidance. For example, where users are assessing sustainable development impacts using the ICAT *Sustainable Development Guidance* in addition to assessing GHG impacts, the assessment period should be the same for both the sustainable development and GHG impact assessment.

Ex-ante assessment

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)

---

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

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

- 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.[11]

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, 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.

Ex-post assessment

For an ex-post assessment, the assessment period can be the period between the date the policy or action 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)

Climate change 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 Guidance* for guidance on conducting an assessment of sustainable development impacts. Table 6.10 lists examples of sustainable development impacts that may be associated with agriculture policies, categorised according to the ICAT *Sustainable Development Guidance.* The Sustainable Development Goals (SDGs) most directly relevant to each impact category are indicated in parentheses.

[11] IPCC 2006.

Table 6.10: Examples of sustainable development impacts relevant to agriculture policies

Dimension	Groups of impact categories	Impact categories
Environmental impacts	Air	• Air quality • Visibility • Odors
	Water	• Availability of freshwater (SDG 6) • Water quality (SDG 6, SDG 14) • Biodiversity of freshwater and coastal ecosystems (SDG 6, SDG 14)
	Land	• Biodiversity of terrestrial ecosystems (SDG 15) • Depletion of soil resource (SDG 15) • Land-use change, including deforestation, forest degradation, and desertification (SDG 15) • Soil quality (SDG 2) • Soil erosion
	Waste	• Treatment of solid waste and wastewater (SDG 6)
	Other/cross-cutting	• Resilience of ecosystems to climate change (SDG 13) • Energy (SDG 7) • Depletion of nonrenewable resources • Toxic chemicals released to air, water and soil • Terrestrial and water acidification (SDG 14) • Infrastructure damages from acid deposition
Social impacts	Health and well-being	• Hunger, nutrition, and food security (SDG 2) • Access to safe drinking water (SDG 6) • Access to land (SDG 2)
	Education and culture	• Capacity, skills, and knowledge development (SDG 4, SDG 12) • Climate change education, public awareness, capacity-building and research
	Institutions and laws	• Strengthening land tenure • Public participation in policy-making processes • Access to information and public awareness (SDG 12)
	Welfare and equality	• Poverty reduction (SDG 1) • Protection of poor and negatively affected communities (SDG 12) • Gender equality and empowerment of women (SDG 5) • Indigenous rights
	Labour conditions	• Labour rights (SDG 8) • Quality of jobs (SDG 8) • Fairness of wages (SDG 8)
	Communities	• Community/rural development

	Peace and security	• Resilience to climate change, including adaptation to dangerous climate change and extreme weather events (SDG 13)
Economic impacts	Overall economic activity	• Economic activity (SDG 8) • Economic productivity (SDG 8, SDG 2)
	Employment	• Jobs (SDG 8) • Wages (SDG 8) • Worker productivity
	Business and technology	• New business opportunities (SDG 8) • Innovation (SDG 8, SDG 9) • Competitiveness of domestic industry in global markets
	Income, prices and costs	• Income (SDG 10) • Prices of goods and services • Costs and cost savings • Market distortions (SDG 12) • Internalisation of environmental costs/externalities • Cost of policy implementation and cost-effectiveness of policies
	Trade and balance of payments	• Balance of trade (imports and exports) • Foreign exchange • Government budget surplus/deficit

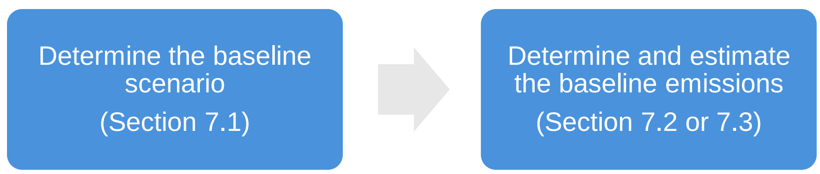
PART III: ASSESSING IMPACTS

7. ESTIMATING THE BASELINE SCENARIO AND EMISSIONS

When using the scenario 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, livestock and soil management practices, and the associated GHG emissions and removals that would have occurred, without the implementation of the policy.

The guidance 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 deemed estimates approach. In such cases, users can skip to Chapter 8.

Figure 7.1: Overview of the steps in the chapter



Checklist of key recommendations

For enteric fermentation:

- Determine livestock categories and feed characterisation
- Estimate the baseline average annual population for the species mix
- Choose or derive emission factors
- Calculate the cumulative GHG emissions for the baseline scenario over the assessment period

For soil carbon sequestration:

- Stratify land by IPCC land-use category and soil management practices
- Estimate the area of land in each stratum
- Determine the soil carbon stock for each stratum
- Calculate the net change in soil carbon stock over the assessment period
- 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 affect 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 agriculture 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:
    - Trends in the increase or decrease of livestock populations
    - Improvements in livestock management
    - Exploitation of organic soils
    - Tillage practices

To the extent possible, 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 historical and forecasting data, any of the following of approaches can be used for determining the baseline scenario. Figure 7.2 illustrates the different baseline approaches. More detailed step-wise guidance for determining the baseline scenario and estimating emissions for enteric fermentation and soil carbon sequestration are provided in the Sections 7.2 and 7.3, respectively.

Constant baseline

This approach assumes there will be no change in agricultural practices, the use of technology, or land use 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 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.

Simple trend baseline

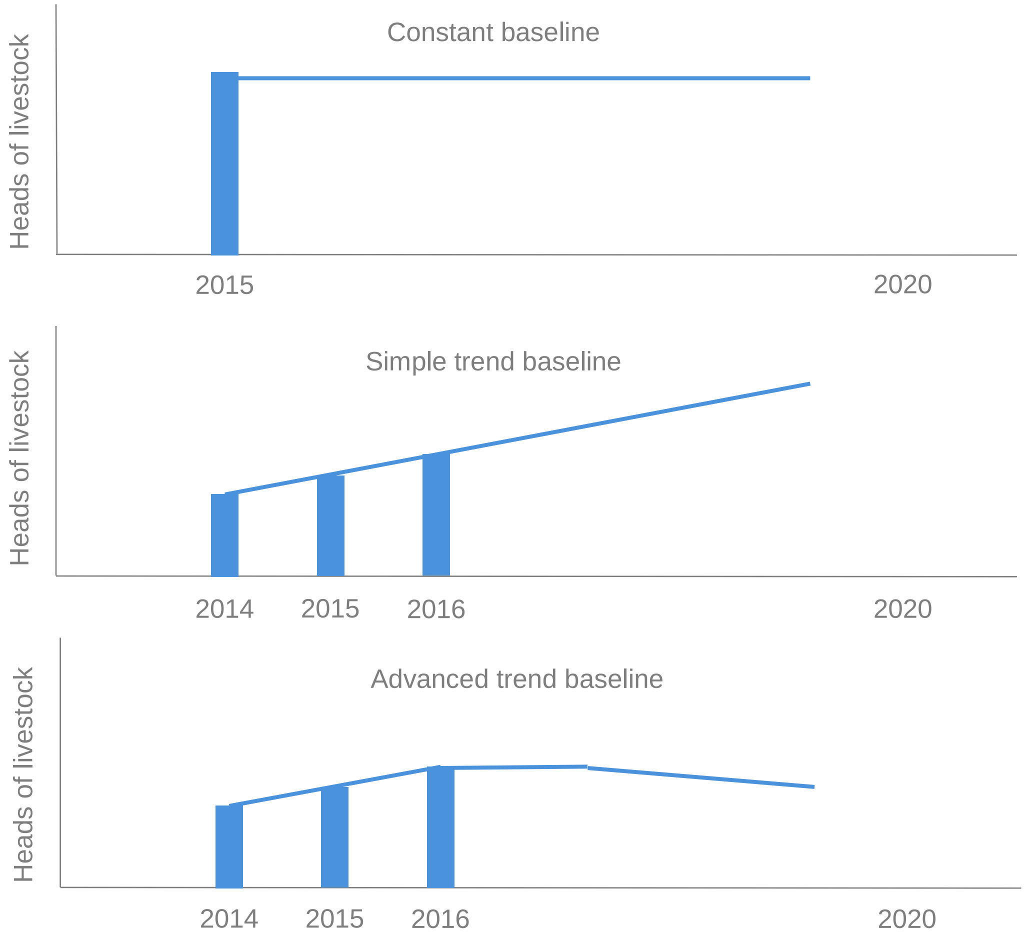
This baseline scenario approach assumes that agricultural practices, the use of technology, and land use will evolve in the same way as they have in the past. This approach typically uses a linear or exponential extrapolation of the historical trend for each baseline parameter. Users can employ a statistical regression analysis to estimate trends. This approach 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, livestock population in the future can be estimated by assuming that the same annual rate of livestock population change prior to policy implementation continues in the baseline. Land-use change can also be extrapolated this way using the historical trends.

Advanced trend baseline

This approach models 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 (e.g., macroeconomic and demographic conditions) will impact the agriculture sector. For example, the approach may model how GDP will impact livestock populations or changes in land-use management and then uses GDP forecasts to predict baseline livestock populations.
- **Bottom-up model**: This approach models the interaction of key factors on specific mitigation practices, use of technologies, and land use. It can offer a more detailed projection of specific GHG sources and carbon pools. This approach will likely require detailed data such as livestock census data, including the average daily feed intake per species, or specific land management practices. It is suitable for policies that target a specific livestock category (e.g., dairy cows or buffalo for milk production) or a specific land type (e.g., grasslands or croplands).

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



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.

Historical data from national GHG inventories, National Communications and Biennial Update Reports, which are prepared following IPCC guidelines, can be used for determining the baseline scenario and estimating baseline emissions and removals.

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 credible 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.

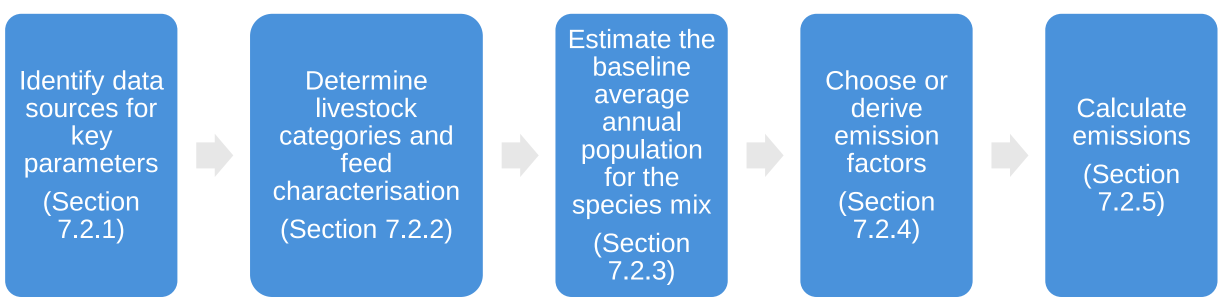
7.2 Estimate baseline emissions from enteric fermentation

This section provides guidance on estimating baseline emissions for enteric fermentation. 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 guidance can also be used to estimate policy scenario emissions for enteric fermentation. To estimate policy scenario emissions, use the same method that was used to estimate baseline emissions with new parameter values derived following the guidance 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.

Note that potential CH_4 and N_2O emissions from animal manure are not included in this guidance. Refer to the guidance in Section 6.2 to determine whether this GHG source should be included in the GHG assessment boundary. For some policies, it may be conservative to assume that the animal manure management systems in the baseline and policy scenarios are the same.

Figure 7.3: Steps for estimating the baseline emissions for enteric fermentation



7.2.1 Identify data sources for key parameters

Methane production from ruminant livestock is dependent on a number of factors, including population, animal characteristics and feed characteristics. To estimate enteric fermentation emissions for the baseline scenario, the key parameters are:

- **Livestock population data**: The annual average livestock population data, over the duration of the assessment period, for the livestock species and categories targeted by the policy
- **Methane emission factors**: A factor that represents the methane emissions per head of livestock per year, based on feed properties and animal attributes

For livestock population data, evaluate available, existing data that can be used to create a baseline. There are three possible sources of data for livestock populations. These include:

- **Agricultural or livestock census data**: Primary data on current and/or historical livestock population and species. The Food and Agriculture Organization (FAO) operates the World Programme on Agricultural Census and provides methodological guidance for carrying out agricultural censuses.[12] Users can follow this guidance. Where available, agricultural or livestock census data that is available from the national GHG inventory can be used for this assessment; conversely any data gathered as part of an agricultural census can be used to inform the national GHG inventory.
- **Population estimates**: Secondary data on the current estimation of livestock population and species (e.g., extrapolation of livestock population from sample surveys).
- **Economic data**: Secondary data on the output of milk and/or meat production from which estimates of livestock population and species can be derived.

Identify the type of emission factors to be used. There are three options for selecting emission factors. The choice of option depends on availability of data and the source of emission reductions. Further guidance on identifying or deriving emission factors is provided in Section 7.2.3. The emission factor options include:

- **Tier 1 IPCC default emission factors**: IPCC 2006 GL, Volume 4, Chapter 10 provides emission factors for dairy and non-dairy cattle for geographic regions in Table 10.11. Table 10.10 provides emission factors for non-cattle livestock types.
- **Published Tier 2 emission factors**: These factors are based on feed and diet characteristic data and are country- or region-specific. These emission factors can found in published research studies or in the national GHG inventory.
- **Derived Tier 2 emission factors**: These factors are developed by the user to represent the baseline scenario and are used for estimating the impact of the policy. They are based on feed and diet characteristic data. This derivation method is explained in Section 7.2.3.

Where the policy aims to reduce the population of livestock, Tier 1 factors can be used. Where the policy aims to improve the efficiency of livestock production, Tier 2 factors should be used to capture changes in management and feeding and improvements in productivity. Higher 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 emission factor method to use.

7.2.2 Determine the livestock categories and feed characterisation

It is a *key recommendation* to determine the livestock categories and feed characterisation. Use the following steps to determine the livestock species categories, sub-categories and typical feed input (i.e., diet) for each livestock subcategory.[13]

---

[12] Available at: http://www.fao.org/world-census-agriculture/en/

[13] This section is adapted from IPCC 2006.

Livestock categories

Users should determine which livestock species to include in the assessment, focusing on livestock categories or subcategories that are affected by the policy. It may also be sufficient to focus on the highest emitting livestock species (such as dairy and non-dairy cattle). Where other types of livestock do not contribute significantly to overall enteric emissions, they can be excluded.

Of all possible types of livestock, dairy cattle tend to have the highest enteric fermentation emissions ranging from 46 - 128 kg CH_4/head/year. Non-dairy cattle groups, such as beef cattle, have enteric fermentation emissions ranging from 27 – 60 kg CH_4/head/year. After cattle, the next highest emitters, in rank order, are buffalo, sheep, goats, swine, horses, camels, mules/asses and poultry.

Livestock characterisation

To accurately estimate baseline emissions, users should characterise each livestock species. A characterisation is a list of livestock sub-categories. In the next step (Section 7.2.3), the average annual population for each category will be derived.

Choose a basic or enhanced livestock characterisation. A basic characterisation uses the livestock subcategories for which there is a default emission factor (e.g., dairy cattle, non-dairy cattle, buffalo, sheep, goats, swine, horses, camels, mules/asses and poultry). An enhanced livestock characterisation is necessary when more detailed Tier 2 emission factors are used. For an enhanced livestock characterisation, subdivide the livestock categories further. Livestock subcategories should be defined as relatively homogenous sub-groupings of animals accounting for variations in age structure and animal performance. Table 10.1 in the IPCC 2006 GL provides representative livestock subcategories and Chapter 10 provides guidance on defining country-specific livestock subcategories.

Feed intake

With Tier 2 emission factor methods, users should estimate the feed intake for a representative animal in each livestock subcategory. The representative feed intake is used to derive each subcategory's emission factor. Guidance for estimating feed intake is provided in Chapter 10 of the IPCC 2006 GL. Feed intake is typically measured in terms of gross energy (e.g., MJ per day) or dry matter (e.g., kg per day). The assumed feed intake should represent animal feeding practices under the baseline scenario. Feed intake is in many cases a key parameter that is changed in the policy scenario.

7.2.3 Estimate the baseline average annual population for the species mix

It is a *key recommendation* to estimate the baseline average annual population for the species mix. Where livestock census or population data are available, use one of the baseline approaches described in Section 7.2.3 to estimate the average annual livestock population numbers and species mix (i.e., population numbers in each livestock subcategory) for the baseline assessment period. See Equation 10.1 in the IPCC 2006 GL for how to calculate average annual population numbers for livestock.

Where livestock census or population data are not available, economic data can be used to infer livestock population numbers. When using economic data (e.g., an output or yield), an advanced trend baseline approach is appropriate for projecting the baseline scenario. The following steps should be followed to estimate livestock population:

- Step 1: Estimate future milk and/or meat demand

- Step 2: Estimate the livestock population needed to meet the demand

Step 1: Estimate future milk and/or meat demand

Start by developing an understanding of how demand for milk and/or meat are expected to change over time. This approach assumes that demand will be met by supply. That is, as demand increases, supply will increase; or as demand decreases, supply will decrease. Therefore, trends in demand are used as a proxy for the expected output of milk and/or meat (e.g., kg of milk meat produced per year) production in the baseline scenario. Users can choose between the following three methods to estimate the future demand for milk and/or meat;

1. Where forecasts for milk and/or meat demand or production are available for the country or region, it is preferable to use those forecasts. Ministry of agriculture, national agricultural research institutes, ministry of finance and international agencies (e.g., FAO) are potential sources of demand forecast data. Where possible, employ national data sources that are widely accepted among policymakers and endorsed by the government.
2. Where forecasts for milk and/or meat demand or production are not available for the country or region, estimate future demand using one of the approaches for determining the baseline described in Section 7.1.1. Users can forecast demand by extrapolating historical data on milk and/or meat demand using a linear trend that aligns with the historical trend (i.e., simple trend baseline).

   Alternatively, users can link milk and/or meat demand or production to trends in population and GDP growth. Users can use future trends in GDP, population or other proxy factors, to estimate how current demand for milk and/or meat will evolve in the future (advanced trend baseline). Bear in mind that future changes in eating patterns could make such correlations poor predictors of future demand.
3. Where neither of the above data sources is available, user can obtain estimates of future milk and/or meat demand or production from sector experts. Users can consult national experts for estimates of growth, to provide the compound annual growth rate for demand for milk and/or meat output as an indicator.

Step 2: Estimate the livestock population needed to meet the demand

The forecasts for milk and/or meat demand or production can be used to estimate the species mix in the baseline scenario (e.g., livestock population in each livestock category or subcategory). Users can choose one of the following approaches to achieve this, or adapt one of the approaches below:

1. **Constant baseline**: Use the constant baseline approach and assume that the percentage of livestock in each category remains the same in the baseline scenario as it is in the current situation, or the situation prior to policy implementation. Users estimate how many of each type of livestock is needed to meet the forecasted milk and/or meat demand. This is the best default assumption where there data about the future species composition is limited.
2. **Simple trend baseline**: Use the simple trend baseline approach and assume that the historical trend for milk and/or meat demand evolve the same way in the future. Based on this, estimate the population of livestock in each category needed to meet the demand as described by the future demand scenario. This approach can lead to unreasonable results for longer timeframes where

certain livestock categories experienced high growth rates in the past but are unlikely to continue at the same rate in the future. It may be necessary to adjust to livestock categories to account for this.

3. **Advanced trend baseline**: Use the advanced trend approach and assume that certain livestock categories decrease more or less than others to meet forecasted demand for milk and/or meat. This approach is appropriate where there is evidence that a certain livestock category will have greater dominance in the future food system. For example, a national study may predict replacement of buffalo milk with cow milk.

7.2.4 Choose or derive emission factors

It is a *key recommendation* to choose or derive emission factors. For each livestock category, users should apply the emission factor to estimate the emission level. The following approaches can be used to choose or derive emission factors:

1. **Tier 1**: Use IPCC default emissions factors for livestock by geographic region (in kg CH_4 per head per year) in Table 10.10 and 10.11 of the IPCC 2006 GL, Volume 4, Chapter 10. Users should also refer to tables in IPCC Annex 10A.1 to ensure that the underlying animal characteristics (e.g., weight, growth rate and milk production) used to develop the emission factors for cattle and buffalo are similar to the conditions in the baseline scenario. Select the emission factor from Annex 10A.1 that best matches the characteristics of the cattle and buffalo populations in the baseline scenario, even if that means choosing an emission factor for a region that is different from where the policy is being implemented. For dairy cattle, average annual milk production data should be used to select an emission factor. If necessary, interpolate between dairy cow emission factors in the table using assumed baseline scenario average annual milk production per head.

   Use the same emission factor for all years in the baseline assessment period (i.e., assume there are no changes in underlying animal characteristics).

2. **Published Tier 2**: Where Tier 2 country-specific emission factors for livestock categories are available in the national GHG inventory report, those emission factors can be used. It is important to know the underlying species mix and feed intake characteristics associated with the emission factors so that these parameters can be adjusted in the policy scenario. If information on these underlying characteristics is not available, even though the emission factors are country-specific, it may be preferable to use one of the other two emission factor options.

   Use the same emission factor for all years into the future (i.e., assume there are no changes in underlying animal characteristics).

3. **Derived Tier 2**: Calculate species-specific emission factors that represent that baseline scenario following the method provided in the IPCC 2006 GL, Volume 4, Chapter 10. The Tier 2 emission factor requires an enhanced livestock characterisation, specifically data on the gross energy intake and methane conversion factor for each livestock category.

   To derive Tier 2 emission factors, follow these steps:

   - Step 1: Derive gross energy for each livestock sub-population. This requires data on: average animal weight and weight gain, average number of hours worked per day (for draft animals), feeding situation (e.g., stall, pasture, grazing lands), mean winter temperature, average daily milk production and fat content of milk (dairy cows only), percentage of females giving birth and number of offspring produced each year, and feed digestibility.

- Step 2: Derive a methane conversion factor (EF) from the gross energy intake for each livestock sub-population using the following equation for estimating a Tier 2 emission factor:

$$EF = \frac{GE \times \frac{Y_m}{100} \times 365}{55.65}$$

Where:

EF = methane emission factor, kg CH_4 /head /yr

GE = gross energy intake, MJ /head /day

Y_m = methane conversion factor, %

55.65 = the energy content of methane, MJ /kg CH_4

Users can assume that the emission factor remains constant over the baseline assessment period, indicating that there is no improvement in the agricultural practice (static baseline emission factor). Users can also assume emission factors change over time (e.g., dynamic baseline emission factors) in rare cases where the livestock species is expected to evolve (through breeding or genetic engineering) or feed quality (and supplements) changes.

7.2.5 Calculate GHG emissions

It is a *key recommendation* to calculate the cumulative GHG emissions for the baseline scenario over the assessment period. This is done by applying the species-specific emission factors to each species in the forecasted livestock population to derive the baseline emissions over the assessment period.

Annual enteric fermentation emissions from a livestock category are calculated as follows:

$$Total\ annual\ CH_4\ Emissions\ = \sum_{t}^{i} EF_t \times N_t$$

Where:

Total annual CH_4 Emissions = total methane emissions from enteric fermentation, kg CH_4 /yr

EF_t = emission factor for the defined livestock population, kg CH_4 /head /yr

N_t = the number of head of livestock per category t in the country, head

t = livestock category or subcategory

i = the number of livestock categories in the characterisation

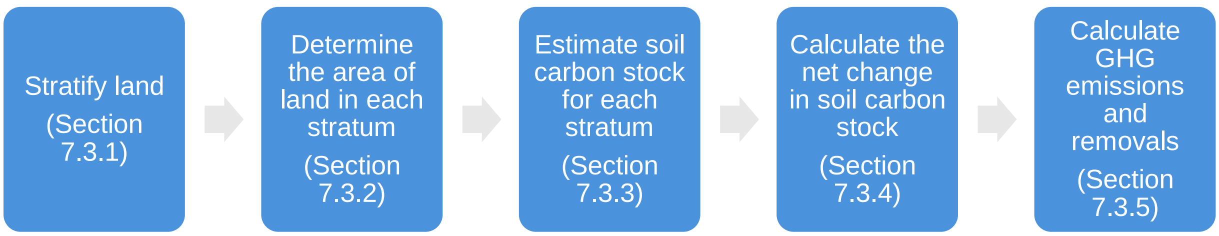
Convert CH_4 to CO_2 equivalent (CO_2e) based on the 100-year global warming potential (GWP) of CH_4 and multiply by 0.001 to convert kg to tonnes. Sum the annual emissions over all years in the assessment period to yield total cumulative emissions.

7.3 Estimate baseline soil carbon sequestration

This section provides guidance on estimating the GHG emissions and/or removals from soil carbon for the baseline scenario. The baseline scenario can be estimated ex-ante or ex-post. Figure 7.4 outlines the steps in this section.

The guidance can also be used to estimate GHG emissions and/or removals from soil carbon for the policy scenario. To estimate policy scenario emissions and/or removals, use the same method that was used to estimate baseline emissions and/or removals with new parameter values (land-use strata and land area in each strata) derived following the guidance 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.

Figure 7.4: Steps for estimating the baseline emissions for soil carbon



Changes in land use can lead to a decrease or increase in soil carbon, and thereby to GHG emissions or GHG removals, respectively. For example, conversion of grassland to cropland usually results in a net loss of carbon from soils. However, cropland established on previously sparsely vegetated or highly disturbed lands (e.g., degraded lands) can result in a net gain in soil carbon and biomass (the latter if there is perennial woody vegetation in the cropland system).

Where land use remains the same in the baseline and policy scenarios (e.g., cropland remaining cropland or grassland remaining grassland), changes in management (e.g., switching from conventional tillage to no till practices or from intensive grazing to rotational grazing practices) can result in net increases or decreases in soil carbon.

The impact of changes in land use and management lasts for approximately 20 years, or until a new change occurs. Where no changes in land use or management have occurred in the past 20 years, carbon stocks in the soil can be assumed to remain constant (i.e., at equilibrium with no net emission or removal of CO_2).

The key parameters for estimating baseline emission reductions and removals are:

- **Areas of land in land categories**: Hectares of land in land categories such as forestland, cropland, grassland, wetlands, settlements or other land divided into subcategories for climate zone, soil type, and management practices.
- **Representative soil carbon stocks**: A factor that represents the average soil carbon stock for a particular land category.

The IPCC Tier 1 and Tier 2 methods are the basis for the guidance below. The Tier 1 and 2 methods assume a constant annual change in soil carbon stocks over a 20-year default time period, based on a constant soil carbon stock change factor, which is derived from land use and land management trends.

Therefore, Tier 1 and Tier 2 methods represent land-use and management impacts on soil carbon stock as a linear shift from one equilibrium state to another.

The Tier 1 method can be readily adapted to a Tier 2 method by using country-specific data in place of Tier 1 defaults and therefore is expected to provide more accurate results; however, Tier 2 still employs the same linear assumptions as Tier 1.

Tier 3 methods may also be used to estimate baseline and policy scenario changes in soil carbon stocks. Tier 3 methods involve advanced measuring, monitoring, and estimation systems that will capture year-to-year variability in soil carbon fluxes. Tier 3 methods are able to address non-linear relationships, represent soil carbon dynamics at shorter time scales than 20-years and are capable of capturing longer-term legacy effects (i.e., effects from longer than 20-years in the past) of land use and management.

7.3.1 Stratify land

It is a *key recommendation* to stratify land by IPCC land-use category and soil management practices. Following guidance in Section 6.1.1, Step 3, users should have identified the affected land categories where soil carbon management impacts are expected to occur under the policy scenario. For each affected land category in the GHG assessment boundary, identify the climate regions, soil types and management categories that occur on those lands in the baseline scenario.

A list of example climate region, soil type and management categories are provided in Table 3.1 of the IPCC 2006 GL, Volume 4, Chapter 3. The definitions of the categories are explained in Annex 3A.5. Additional management categories for cropland and grassland are provided in the Tables 5.5 and 6.2 of the IPCC 2006 GL. Where using the Tier 1 estimation methods described in Section 7.3.3, management categories should correspond to relative stock change factors developed by the IPCC.

Stratify land following the guidance on land stratification provided in the IPCC 2006 GL, Volume 4, Chapter 3. The approaches for land stratification range from simple (Approach 1) to complex, requiring spatially explicit data sets derived from remote sensing (Approach 3). Where users are relying on datasets prepared for other purposes (such as forest and agriculture census data or land cover maps showing one point in time) Approach 1 for land stratification may be the best option.

Where relying on Approach 1, the land categories are simplified to cropland, grassland and forest land at a given point in time (without regard to prior land use). Users need data on the area of land in each strata. Where data on conversions between land categories (i.e., land remaining in a land-use category and land converted to a new land-use category) is not available, it is still possible to assess impacts with an Approach 1 stratification following the methods in Section 7.3.2.

7.3.2 Estimate the area of land in each stratum

It is a *key recommendation* to estimate the area of land in each stratum. To determine the soil carbon stock of each stratum for the baseline scenario, it is important to understand how the land-use and management practices are expected to evolve in the absence of the policy.

Estimates for the hectares of land in a land stratum should be derived from national data sources that are widely accepted among policymakers and endorsed by the government. Potential data sources include 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 useful. These data sources will typically provide information on historical and current land area.

Where historical and current data are available, they can be used to estimate the hectares of land in each stratum for the baseline scenario following any one of the approaches for determining the baseline scenario in Section 7.1.1. Further guidance on using the baseline approaches to estimate area of land in each stratum is provided below:

- **Constant baseline**: Assume that the current percentage of land in each stratum remains unchanged over the period of the baseline scenario. This assumption is suitable where future land use is unknown.
- **Simple trend baseline:** Recognising that land can transition between use and management categories, the baseline scenario can be estimated by continuing historical trends. Users can assume that the historical trend for the change in land area between strata evolves in the same way into the future.

  An example for how to do a simple trend extrapolation using an Approach 1 land stratification follows. Estimate the hectares of land in each stratum for at least two points in time in the past. For each stratum, calculate the change in area over time and divide by the number of years in the time period to give the historical average annual rate of change in area for that stratum (ha/year). Use the simple trend to estimate future land area in each strata (see Table 7.1 and Table 7.2 for examples of how to do this). Datasets from multiple sources may need to be combined to cover all of the strata in the land classification developed following Section 7.3.1.

  Table 7.1 shows land area data (hypothetical), according to an Approach 1 land stratification for two past points in time that are 20 years apart. From these data, one can calculate the annual average rate of change in area of a given strata (see the last column).

  Table 7.2 shows how historical land area change rates are used to extrapolate the amount of land in each category into the future. Note that if the total land area changes in the extrapolation, there is an inconsistency in the data or error in the projection.

Table 7.1: Example area estimates at two points in time in the past

Strata	Area at time $T_{(0-20)}$ (million ha)	Area at time $T_{(0)}$ (million ha)	Average annual change over 20 yrs (million ha/yr)
Grassland (moderately degraded)	10	7	-0.15
Grassland (improved)	2	5	0.15
Cropland (intensive till)	5	10	0.25
Forest	20	15	-0.25
TOTAL	37	37	0

Table 7.2: Future extrapolation of land areas for next 1 to 20 years (million hectares)

Strata	$T_{(1)}$ (million ha)	$T_{(20)}$ (million ha)

Grassland (moderately degraded)	6.85	4.0
Grassland (improved)	5.15	8.0
Cropland (intensive till)	10.25	15.0
Forest	14.75	10.0
TOTAL	37	37

- **Advanced trend baseline**: Assume that certain land-use strata decrease more or less than others. This assumption is appropriate when a simple forward extrapolation of historical land data results in changes deemed unrealistic, such as a complete loss of forests. In this approach, users can adjust annual average changes in particular categories based on expert judgment.

7.3.3 Determine soil carbon stock for each land stratum

It is a *key recommendation* to determine the soil carbon stock for each land stratum. Determine a representative soil carbon stock value (tC/ha) for each land stratum using either a Tier 1 or Tier 2 approach. The two approaches are further described below:

- **Tier 1**: The representative soil carbon stock (tC/ha) for each stratum is calculated by multiplying a reference soil carbon stock with stock change factors. The reference soil carbon stock represents the average soil carbon stock that would occur on unmanaged soils in a given climate zone for a given soil type. The stock change factors adjust the reference soil carbon stock up or down based soil management practices. There are three types of stock change factors: stock change factor for land-use systems or sub-systems (F_{LU}); stock change factor for management regime (F_{MG}); and stock change factor for inputs of organic matter (F_I).

  IPCC default reference soil carbon stock values are available in Table 2.3 of the IPCC 2006 GL, Volume 4, Chapter 2. These are based on climate region and soil type. Relative stock change factors are provided in Table 5.5 for cropland and Table 6.2 for grassland in the IPCC 2006 GL, Volume 4, Chapters 5 and 6. Where there is not a default IPCC stock change factor that is suitable for the conditions in the country use a factor of “1”.

  Table 7.3 provides an example for how to prepare a Tier 1 estimation of representative soil carbon stocks for the strata in the example above. This simple example assumes the entire GHG assessment boundary is in a tropical moist climate zone with high activity clay (HAC) soils.

Table 7.3: How to estimate representative soil carbon stocks using IPCC Tier 1

Land-use category	Reference soil carbon stock	Stock change factors			Representative soil carbon stock
	SOCref (tC/ha)	F_{LU}	F_{MG}	F_I	*SOC* (tC/ha)
Grassland (moderately degraded)	65	1	0.97	1	63.05
Grassland (improved)	65	1	1.17	1	76.05
Cropland (intensive till)	65	1	1	1	65.00

Forest	65	1	1	1	65.00

- **Tier 2**: Where country-specific representative soil carbon stock values are available (e.g., from a national GHG inventory or scientific research studies occurring within the geographic region of the country), they can be used. Tier 2 approaches can combine some Tier 1 defaults with country-specific factors. For example, if data are available to derive country-specific reference soil carbon stocks, these can be used with the IPCC default stock change factors for a Tier 2 estimate. Generally, Tier 2 representative soil carbon stocks are more accurate than Tier 1 representative soil carbon stocks.

7.3.4 Calculate the net change in soil carbon stock

It is a *key recommendation* to calculate the net change in soil carbon stock over the assessment period. Two approaches are described below for calculating the net change in soil carbon stock.

Where the baseline scenario is a constant baseline, then land area in each land stratum stays the same for the duration of the assessment period. In this case, carbon stocks are in a steady state and there is zero net change in soil carbon stocks over the assessment period for the baseline.

Where the baseline scenario is a simple or advanced trend baseline for changes in land use and management, calculate the baseline change in soil carbon stock over the assessment period for each land stratum following the steps below. In this case, changes in soil carbon stocks occur over the assessment period because of shifts in land area between categories of land use and management over the assessment period. An example calculation of these steps is provided in Table 7.4.

1. Multiply the representative soil carbon stock (tC/ha) by the land area (ha) for each land stratum at year 0 ($T_{(0)}$); this yields the total soil carbon stock (tC) of that land stratum at the beginning of the assessment period or for the reference year of the policy.

2. Sum total soil carbon stocks across all the strata to yield a total soil carbon stocks in all land in the GHG assessment boundary at the beginning of the assessment period or for the reference year of the policy.

3. Repeat steps 1 and 2, for the end of the assessment period ($T_{(x)}$), to yield a total soil carbon stock for all land in the GHG assessment boundary at the end of the assessment period. The example in Table 7.4 is based on a 20-year assessment period ($T_{(x)} = T_{(20)}$).

4. Subtract the total soil carbon stock at the beginning of the assessment period from total soil carbon stock at the end of the assessment period (i.e., $SOC\ T_{(x)} - SOC\ T_{(0)}$); this yields the baseline net change in soil carbon stock over the entire assessment period. Positive values indicate net gain of carbon in soils over time and negative values indicate a net loss of carbon from soils over time.

Table 7.4: Example of calculating the total net change in soil carbon stock over time using IPCC Tier 1

Land-use category	Representative soil carbon stock (tC/ha)	Land Area (million ha)		Total soil carbon stock (million tC)		Net change in soil carbon stock (million tC)
		$T_{(0)}$	$T_{(20)}$	$T_{(0)}$	$T_{(20)}$	

Grassland (moderately degraded)	63.05	7	4	441.4	252.2	
Grassland (improved)	76.05	5	8	380.3	608.4	
Cropland (intensive till)	65.00	10	15	650.0	975.0	
Forest	65.00	15	10	975.0	650.0	
Total				2,446.6	2,485.6	39.0

In the example above, total soil carbon stock increases over time in the baseline scenario by 39 million tonnes of carbon. The net increase in soil carbon stock over time is most likely explained by management changes. Grasslands that were formerly moderately degraded appear to come under improved management by the end of the period because there are 3 million more hectares of improved grassland and 3 million less hectares of degraded grassland at the end of the period. In addition, the improved grasslands have a higher representative soil carbon stock than degraded grasslands. The data also suggests that land use changed from forest to intensively tilled cropland. But, because the representative soil carbon stocks values are the same for forests and intensively tilled croplands, this type of transition is not causing the total net change in soil carbon stock.

7.3.5 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. This is done by converting the total net change in soil carbon stock to CO_2e emissions in tonnes by multiplying the total net change in soil carbon stock by 44/12 and by -1. This yields total cumulative CO_2e emissions (positive) or removals (negative) for the baseline, meaning the amount of CO_2e emissions and removals that occurred over the assessment period in the baseline.

Average annual emissions and removals can also be calculated by dividing the cumulative CO_2e emission or removals by the time interval of the assessment period (i.e., 20 years). In the example above, cumulative CO_2e removals are calculated as follows:

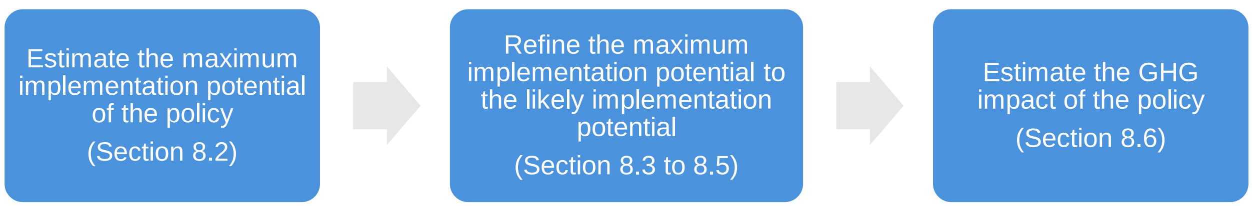
39.0 million tC x (44/12) x (-1) = -143 million tCO_2e

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 (mostly 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 scenario 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 estimate the relative change in GHG emissions based on the likely implementation potential of the policy, using the deemed estimates approach.

Figure 8.1: Overview of steps in the chapter



Checklist of key recommendations

- Determine the maximum implementation potential of the policy
- Analyse policy design characteristics and national circumstances that may reduce the effectiveness of the policy, and account for their effect on the maximum implementation potential
- Analyse the financial feasibility of the policy for each stakeholder group, and account for the effect on the implementation potential of the policy
- Analyse 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 mostly likely to occur in the presence of the policy being assessed. The guidance 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.

Guidance is provided in the subsequent sections on how to estimate the implementation potential of the policy based on policy design characteristics and national circumstances (Section 8.2), financial feasibility

(Section 8.3), and other barriers (Section 8.4). 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 4.1.3.

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

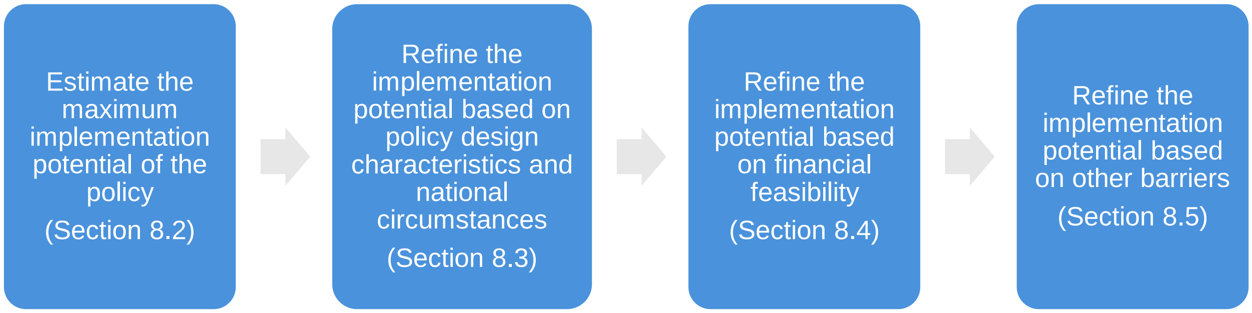
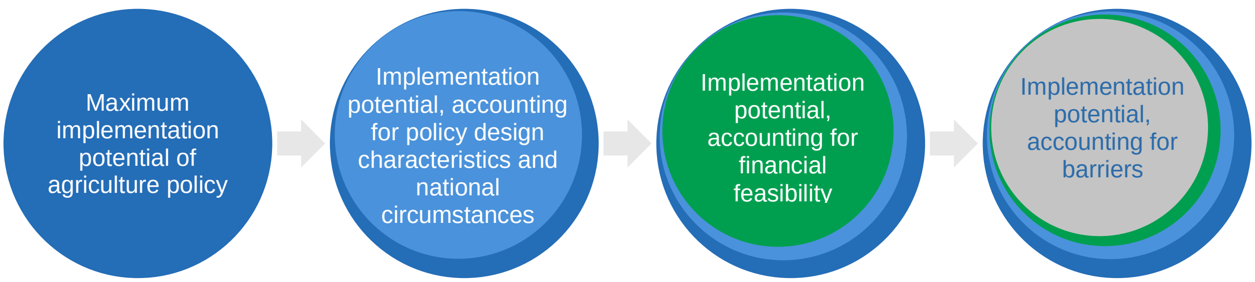


Figure 8.3 illustrates how the maximum implementation potential of the policy is refined after each step to achieve a more realistic estimate of the implementation potential. It is possible that the policy's likely implementation potential could exceed the estimated maximum implementation potential. This could occur where policies have a reinforcing effect (as discussed in Section 5.2).

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 8.1. 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 guidance in Section 8.5.

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 agriculture policy for national level GHG mitigation

The government is planning to put in place a national programme for Sustainable Pastures and Livestock Production (SPLP) to promote reduction of CH_4 emissions from enteric fermentation through the improvement of management practices for pastoral lands and livestock.

Through the SPLP, the government will provide incentive payments to pastoralists for the implementation of improved pasture management practices. Interventions will target beef and dairy producers whose herds are managed on small areas (less than 500 hectares) and medium-size areas (500-2,500 hectares).

The programme will start in 2021 and continue for 15 years. The government has approved USD 2 million per year for 15 years to the agriculture extension service. However, financial resources for the incentive payments to pastoralists have not been secured and efforts are currently being made to identify both national and international sources of funding.

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., the number of livestock grazing on improved pasture), 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 the 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 analysing implementation potential

GHG source or carbon pool	Policy	Activity Data
Biomass and soil carbon	• Payments for afforestation/reforestation • Technical assistance to improve grassland productivity • Public awareness campaign to	• Hectares of cropland converted to forest land • Hectares of improved grassland • Hectares of cropland under no-till cultivation

	promote use of no-till agriculture	
Enteric fermentation	• Technical assistance to improve feeding strategies	• Number and type of livestock receiving improved feed

The maximum implementation potential can be estimated based on a number of elements. The options include 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 can be estimated using a single or 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 removed 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 an agriculture policy could be to have 100% of all corn cultivated using no-till methods by 2050.

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 utilised 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 organisation 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 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 reducing enteric fermentation in dairy cattle and it costs USD 100 per head of cattle to implement, the maximum implementation level of the policy can be estimated as 10,000 cattle. Ideally this value would be reconciled with an estimate of the total number dairy cattle in the country to ensure that it is realistic to assume at least 10,000 cattle could be targeted by the policy measures.

Note that this analysis focuses on policy-level financing (e.g., national and sectoral-level). Guidance is provided in Section 8.2.3 for how to assess the financial feasibility of a policy from the perspective of landowners.

8.2.4 Land area and other resource potential

Analysing 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 land 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

Analysing 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 analyse 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 4.1.3).

8.2.6 Example of determining maximum implementation potential

The SPLP policy seeks to engage pastoralists in adopting more efficient land and livestock management practices to improve the quality of forage for livestock on pasture, through: (a) improved herd management strategies, (b) improved pasture management, and/or (c) improved silvopastoral systems.

Based on data from the latest national agriculture census, non-federally owned pasture cover approximately 34 million hectares (ha). The programme focuses on the improvement of pasture management on 3.5% of the eligible land (i.e., approximately 1.2 million hectares), which have been identified as the most vulnerable to degradation from overgrazing and mismanagement. On those lands, the average animal density is about 0.9 head/ha (higher than the national average of 0.6 head/ha) and no rotational grazing best practices are used.

Because the policy is formulated around pasture land and livestock management, the activity data chosen to determine the maximum implementation potential are land area and number of livestock. The maximum implementation potential in terms of the amount of land affected by the policy is 1.2 million hectares and in terms of total number of cattle affected is 1.08 million, over 15 years (Table 8.2).

The National Agriculture Agency is planning to engage farmers in voluntary contracts over 15 years. Pastoralists will receive annual payments for the first five years of participation to improve management practices for their land and livestock. Payments will range from USD 50/ha to USD 100/ha, and participation will be capped to keep the programme costs under USD 400 million over 15 years. An additional USD 2 million per year for 15 years will be made available to the agriculture extension service to provide training and support to participating pastoralists.

Table 8.2: Example of maximum implementation potential

Activity data	Maximum implementation potential
Implementation area (ha)	1,200,000
Number of animals (head)	1,080,000

8.3 Account for policy design characteristics and national circumstances

It is a *key recommendation* to analyse 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 analysing policy design characteristics and national circumstances that may reduce the effectiveness of the policy (Step 1) and estimating their effect on maximum implementation potential (Step 2). Section 8.3.2 provides some further guidance 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: Analyse 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 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 Guidance* (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 jeopardise 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 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 minimise the negative impacts. For example after following the guidance 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, and 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., favoring friends or relatives), allowing illegal practices (e.g., logging without permits), and misuse of funds intended for the policy.

Participation requirements

Participation in the policy, by people or organisations, 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 fertiliser 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 impacts 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 analysed (Step 1). Three of the questions related to institutional arrangements and national circumstances were considered to be not relevant. Extensive consultation with experts resulted in responses and scores shown in Table 8.4 below.

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?* The Agriculture Extension Agency has worked effectively with pastoralists for decades. Agriculture extension specialists will conduct routine site visits to assist with implementation of management plans drawn by participating pastoralists. There is past experience with the participation of farmers in government-funded projects relating to land management.	1
b.	*Is there corruption in the areas or regions under consideration, and if yes, how extensive?* Corruption is generally a problem in the country. However, the direct involvement of individual farmers/pastoralists (instead of associations or collaboratives that have chronic corruption issues) is expected to minimise any negative impacts on the policy implementation. After consulting with local agricultural offices, it became clear that in certain parts of the country (comprising approximately 45,000 ha) it will not be possible to directly involve pastoralists because of corruption, in which case it was assumed that any funds provided in those regions would not result in the expected policy outcomes	3
c.	*Is there clear title and rights to stakeholders receiving the benefits offered by the policy?*	N/A
d.	*How well will the levels of governance that influence land use be able to coordinate to achieve the intended outcome?*	N/A
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?*	N/A
2. Participation requirements		
a.	*Is participation or compliance with the policy voluntary or mandatory?* Because of the voluntary nature of the policy, experts believe that only about 75% of the targeted pastoralists will be willing to participate owing to the financial incentives (the government payment of USD 50/ha to USD 100/ha corresponds to a 2.5-5% increase of income) in addition to the expected productivity gains. These pastoralists manage about 93% of the total target area and about 90% of the number of animals.	3
3. Compliance monitoring and enforcement		
a.	*Is there a monitoring programme planned or in place to inspect policy implementation?* Yes, the agriculture extension specialists will monitor with site visits.	1

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?* Agriculture extension specialists will conduct routine site visits to monitor implementation of the policy. If site visits reveal implementation has not occurred or not occurred effectively, future payments will be withheld. It is highly likely to be enforced. There are no similar standards, rules or regulations to compare to.	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?* The Climate-Smart Agriculture programme aims to reduce GHG emissions from agriculture and deforestation through capacity building in a region containing 5 million ha of pasture land eligible for the SPLP programme. This may have a slight positive impact in the region, but it represents such a small fraction of the eligible land, that the impact on policy effectiveness is probably very minimal.	2
b.	*To what extent is the policy part of an interdisciplinary approach linking food security, ecosystem services and/or sustainable development?* The policy will contribute to improving water quality as a result of better water retentions and reduced runoff. The policy is also expected to halt expansion of land degradation through agricultural intensification, which may reduce deforestation pressure in some regions.	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 training and technical assistance to raise awareness and enhance technical skills of pastoralists	1
5. Policy implementation risks		
a.	*To what extent are the intended policy outcomes vulnerable to risks (including natural events and disasters) that could jeopardise or reverse the policy outcomes?* About 12% of the pastoral areas targeted by the policy are regions susceptible to wildfires due to a serious drought over the last 3 years. However, according to expert judgment, only half of that area is at risk of being destroyed by fires during the next 15 years. Should fires occur, they can damage infrastructure investments and decimate forage species, which may not re-establish without further management interventions costing time and money; it has also been established that of the high-risk area, 40% overlap with areas where corruption issues are expected (see 1c above).	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?* A small-scale pilot project was implemented during the period 2002-2006. The project targeted a select number of small pastoralists. The results were promising, and the experience from that project has helped with the design of SPLP.	1

The distribution of scores was evaluated (Step 2). Out of the 10 factors above, seven received a score of 1 or 2, indicating most factors considered are expected to have either a positive or no impact on the implementation of the policy. Three factors are likely to have a negative impact and received a score of 3. They were related to corruption (1b), participation requirements (2a), 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[14]:

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 summarises the estimated extent to which these factors will reduce policy outcomes.

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**	
	Land area	**Number of animals**
Reduce policy effectiveness by removing from the analysis pasture areas where farmers cannot participate directly but only through collaboratives that have a reputation for corrupt practices.	3.75%	3.75%
Experts estimate that only about 75% of pastoralists targeted will participate; therefore the policy is likely to be effective on 93% of the total area targeted and on 90% of the number of animals. Reduce the estimated area affected by the policy by 7% and the number of animals by 10%.	7.00%	10.00%
Six percent of the total area targeted by the policy is at risk of severe wildfires, 40% of that area overlaps with areas subject to corruptions issues, which was already accounted for in the first row of this table.	3.60%	3.60%
Total potential adjustment (percent reduction in policy effectiveness)	14.35%	17.35%

Complementarity and synergy factors 4a, 4b and 4c could create interest and possibly increase participation from farmers or pastoralists who see the benefits of the policy. However, the potential positive effect is not quantified.

At the end of the analysis, the maximum area and number of animals 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

Activity data	**Maximum implementation potential**	**Refined implementation potential based on policy design and national circumstances**
Implementation area (in ha)	1,200,000	1,027,800

[14] In cases where quantifiable information is not available, estimated adjustments to 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 factor considered is likely to have a negative effect.

Number of animals (head)	1,080,000	892,620

8.4 Account for financial feasibility

It is a *key recommendation* to analyse 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 analyses
- Exiting national cost studies
- Global cost studies
- Expert judgment based on assessments or desk review

In the absence of other available resources, guidance is provided in the section below for performing a basic cost analysis. Section 8.4.1 provides a method for analysing financial feasibility. Section 8.4.2 provides some further guidance 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 realise 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 analyse

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 analyse 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 significant inflation is not expected 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: Guidance on Discount Rates provides additional information on discount rates. To enable comparison between stakeholder groups, the costs should be normalised, for example per hectare, per operation, 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 realised 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 fertiliser 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.[15]

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:

[15] 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

- 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

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 participate 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 organisational processes or training new workers that are needed to provide different skills into the organisation.

- 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 guidance.[16]

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 pastoralists managing the land. This example considers 15 years of policy implementation.

First, the costs and revenues for the baseline scenario are estimated assuming that current pasture and livestock management practices would continue in the absence of the policy. Results are shown in Table 8.8, which presents annual data for Year 1-2, Years 3-5 and Year 6-15 of the policy. Negative numbers represent costs (expenses) and positive numbers represent revenues (income).

Table 8.8: Example calculation of baseline costs and revenues

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

Baseline	Annual costs and revenues for Year* (USD/ha):			Total
	1-2	3-5	6-15	
Costs				
Labour	-30	-30	-30	
Inputs (seed, feed, equipment, fuel, vet costs)	-15	-15	-15	
Land cost, taxes, concession fees	-20	-20	-20	
Total baseline cost	-65	-65	-65	
Revenues				
Revenues from animals	550	550	550	
Net baseline revenue, undiscounted	485	485	485	7,275
Net baseline revenue, present value	[485 – 422]	[367 – 277]	[241 – 69]	3,261

* Years are grouped for simplicity. Square brackets indicate the range of values during that time period. For example, [367 -277] means values range from USD 367/ha in Year 3 to USD 277/ha in Year 5.

Table 8.8 provides average present day estimates for costs and revenues per hectare under the baseline scenario. The costs identified are labour, inputs (seed, feed, equipment, fuel, vet costs), and land cost, taxes concession fees. The revenues identified include all income from selling animals. It is assumed that mature, slaughter-ready beef cattle weighs 450 kg/head. It takes 1.75 years and 1.1 hectares of grazing land to reach maturity. Beef can be sold for USD 2.40 per kg. Based on these assumptions, it is estimated that the annual per-hectare revenue for beef cattle on grazing land is USD 550/ha/year.

The cost and revenue were kept constant for all 15 years. Based on these assumptions, a typical farmer has net annual revenues (or cash flow) of USD 485/ha. Applying a discount rate of 15% reduces the annual revenue from USD 485/ha in Year 1 to USD 69/ha by Year 15.

Next, the costs and revenues for the policy scenario were estimated by assuming that the SPLP results in an increase in productivity through rotation practices and fencing. The results are shown in Table 8.9.

Table 8.9: Example calculation of policy scenario costs and revenues for the SPLP

Policy Scenario: SPLP	Annual costs and revenues for Year* (USD/ha):			Total
	1-2	3-5	6-15	
Costs				
Labour	-50	-35	-35	
Inputs (seed, feed, equipment, fuel, vet costs)	-183	-20	-20	
Land cost, taxes and concession fees	-20	-20	-20	
Total cost	-253	-75	-75	
Revenues				
Revenues from animals	550	578	578	
Government payment for improvements made	75	75	0	
Total revenue	625	653	578	

Net SPLP revenue, $/ha, undiscounted	372	578	503	7,502
Net SPLP revenue, $/ha, present value	[372 – 323]	[437 – 330]	[250 – 71]	3,284

* Years are grouped 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, in addition to those in the baseline scenario, are for labour and improvements to be made. The improvement costs are anticipated to be USD 375/ha and split between Year 1 and Year 2 (USD 188 each year). Labour costs are expected to be higher than in the baseline scenario. For the first 2 years, additional labour is required for the installation of fencing. For the following years, costs are higher because rotational grazing requires more active movement of cattle, and growing the right forage can require reseeding and applying fertiliser annually.

The revenues identified are expected to be the same as in the baseline (i.e., USD 550/ha) for the first two years. For the following years, the revenue increases by 5% as result of productivity improvements (beef and dairy production increases) made under the policy. Payments by the government are made for the first five years to compensate for the additional expenses for the improvements. The payments are made in equal installments of USD 75/ha per year.

Based on these assumptions, the net annual revenues will be lower for the first two years for a typical pastoralist (USD 372/ha compared to USD 485/ha), but higher in the following years (USD 578 for Years 3-5, and USD 503 for Years 6-15). Applying a discount rate of 15% reduces the annual revenue from USD 372/ha in Year 1 to USD 71/ha by Year 15.

The net cash flow in the policy scenario is positive and exceeds the net cash flow for the baseline scenario. Comparison of discounted net revenues in baseline (USD 3,261/ha) and policy (USD 3,284/ha) scenarios indicates that the USD 75/ha payment and 5% increase in revenues as result of higher productivity do not make the situation profitable enough to be financially feasible for the stakeholder. This level of productivity increase, however, is considered as a minimum and according to national experts, higher productivity gains are possible.

Yearly cash flow trends in the policy scenario show a reduction of income during the first two years of policy implementation compared to the baseline. Because of this, some pastoralists (this is likely to be the case for small scale operations) may decide not to participate. For others (e.g., medium or larger operations) it may not create severe cash flow problems and they would be more likely to participate.

Given this, the policy is adjusted to increase the payment by the government to the maximum end of the range (i.e., USD 100/ha) for small operations (less than 200 ha). Based on data from national statistics, small farms account for about 35% of the land area. The modifications in incentive payments will affect the overall budget as shown in Table 8.10.

To confirm these changes will improve financial feasibility, the cash flow analysis was recalculated with payments of USD100/ha and 10% productivity improvements. With these changes, the results indicate clear financial feasibility. The net present value of the policy scenario under these conditions is USD 3,514/ha, which is over 7% higher than the baseline net present value of USD 3,261/ha

With the modification in payment amounts and assurances from experts that higher productivity gains are possible, the policy appears to be financially feasible for all participants.

Table 8.10: Distribution of land area, number of animals and annual payments for small and medium-size landowners/farmers

	Small landowners/ farmers	Medium landowners/ farmers	Total
Area (ha)	359,730	668,070	1,027,800
Number of animals (head)	312,417	580,203	892,620
Annual payment	USD 100/ha	USD 75/ha	
Total payment over 5 years	USD 179,865,000	USD 250,526,250	USD 430,391,250

However, participation levels must be reduced to keep the policy on budget. As shown in Table 8.10, the revisions lead to an overall budget that is higher than the financial cap of the policy. To maintain the overall budget to no more than USD 400 million, participation of medium-size farmers will be decreased by 13% thus decreasing the original estimate of potential impact. This would result in a refined implementation potential as shown in Table 8.11.

Table 8.11: Example of refined implementation potential

Activity data	Maximum implementation potential	Refined implementation potential based on policy design and national circumstances	Refined implementation potential based on financial feasibility
Implementation area (in ha)	1,200,000	1,027,800	940,951
Number of animals (head)	1,080,000	892,620	817,194

8.5 Account for other barriers

It is a *key recommendation* to analyse 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 analysing these barriers and estimating their effect on implementation potential of the policy. Section 8.5.2 provides some further guidance 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: Analyse 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 Guidance* (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 or aesthetic 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 analysed 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, favoritism 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 enrollment 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 analysed 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 Guidance* 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 neighboring 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. In consultation with experts, responses were tabulated and scored in Table 8.13.

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?*	1

	There are no other ministries beside the agriculture extension agency that work with pastoralists; therefore, no conflicts are expected.	
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?* Experts believe it is unlikely but there is very limited information available. There are no safeguards to prevent discrimination in place at the agriculture extension agency	4
2. Cultural barriers		
a.	*Are different languages used in the region where the policy will be implemented?* Spanish is the main language spoken in the country (more than 99%). A small number of communities use Amerindian and Creole languages. Most local offices have sufficient capacity to communicate in these languages.	1
b.	*Is the policy congruent with cultural or aesthetic norms and values?*	N/A
c.	*Are there gender issues in access to resources or communication?*	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?* In the last few years, more young people are interested in staying in rural areas to farm rather than move to urban areas in search of work. This has resulted in more willingness of local people to consider the adoption of new and novel ideas and technologies for their farms/ranches.	1
e.	*Are there any areas or landmarks with religious significance of the region under consideration?*	N/A
f.	*Is there a group that has very strong opposition to the policy?*	N/A
3. Physical barriers		
a.	*Are land areas proposed for intervention easily accessible?* According to expert judgment, the vast majority of lands considered for the policy are accessible. Routine road improvement projects that are already being implemented will help maintain access to all farms and ranches. However, very remote areas (approximately 38,500 ha of the eligible land) are unlikely to be monitored effectively. To account for this, it is assumed that the policy will not be effectively implemented on all of those lands.	2
b.	*Is the necessary physical infrastructure in place for the proposed policy?*	N/A
c.	*Are there any war conflicts in the country that would limit access to certain land areas?* A conflict in the country has recently been resolved. Land areas in the conflict region were originally excluded from the policy. Depending on the progress of implementation, some of these areas will be considered in a future phase of the project pending availability of resources.	1

The distribution of scores was evaluated (Step 2). Four barriers received a score of 1. One barrier received a score of 2. One barrier 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 considered 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). To account for physical barrier 3a, the implementation potential will be modified by reducing the target area affected by the policy by 1,350 ha (corresponding to 3.5% of the 38,500 ha of very remote land eligible for the policy). This also results in a reduction in the number of animals that could be grazed on those lands. The national average density for grazing beef cattle is six head per hectare. Over 1,350 hectares, this barrier reduced the number of animals by 8,100 head.

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

Table 8.14: Example of refined implementation potential

Activity data	Maximum implementation potential	Refined implementation potential based on policy design and national circumstances	Refined implementation potential based on financial feasibility	Refined implementation potential based on other barriers
Implementation area (ha)	1,200,000	1,027,800	940,951	936,601
Number of animals (head)	1,080,000	892,620	817,194	809,094

Table 8.14 illustrates how land area and number of animals were 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 scenario approach or deemed estimates approach. Where baseline emissions were estimated, users can calculate the change in emissions between the baseline and policy scenarios (scenario 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 (deemed estimates approach). Guidance for estimating the GHG impacts for each approach is given below.

8.6.1 Scenario approach

Use the likely implementation potential of the policy (derived following the guidance 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.

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.

8.6.2 Deemed estimates 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 guidance below to calculate the impact of the policy on each GHG source and carbon pool in the GHG assessment boundary. This guidance covers enteric fermentation and soil carbon sequestration. Sum the GHG impacts for all GHG sources and carbon pools to yield total policy impact on GHGs.

Enteric Fermentation

Using the estimates of how much the policy will increase or decrease the average annual number of animals in livestock categories affected by the policy (determined following the guidance in Sections 8.2 – 8.5), identify the livestock categories that are affected by the policy. These categories are called the target group. Guidance is provided in Section 7.2.2 on how to define livestock categories.

Derive new emission factors (EF_{policy_impact}) for the target groups (i.e., the policy impact on GHG emissions of a typical animal in the target group). Calculate the annual GHG emissions and removals of the policy by multiplying EF_{policy_impact} by the increase or decrease in average annual number of animals in the target groups. Multiply the annual GHG emissions and removals by the number of years in the assessment period for the cumulative GHG emissions and removals. Sum all target groups to estimate total policy impact on CH_4 from enteric fermentation. Multiply the result by the 100-year GWP of CH_4 to convert CH_4 to CO_2e and multiply by 0.001 to convert kg to tonnes.

Guidance is provided below for three options for deriving new emissions factors for target groups. The steps should be repeated for each target group.

Tier 1 Option

- Step 1: Estimate how the policy will change the weight, growth rate and milk production (dairy cattle only) of the target group.
- Step 2: Choose a Tier 1 emission factor from IPCC 2006 GL, Table 10A.1 that best matches the weight, growth rate and milk production (dairy cattle only) of a typical animal in the target group if the policy were not enacted ($EF_{without\_policy}$). See Section 7.2.4 for guidance on choosing a Tier 1 emission factor. The emission factor units are kg CH_4/head.
- Step 3: Use the information from Step 1 to choose a different Tier 1 emission factor from IPCC 2006 GL, Table 10A.1 that matches the weight, growth rate and milk production (dairy cattle only) of a typical animal in the target group as a result of the policy (EF_{with_policy}).
- Step 4: Subtract the emission factor in Step 2 ($EF_{without\_policy}$) from emission factor in Step 3 (EF_{with_policy}) to yield the emission factor for the policy impact (EF_{policy_impact}).

Tier 2 Option A

- Step 1: Estimate how the policy will change feed intake of the target group affected by the policy. See Section 7.2.2 for guidance on how to estimate feed intake.
- Step 2: Calculate an IPCC Tier 2 emission factor for a typical animal in the target group based on estimated gross energy intake of the animal without the policy ($EF_{without\_policy}$). See Section 7.2.4 for guidance on how to estimate a Tier 2 emission factor.
- Step 3: Use the information from Step 1 to estimate gross energy intake for a typical animal in the target group with the policy and use it to calculate a new Tier 2 emission factor (EF_{with_policy}).
- Step 4: Subtract the emission factor in Step 2 ($EF_{without\_policy}$) from emission factor in Step 3 (EF_{with_policy}) to yield the emission factor for the policy impact (EF_{policy_impact}).

Tier 2 Option B

Country-specific Tier 2 emission factors can be used in place of the calculated Tier 2 emission factors in the steps above. See Section 7.2.4 for guidance on using country-specific Tier 2 emission factors.

Soil Carbon Sequestration

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 guidance in Sections 8.2 – 8.5), subdivide the land categories into strata according to guidance in Section 7.3.1. These are the policy scenario strata.

Determine the policy impact on GHG emissions for each policy scenario stratum, following the steps below. Repeat the steps for each policy scenario stratum.

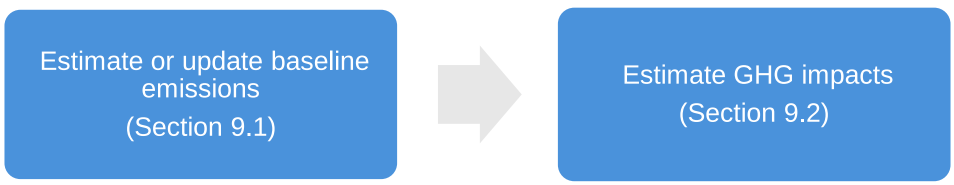
- Step 1: Determine the baseline stratum, which is the most likely alternative stratum in the absence of the policy (without policy). The climate region and soil type in the baseline stratum should be the same as in the policy scenario stratum. The land category and/or management category should be different from the policy scenario stratum.
- Step 2: Calculate the category-specific soil carbon density for the baseline stratum following guidance in Section 7.3.3 ($SOC_{without\_policy}$). Soil carbon density units are tonnes C/ha.
- Step 3: Calculate the category-specific soil carbon density for the policy scenario stratum following guidance in Section 7.3.3 (SOC_{with_policy}).
- Step 4: Subtract the category-specific soil carbon density (also known as soil organic carbon or SOC) in Step 2 ($SOC_{without\_policy}$) from category-specific soil carbon density in Step 3 (SOC_{with_policy}) to yield the policy impact on soil carbon density (SOC_{policy_impact}).
- Step 5: Multiply the SOC_{policy_impact} by the increase or decrease in hectares of land in the policy scenario stratum over the assessment period.

Calculate the total policy impact on soil carbon density (SOC) by summing the results for all policy scenario strata. Convert the change on soil carbon density to GHG emission reductions or removals, expressed as tonnes of CO_2e, by multiplying by 44/12 and by -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.

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 (developed in Chapter 8). 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 guidance in Chapter 7. 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 (e.g., milk production or land classification).

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 evaluation 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 can be used to estimate policy scenario emissions.

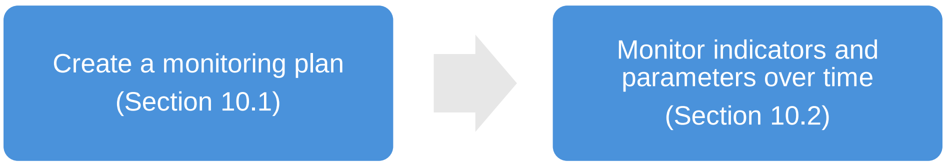
Calculate policy scenario emissions using the estimation methods provided in Chapter 7. Use observed, measured or recently collected activity data, and measured or re-estimated emission factors. Further guidance on monitoring parameters is provided in Chapter 10. Calculate the GHG impacts of the policy by subtracting baseline emissions (estimated in Section 9.2) from the ex-post policy scenario emissions for each GHG source and carbon pool included in the GHG assessment boundary.

Part IV: Monitoring and Reporting

10. Monitoring Performance Over Time

Monitoring allows the user to collect the information needed for the quantification of the GHG impacts during or after policy implementation. It also allows the user to understand whether the policy is on track and being implemented as planned. This chapter provides guidance on how to develop a monitoring plan and identifies data and parameters to monitor over time.

Figure 10.1: Overview of steps in the chapter



Checklist of key recommendations

- Create a plan for monitoring key performance indicators and parameters
- 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
- Monitor each of the indicators and parameters over time, in accordance with the monitoring plan

10.1 Create a monitoring plan

Monitoring during the policy implementation period serves two objectives:

- **To evaluate performance of the policy**: Monitor trends in performance parameters to understand whether the policy is on track and being implemented as planned
- **To estimate GHG impacts**: Collect the data needed for ex-post assessment of GHG impacts

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.

To monitor progress and estimate GHG effects ex-post, users need to collect data on parameters during and/or after the policy implementation period. 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 analysing 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. Further guidance on the parameters to monitor is provided in Section 10.2.

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 guidance documents. For example, if assessing sustainable development impacts using the ICAT *Sustainable Development Guidance* 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.[17]

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.

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

- **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.
- **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.

10.2 Monitor indicators and parameters over time

This section describes the key performance indicators and parameters to monitor. Key performance indicators are used to monitor policy performance. Parameters are used to estimate the GHG impacts in an ex-post assessment. 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. 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.

Key performance indicators

The following table defines and provides examples of the types of key performance indicators: inputs, activities, intermediate effects, 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	Budget allocation to agriculture extension service

Activities	Administrative activities involved in implementing the policy	Number offered and attendance at agriculture extension training sessions
Intermediate effects	Changes in behaviour, technology, processes or practices	Increase in rate of livestock weight gain
GHG impacts	Changes in GHG emissions by sources or removals by carbon pools that result from the intermediate effects of the policy	Decreased rate of enteric fermentation emissions per head of livestock
Sustainable development impacts	Changes in relevant environmental, social or economic conditions that result from the policy	Improved food security

Parameters

Table 10.2 defines and describes the three types of parameters: assumptions, activity data and GHG emission factors.

Table 10.2: Parameters to monitor

Parameters	Definition	Data Example
Assumptions	Data that influence the estimated 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.	Livestock population
GHG emission 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.	CH_4 per head of livestock

Table 10.3 and Table 10.4 further elaborate specific parameters for enteric fermentation and soil carbon, respectively. In some cases parameters may also be used as key performance indicators, as noted in the tables. Parameters are organised by those needed for either an IPCC Tier 1 or Tier 2 estimation of GHG emissions. Parameters that are needed for all types of GHG estimation methods, regardless of tier level, are listed under "All." Parameters needed for estimating 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: Enteric fermentation monitoring parameters

Parameter and unit	Potential sources of data	Parameter type	Suggested monitoring frequency
All			

Livestock population categorisation: defining livestock groups according to species and diet (unitless)	Agriculture or livestock census Extrapolation from sample surveys	Assumption	Once Can be updated in conjunction with collecting data on average annual livestock population (see next parameter)
Average annual livestock population in each category (head per year)	Agriculture or livestock census Extrapolation from sample surveys Derived from economic forecasts of milk and beef demand	Activity data Key performance indicator	Periodically
100-yr GWP of CH_4 (ratio of the mass of CO_2 to the mass of CH_4)	IPCC Assessment Report	Convert CH_4 to CO_2e emissions	Once
Tier 1			
Average animal weight per category (kg)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to choose Tier 1 emission factor) Key performance indicator	Once per category
Average animal growth rate (weight gain) per category (kg per day)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to choose Tier 1 emission factor) Key performance indicator	Once per category
Average animal milk production per category (kg per head per day)	Agriculture or livestock census Extrapolation from sample surveys or measurements Extrapolated from milk production economic statistics	GHG emission factor (needed to choose Tier 1 emission factor) Key performance indicator	Once per category
CH_4 emission factor (kg CH_4 per head per year)	Tier 1: IPCC 2006 GL* Tables 10.11, 10. A.1 and 10 A.2	GHG emission factor	Once per category
Tier 2			
Average animal weight per category (kg)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter) Key performance indicator	Periodically
Average animal growth rate (weight gain) per category (kg per day)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter) Key performance indicator	Periodically
Mature weight	Agriculture or livestock census Extrapolation from sample surveys	GHG emission factor (needed to derive feed	Periodically

(kg)	or measurements	intake parameter) Key performance indicator	
Average number of hours worked per day (draft animals only) (hours per day)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter)	Periodically
Feeding situation (unitless)	Agriculture or livestock census Extrapolation from sample surveys or measurements	Assumption	Periodically
Activity coefficient by feeding situation (unitless)	IPCC 2006 GL* Table 10.5	GHG emission factor (needed to derive feed intake parameter)	Once per feeding situation
Mean winter temperature (°C)	Weather data	GHG emission factor (needed to derive feed intake parameter)	Periodically
Average daily milk production (milking ewes, dairy cows and buffalo only) (kg per day)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter) Key performance indicator	Periodically
Fat content of milk (for lactating cows, buffalo and sheep producing milk for human consumption) (percent)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter)	Periodically
Percent of females that give birth in a year (for mature cattle, buffalo and sheep) (percent)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter)	Periodically
Number of offspring produced per year (for female livestock having multiple births per year) (head per year)	Agriculture or livestock census Extrapolation from sample surveys or measurements	GHG emission factor (needed to derive feed intake parameter)	Periodically
Feed digestibility (percent)	IPCC 2006 GL* Table 10.2 (example values as a guideline) Measured values for the dominant feeds or forages being consumed by livestock Local scientific data or data from representative research studies	GHG emission factor (needed to derive feed intake parameter)	Once per feed type per livestock type
Average annual wool production (sheep only) (kg per head per year)	Agriculture or livestock census Wool sales records	GHG emission factor (needed to derive feed intake parameter)	Periodically

Feed intake in terms of gross energy per livestock category (MJ per day or kg dry matter per day)	Estimated	GHG emission factor (needed to derive Tier 2 emission factor) Key performance indicator	Periodically
Methane conversion factor (Ym) (% of gross energy in feed converted to methane)	IPCC 2006 GL* Table 10.12 or 10.13 Estimated with country-specific research	GHG emission factor (needed to derive Tier 2 emission factor)	Periodically
CH_4 emission factor (kg CH_4 per head per year)	Tier 2a: calculated using equation 10.21 Tier 2b: country-specific research	GHG emission factor	Periodically

1 *Table 10.4: Soil carbon monitoring parameters*

Parameter and unit	Potential sources of data	Parameter type	Suggested monitoring frequency
All			
Land stratification by climate region, soil type and soil management practices (unitless)	Agriculture census Soil surveys Soil classifications (e.g., IPCC 2006 GL* Figure 3 A.5.3 and 3 A.5.4 Climate zone map in IPCC 2006 GL* Figure 3 A.5.1 and classification scheme in Figure 3 A.5.2	Assumption	Once May be updated in conjunction with collecting data on the area of land in each strata (see next parameter)
Area of land in each strata (ha)	Agriculture census Soil surveys International land cover data sets or other land cover maps Remote sensing data Ground based surveys	Activity data Key performance indicator	At least twice, at beginning and end of policy implementation period. Or, periodically during the policy implementation period.
Tier 1			
Reference carbon stock (tonnes C per ha)	Tier 1: IPCC 2006 GL* Table 2.3	GHG emission factor (needed to derive strata-specific soil carbon density)	Once per stratum type
Management factors for land-use (F_{LU}), management practices (F_{MG}), and inputs (F_I) (unitless fraction)	IPCC 2006 GL* Table 5.5, 6.2	GHG emission factor (needed to derive strata-specific soil carbon density)	Once per stratum type

Land-category (strata) specific soil carbon density (tonnes C per ha)	Calculate using IPCC 2006 GL* Equation 2.25 for SOC	GHG emission factor (needed to derive soil carbon stock flux)	Once per stratum type
Tier 2			
Land-category (strata) specific soil carbon density (tonnes C per ha)	Country-specific research	GHG emission factor (needed to derive soil carbon stock flux)	Once if using country-specific research studies to derive a representative carbon density. Periodically if using field studies to measure soil carbon on land affected by the policy during the policy implementation period.

*IPCC 2006 GL, Volume 4, AFOLU

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). For guidance on providing information to stakeholders, refer to the *ICAT Stakeholder Participation Guidance* (Chapter 7).

General information

- The name of the policy assessed
- The person(s)/organisation(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
- Whether the assessment is ex-ante, ex-post or a combination of ex-ante and ex-post

Chapter 6: Identifying impacts: how agriculture policies reduce or remove emissions

- 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, scenario approach or deemed estimates approach, for estimating the policy's expected GHG impact;
- A description of the baseline scenario and justification for why it is considered the most likely scenario
- 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
- 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
- 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 net 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)

- 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 Guidance*.

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 agricultural 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 Guidance*.

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

Chapter/step in this guidance document	Why stakeholder participation is important at this step	Relevant chapters in Stakeholder Participation Guidance
Chapter 2 – Objectives of assessing GHG impacts	• Ensure that the objectives of the assessment respond to the needs and interests of stakeholders	Chapter 5 – Identifying and understanding stakeholders
Chapter 4 – Steps and assessment principles • Section 4.1.4 Planning the assessment	• 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 agriculture policies reduce or remove GHG Emissions	• 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
Chapter 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 analyse 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 analyse the policy from the perspective of the investors. Where a private land manager will use its own capital for the investment, analyse from the perspective of the land manger. Where land managers need to borrow capital from others, it is useful to analyse the policy from the perspective of potential investors.

The discount rate used to analyse private investments, from the perspective of private firms (e.g., timber companies), will be different from the discount rate used to analyse 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 analysed. 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 analysing 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. Subsidised rates are not appropriate. For example, if an NGO provides subsidised 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.

Abbreviations and Acronyms

AFOLU	agriculture, forestry and other land use
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
MJ	megajoules
MRV	measurement, reporting and verification
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NGO	non-governmental organization
N_2O	nitrous oxide
tC	tonnes of carbon
SDG	Sustainable Development Goals
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	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 favorable 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, organisations, 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 characterises 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.

REFERENCES

Dickie, A., Streck, C., Roe, S., Zurek, M., Haupt, F., Dolginow, A. 2014. *Strategies for Mitigating Climate Change in Agriculture: Abridged Report.* Climate Focus and California Environmental Associates, prepared with the support of the Climate and Land Use Alliance. Report and supplementary materials. Available at: www.agriculturalmitigation.org.

European Commission. 2008. *Guide to Cost Benefit Analysis of Investment Projects.* Available at: http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf.

Investopedia. 2017. Available at: http://www.investopedia.com.

IPCC. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at http://www.ipcc-nggip.iges.or.jp/public/gp/english.

IPCC. 2006. *Guidelines for National Greenhouse Gas Inventories*. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl.

IPCC. 2014. Summary for Policymakers in Climate Change 2014: Mitigation of Climate Change, Contribution of Working Groups III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf.

Liu, E., C. Yan, X. Mei, Y. Zhang, T. Fan. 2013. *Long-term effect of manure and fertilizer on soil organic carbon pools in dryland farming in northwest China.* PLoS ONE 8(2): e56536. https://doi.org/10.1371/journal.pone.0056536.

USAID. 2015. USAID Guidelines: Cost-Benefit Analysis.

VCS. 2014. *Global Commodity Leakage Module: Effective Area Approach, v1.0*. Available at: http://database.v-c-s.org/methodologies/global-commodity-leakage-module-effective-area-approach-v10.

VCS. 2014. *Global Commodity Leakage Module: Production Approach, v1.0*. Available at: http://database.v-c-s.org/methodologies/global-commodity-leakage-module-production-approach-v10.

VOLANTE. 2015. *VOLANTE Roadmap for future land resource management in Europe – The Scientific Basis*. Edited by: Pedroli B, M Gramberger, A Gravsholt Busck, M Lindner, M Metzger, J Paterson, M Pérez Soba and P Verburg   Alterra Wageningen UR, The Netherlands. Available at: http://www.volante-project.eu/images/stories/DELIVERABLES/The_VOLANTE_Roadmap_towards_Sustainable_Land_Resources_Management_in_Europe_Scientific_Basis.pdf.

World Resources Institute (WRI). 2014. Greenhouse Gas Protocol *Policy and Action Standard*. Available at: http://www.ghgprotocol.org/policy-and-action-standard.

CONTRIBUTORS

Guidance development leads

Carolyn Ching, VCS (co-lead)

Katie Goldman, Greenhouse Gas Management Institute (technical lead)

Molly White, Greenhouse Gas Management Institute

Drafting team

Adriana Pinto Brun, Ministry of Environment, Colombia and UNDP (TWG member)

Christopher Manda, Environmental Affairs Department, Ministry of Natural Resources, Energy and Mining, Malawi (TWG member)

Gil Nemesh, Food and Agriculture Organization (TWG member)

Gordon Smith, Greenhouse Gas Management Institute

Michael Gillenwater, Greenhouse Gas Management Institute

Patrick Cage, Greenhouse Gas Management Institute

Sandeep Kanda, South Pole Group (TWG member)

Stelios Pesmajoglou, Greenhouse Gas Management Institute

Technical working group

Debbie Reed, Coalition on Agricultural Greenhouse Gases

Edwin Aalders, DNV GL

Julius Adewopo, International Institute of Tropical Agriculture

Keith Paustian, University of Colorado

Lini Wollenberg, CGIAR Research Program on Climate Change, Agriculture and Food Security

Martial Bernoux, Food and Agriculture Organization

Monica McBride, Coalition on Agricultural Greenhouse Gases

Rama Reddy, World Bank

Sarah Walker, Winrock International

Sergio Musmanni Sobrado, GIZ

Shahira Esmail. Terra Global Capital

Thayer Tomlinson, Coalition on Agricultural Greenhouse Gases

Valentina Robiglio, World Agroforestry Centre

Xavier Hatchondo, Ecocert