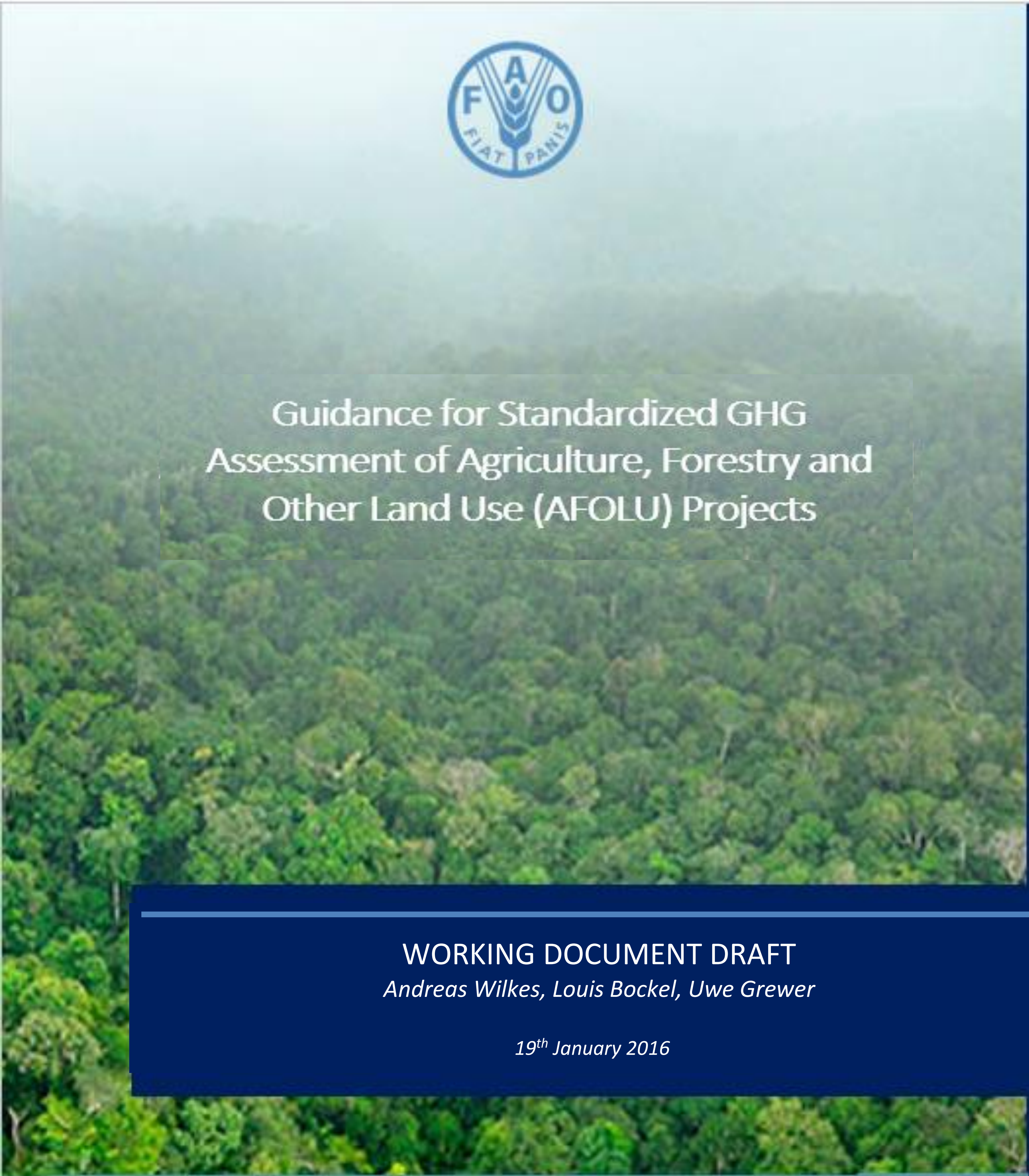
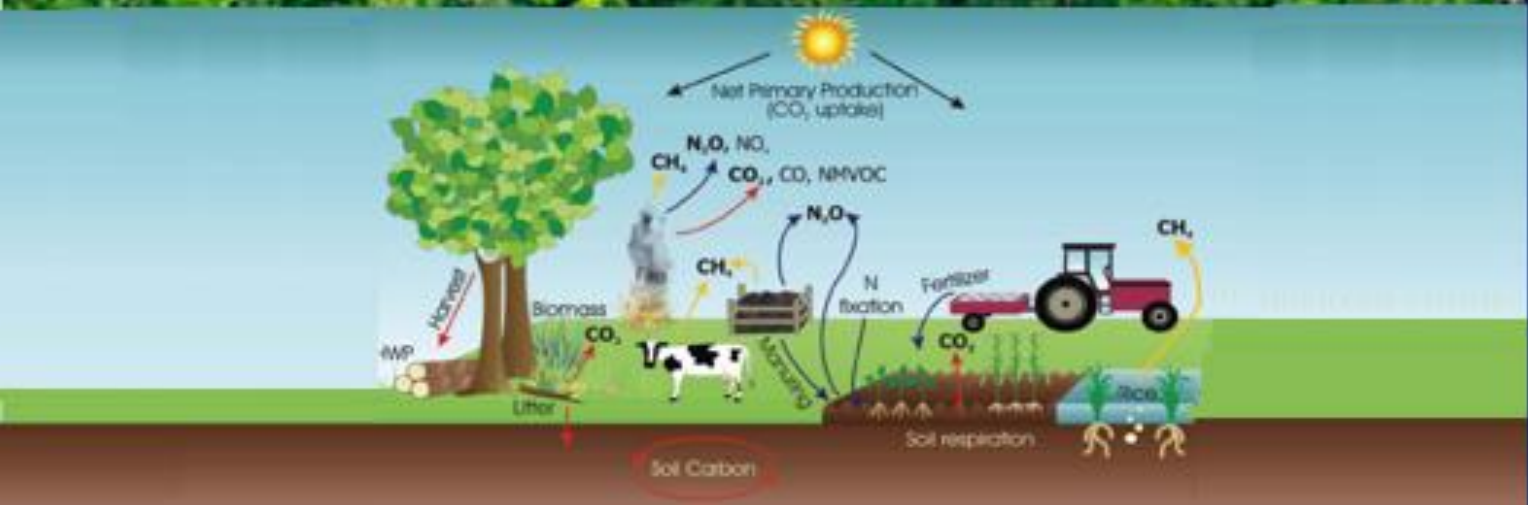


Guidance for Standardized GHG Assessment of Agriculture, Forestry and Other Land Use (AFOLU) Projects

WORKING DOCUMENT DRAFT

Andreas Wilkes, Louis Bockel, Uwe Grewer

19th January 2016



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Summary

Multilateral finance institutions, bilateral agencies, climate finance mechanisms, and national governments are increasingly developing policies requiring quantification of greenhouse gas (GHG) mitigation impacts of projects and investments in the agriculture, forestry and other land use (AFOLU) sector.

This guidance document is tailored to the needs of finance institutions, multilateral and bilateral donors and their implementing agencies, international organizations and national governments seeking to quantify the GHG mitigation benefits of AFOLU sector project activities, under the following general conditions:

- ex ante estimates of mitigation impact are required to justify and access finance; and/or
- if ex post estimates of mitigation benefits are required, these are not used to generate tradable credits; and/or
- agencies seek to estimate mitigation benefits in a transparent and credible manner with low minimum requirements for investment of resources in GHG quantification; and
- standard international practice in results-based management is required, involving monitoring and evaluation based on project logframe or results framework indicators; and
- the use of other specific GHG quantification methodologies is not mandated.

While specific organizational policies vary, there is a common demand among these agencies for low-cost approaches to GHG assessment as an integral part of project cycle and investment portfolio management, and a need for guidance on standardized approaches to GHG assessment that produce credible and comparable results. This can support aggregation of the results of GHG assessment at individual project level for reporting at programme, fund or organization level.

The approach set out in this document integrates GHG assessment activities with the project cycle. It provides guidance on procedures for ex ante assessment of GHG mitigation impacts; for integrating the data requirements for GHG assessment in project monitoring and evaluation (M&E) systems; for the conduct of ex post GHG assessment at project mid-term and terminal evaluation; and for transparent reporting of project-level GHG assessment results. By integrating GHG assessment with the project cycle, and utilizing to the fullest extent possible the data available in project documentation and project M&E systems, it is intended to minimize the additional costs to the project of GHG assessment.

In addition to differences between project activities, significant variation in project level GHG assessment results may arise from decisions regarding the scope of the GHG assessment and the quality and choice of data. This document provides a standardized procedure for determining the scope of GHG assessment, and guidance on how to assess data quality and obtain and utilize the data available during different stages of the project cycle to produce credible estimates of project GHG effects. The credibility of assessment results is also affected by the transparency of reporting. A standardized framework is provided to support transparent reporting of assessment results. A GHG quality control multi-criteria based index is proposed to assess the quality standard of GHG appraisal (below minimum, low standard, high standard, GHG Top standard with In-depth work with tier 2 and series of data control and reviews).

A number of methodologies and tools are available for project GHG assessment in the AFOLU sector. The Ex-ante Carbon Balance Tool (EX-ACT), developed by FAO is one widely used tool. The content of this guidance document is not specific to any particular GHG calculator or tool. However, instructions for implementation of the guidance and examples of using EX-ACT are given.

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Abbreviations and acronyms

AFOLU	agriculture, forestry and other land uses
CCAFS	Climate Change, Agriculture and Food Security Programme of the CGIAR
CDM	Clean Development Mechanism
CH_4	methane
CO_2	carbon dioxide
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EX-ACT	Ex-ante carbon balance tool
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GEF	Global Environmental Facility
GHG	greenhouse gas
GRA	Global Research Alliance on Agricultural Greenhouse Gases
ha	hectares
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFI	international finance institution
IPCC	Intergovernmental Panel on Climate Change
KPI	key performance indicator
LULUCF	land use, land-use change and forestry
m^2	square meters
M&E	monitoring and evaluation
MDB	multilateral development bank
MRV	measurement, reporting and verification
NAMA	nationally appropriate mitigation action
NSP	NAMA support project of the NAMA Facility
N_2O	nitrous oxide
QA	quality assurance
QC	quality control
REDD+	reducing emissions from deforestation and forest degradation
tCO_2e	metric tonnes of carbon dioxide equivalent
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

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1. About this guidance document

Key points:

- Multilateral finance institutions, bilateral agencies, climate finance mechanisms, and national governments are increasingly developing policies requiring quantification of the GHG mitigation impacts of projects and investments in the AFOLU sector.
- Organizational policies vary in terms of whether ex ante or ex ante *and* ex post GHG assessment is required, and in terms of the scope of the GHG effects included in the assessment. This document provides guidance for both ex ante and ex post GHG assessment, and provides a standardized procedure for determining the scope of GHG assessment. The guidance integrates GHG assessment with the project cycle and promotes the use of data available in project documentation and project M&E systems to minimize the additional costs of GHG assessment.
- In order to support credible and comparable GHG assessment results, this document provides guidance for project analysts on procedures for determining the scope of GHG assessment; for including the data needed for GHG assessment in project M&E systems; and for obtaining data, assessing data quality, and selecting and utilizing available data in ex ante and ex post GHG assessment. Guidance is also provided on transparent reporting.

1.1 Background

Climate-smart agriculture is emerging as an approach to simultaneously address three intertwined challenges: ensuring food security through increased productivity and income, adapting to climate change, and contributing to climate change mitigation.[1] Climate-smart agriculture aims to improve food security, strengthen resilience to climate change, and reduce greenhouse gas (GHG) emissions by promoting adoption of appropriate practices, developing an enabling policy and institutional environment and mobilizing finance. Because of the close interactions between land uses, climate-smart agriculture should be implemented through a landscape approach that enables the integrated management of agricultural systems and the natural resources that support ecosystem services affecting all land use sectors. Many options for climate-smart agriculture also reduce GHG emissions per unit land area or per unit of agricultural product or increase carbon stocks in the landscape, and thus contribute to mitigating climate change.

Agriculture, forestry and other land use (AFOLU) is a major source of GHG emissions, contributing between one fifth and one quarter of anthropogenic GHG emissions, mainly from deforestation, livestock emissions, and agricultural soil and nutrient management.[2] GHG mitigation options in the AFOLU sector are generally well-known and include many options that are technically feasible, readily available and relatively low-cost, although locally-specific barriers to adoption by land users may have to be addressed.[3] In particular, finance and other interventions are often

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[1] FAO (2013) Climate-smart Agriculture Sourcebook. FAO: Rome.

[2] IPCC (2014) Summary for Policymakers. In: Climate Change 2014, Mitigation. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (eds Edenhofer O, Pichs-Madruga R, Sokona Y, Farahani E, Kadner S, Seyboth K, Adler A, Baum I, Brunner S, Eickemeier P, Kriemann B, Savolainen J, Schl€omer S, von Stechow C, Zwickel T, Minx JC), pp. 5–7. Cambridge University Press, Cambridge, UK and New York, NY, USA; Tubiello F, et al. (2015) The Contribution of Agriculture, Forestry and other Land Use activities to Global Warming, 1990–2012. *Global Change Biology*.

[3] Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N. H. Ravindranath, C. W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. Tubiello, 2014: Agriculture, Forestry and Other Land Use (AFOLU). In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

required to assist land users to overcome barriers to adoption associated with upfront investment requirements, opportunity and transaction costs of adoption.[4]

While carbon market mechanisms such as the Clean Development Mechanism (CDM) have been widely used to incentivize mitigation activities in many sectors, with the exception of some bioenergy technologies carbon finance in the agriculture sector has been limited.[5] Some constraints have derived from the application of the CDM rules to the land use sector, while other constraints reflect the characteristics common in the agriculture sector itself, including unclear land tenure and the transaction costs of coordinating and monitoring the actions of large numbers of land users. The lack of robust and cost-effective methods for quantification of the GHG mitigation benefits of many agricultural activities is one particular constraint on accessing mitigation finance.[6] Private investment (including investment by farmers) remains the main source of finance for the sector,[7] but public finance from national and international sources can make critical contributions to both the creation of an enabling environment and to the direct adoption climate-smart agricultural practices. In addition to multilateral and bilateral finance for AFOLU sector activities in developing countries, various sources of climate finance are emerging as potential sources of support for climate-smart agriculture. Developing and demonstrating appropriate approaches to the measurement, reporting and verification (MRV) of climate-smart agriculture activities that target GHG mitigation or that have significant GHG mitigation co-benefits are an essential component of efforts to access these sources of finance.

1.2 GHG accounting and reporting by international finance institutions

Within the land use sector, parties to the United Nations Framework Convention on Climate Change (UNFCCC) have agreed a methodological framework for GHG mitigation benefit measurement, reporting and verification of initiatives to reduce emissions from deforestation and forest degradation (REDD+).[8] Several international and multilateral agencies are supporting national governments to develop capacities to implement these agreements. However, there are no agreed, internationally binding approaches to GHG mitigation benefit measurement or reporting for other types of activity in the land use sector supported by international, multilateral and bilateral institutions.

At the same time, there is increasing demand for quantification of the GHG mitigation benefits of projects supported by international climate finance mechanisms (e.g., GEF, GCF), multilateral development banks (MDBs), bilateral climate finance and national governments. International finance institutions (IFIs) have begun a process of harmonizing GHG calculation and reporting approaches.[9] Some institutions have made estimation of GHG mitigation benefits mandatory for accessing finance and for project reporting. In some cases, this is limited to *ex* ante estimates of mitigation potential. In other cases, ex post estimation and reporting of mitigation impacts is required, even where the supported activities do not generate tradable carbon credits. Text Box 1 summarizes the current (October 2015) status of GHG mitigation benefit calculation and reporting requirements of a selection of finance institutions. In general, guidance is more developed for the energy sector, and despite the

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[4] McCarthy, N., Lipper, L., & Branca, G. (2011). Climate-smart agriculture: smallholder adoption and implications for climate change adaptation and mitigation. *Mitigation of Climate Change in Agriculture Working Paper*, *3*.

[5] Larson D, Dinar A, Aapris Frisbie J (2011) Agriculture and the Clean Development Mechanism. Policy Research Working Paper 5621, World Bank: Washington D.C.

[6] Olander, L. P., Wollenberg, E., Tubiello, F. N., & Herold, M. (2014). Synthesis and Review: Advancing agricultural greenhouse gas quantification. *Environmental Research Letters*, *9*(7), 75003-75009.

[7] FAO (2012) State of the World's Agriculture 2012. FAO: Rome.

[8] https://unfccc.int/files/methods/application/pdf/compilation_redd_decision_booklet_v1.1.pdf

[9] http://www.worldbank.org/content/dam/Worldbank/document/IFI_Framework_for_Harmonized_Approach%20to_Greenhouse_Gas_Accounting.pdf; http://www.worldbank.org/content/dam/Worldbank/document/Climate/common-principles-for-climate-mitigation-finance-tracking.pdf

importance of international and multilateral investment in the AFOLU sector, guidance on GHG mitigation benefit calculation in the AFOLU sector is limited.

Text Box 1: GHG mitigation benefit calculation and reporting requirements of selected institutions

Global Environment Facility (GEF): Since 2011, full- and medium-size GEF projects have been required to use a climate change mitigation tracking tool to report on the GHG mitigation benefits of GEF projects. Manuals for calculating GHG mitigation benefits of projects in the energy and transport sectors have been issued. In 2014-15, a review was conducted of the GEF's policies and guidance, and recommendations for GHG quantification in the AFOLU sector were made.

International Finance Institutions (IFIs): In 2012, nine IFIs committed to engage in a process of harmonizing their reporting on GHG mitigation benefits. General principles were agreed, and guidance notes specific to the energy sector are under development. Among these organizations:

World Bank: The World Bank's environment strategy, issued in 2012, commits to analyze the GHG emissions of investment projects financed by IDA/IBRD. *Ex ante* quantification of emissions and emission reductions for energy and forestry projects began in 2013, for agriculture in 2014, and transport, water and urban sector projects will begin in 2015. Guidance notes on how to meet calculation and reporting requirements in these sectors have been drafted.

The European Bank for Reconstruction and Development (EBRD): EBRD's Environmental and Social Policy mandates that clients provide the data necessary for GHG assessment for projects with expected emissions exceeding 100,000 tCO_2e per annum. Reportedly, almost all projects are screened for their GHG impact during the project assessment phase. A set of Guidance Notes have been produced to assist consultants and staff in completing these requirements.

European Investment Bank (EIB): In 2014, the EIB completed a 3-year pilot carbon foot printing initiative and has now released guidelines for estimating the gross emissions and emission reductions of financed projects. Ex ante assessment is required for projects expected to produce gross emissions of more than 100,000 tCO_2e per annum or a relative change in emissions of more than 20,000 tCO_2e per annum.

A number of other IFIs have been estimating the GHG emission reduction impact of energy sector projects, but assessment for other sectors is less common. Some international development institutions have also developed related policies. For example:

United Nations Development Programme (UNDP): Since 2015, the *Social and Environmental Standards* of UNDP requires screening of all projects above US$ 500,000, and projects with emissions of more than 25,000 tCO_2e per annum are deemed 'high risk', may require in-depth social and environmental impact assessment, and emissions must be tracked and reported in accordance with IPCC estimation methodologies.

Sources: Climate Investment Funds (2014) Greenhouse Gas Analysis and Harmonization of Methodology (CIF/TFC.14/Inf.2); UNDP (2014) Social and Environmental Standards

Some agencies have begun to gain experience with the assessment of GHG mitigation benefits of investments in AFOLU projects.[10] A variety of GHG calculators and tools are available for use in the AFOLU sector.[11] Several agencies have chosen to use the Ex-ante Carbon Balance Calculation Tool (EX-ACT) developed by FAO to estimate GHG benefits of AFOLU projects.[12] EX-ACT is a recommended tool for use in calculating GHG benefits in agriculture projects supported by the World Bank Group.[13] EX-

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[10] http://www.ifad.org/climate/resources/advantage/mitigation_advantage.pdf; Cervigni et al. (2013) Assessing low-carbon development in Nigeria: an analysis of four sectors. World Bank Study 78281.

[11] Colomb et al. (2013) Selection of appropriate calculators for landscape-scale greenhouse gas assessment for agriculture and forestry. *Environmental Research Letters*, *8*(1): 015029.

[12] http://www.fao.org/tc/exact/ex-act-home/en/

[13] World Bank (2014) World Bank GHG Accounting Guidance Note #3: Agriculture Sector Investment Projects. World Bank Agriculture Global Practice.

ACT has also been recommended as a tool for use in estimating the GHG benefits of GEF projects in the AFOLU sector.[14]

Elaboration of practical guidance for project GHG assessment in line with the mitigation reporting policies and operational procedures of these organizations is intended to provide national governments, organizations investing in the AFOLU sector and implementation agencies with guidance on standardized procedures for AFOLU sector GHG mitigation benefit quantification, together with practical guidance on integrating robust estimation of mitigation benefits into their management operations. It is expected that this will enhance the ability of agencies active in the AFOLU sector to meet mitigation reporting requirements and the ability of the AFOLU sector to access climate finance.

Finance institutions supporting climate-smart action in the AFOLU sector have many common needs for GHG benefit calculation, but also some divergent requirements (see examples in Table 1). Three main dimensions along which their requirements vary are:

- Ex ante GHG mitigation benefit calculation vs. ex ante *and* ex post benefit calculation;
- GHG mitigation benefit calculation for a whole project investment vs. calculation of the incremental benefits of partial finance to a project;
- GHG quantification accounting only for direct and indirect emissions vs. accounting for direct and indirect emissions as well as consequential emissions due to project upscaling and replication after project completion.[15]

This guidance document provides guidance relevant to all these alternative quantification requirements, but project analysts conducting GHG mitigation benefit accounting for specific institutions will have to choose the appropriate approach based on the actual requirements of the information user.

Table 1: Requirements for GHG calculation by selected finance institutions*

Requirement	Institutions	Requirement	Institutions
Ex ante	GEF, WB, EIB, EBRD	Ex post	GEF, EBRD
Climate impacts of whole project investment	WB, EIB, EBRD	Climate impact of incremental investments	GEF
Direct and indirect emissions	GEF, WB, EIB	Consequential emissions	GEF

*Excluding projects seeking to generate tradable credits.

1.3 Target users of this guidance document

This guidance document is tailored to the needs of finance institutions, international, multilateral and bilateral donors and their implementing agencies, and national governments seeking to quantify the GHG mitigation benefits of AFOLU sector project activities, under the following general conditions:

- ex ante estimates of mitigation impact are required to justify and access finance; and/or
- if ex post estimates of mitigation benefits are required, these are not used to generate tradable credits; and/or
- agencies seek to estimate mitigation benefits in a transparent and credible manner with low minimum requirements for investment of resources in GHG quantification; and
- standard international practice in results-based management is required, involving monitoring and evaluation based on project logframe or results framework indicators; and
- the use of other specific GHG quantification methodologies is not mandated.

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[14] https://www.thegef.org/gef/sites/thegef.org/files/documents/EN_GEF.C.48.Inf_.09_Guideline_on_GHG_Accounting_and_Reporting_for_GEF_Projects.pdf

[15] See Text Box 7 for definitions of direct, indirect and consequential emissions.

Where projects in the AFOLU sector seek to generate tradable credits, methodologies approved by the Clean Development Mechanism of the UNFCCC or by other voluntary carbon market standards may be more appropriate.[16] Where projects support implementation of REDD+ activities, national governments and their international partners should consider following the methodological framework agreed under the UNFCCC.[17] Some finance institutions have mandated the use of specific GHG calculation tools for some project sub-types within the AFOLU sector.[18]

Where the conditions listed above are met, financing agencies and their staff may consider following the guidance in this document on methods for ex ante and ex post estimation of the GHG benefits of AFOLU projects. However, since the requirements of each institution vary, users may have to make adjustments to the specific recommendations in this guidance document to ensure that the requirements of the information user are met. Financing and implementation institutions may also wish to develop technical guidance for the AFOLU sector that reflect their specific policies and project management procedures.

1.4 Contribution of this guidance document

Technical guidance on the conduct of project GHG assessment in a manner consistent with internationally accepted principles for GHG assessment can support the production of credible assessment results, and standardized approaches to project GHG assessment can support the production of comparable results so that aggregation of individual project GHG assessment results across projects supported by a programme, fund or organization can be meaningful.

This guidance document is intended to apply in situations where organizations require a low-cost approach to ex ante or ex post GHG assessment during the project cycle. There are three main challenges to conducting GHG assessment on the basis of project data. Firstly, despite the fact that functional M&E systems can contribute to improved project outcomes, M&E in agricultural projects is often a weak link due to insufficient institutional priority for M&E, the limited capacity of implementing agencies, insufficient funding and weak incentives to invest time and resources in M&E.[19] As a result, project documentation and project M&E systems may not be able to provide the data required for GHG assessment, or data may be of poor quality in terms of its reliability, representativeness or coverage. Secondly, the specific parameters required to quantify GHG effects may differ from the variables of interest for the other functions that M&E systems are expected to perform. So, while project documentation and evaluation results may provide clear justification for project interventions and their impacts, it may not be possible to directly determine the project's effects on GHGs.

Regarding these first two challenges, this guidance document takes a pragmatic approach in which data available from project documentation may be supplemented by data from other sources, and expert judgment may be used where no reliable data can be identified. Guidance is provided on the assessment of data quality, the collection of reliable and accurate data and the integration of the data needs for GHG assessment with project M&E systems. However, it is recognized that in many situations project analysts and others involved in mid-term and final project evaluations will have to work with data from a range of sources of differing quality. Pragmatism is therefore moderated by providing guidance on how to ensure that the data values chosen give a conservative estimate of a project's net GHG emission reductions. Making conservative choices of data values and justifying why they give a conservative GHG assessment result make critical contributions to the credibility of assessment results when reliable data is in short supply.

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[16] E.g. https://cdm.unfccc.int/methodologies/index.html; http://www.v-c-s.org/methodologies/find

[17] http://unfccc.int/land_use_and_climate_change/redd/items/8180.php

[18] E.g. World Bank Group forestry sector projects mandate the use of the CAT-AR tool for GHG quantification. See World Bank (2013) World Bank GHG Accounting Guidance Note #3: Forest Sector Investment Projects. Agriculture and Environmental Services Department.

[19] ECG (2011) Evaluative lessons for agriculture and agribusiness. ECG Paper #3; Lindstrom J. (2009) What is the state of M&E in agriculture? Findings of the ALINe online consultation survey. http://www.aline.org.uk/resources/alineworkingpapers

A third challenge to GHG assessment in the project context derives from the numerous decisions that project analysts can make regarding the project scope and the assumptions underlying the data values selected. Differences in the scope of GHG assessment can have a huge impact on the resulting estimates of a project's net GHG emission reductions. Some aspects of a project's scope are determined by organizational policies governing GHG assessment, but other aspects depend on the judgment of the project analyst. A standardized procedure for defining the scope of GHG assessment is provided, and guidance on transparent reporting of key decisions regarding the scope of GHG assessment is given. In ex ante GHG assessment, in particular, assumptions regarding adoption rates can have a major impact on the results of assessment. Sensitivity analysis is recommended as an approach to testing the significance of alternative assumptions regarding adoption rates, and where information exists suggesting that different adoption rates are plausible, it is recommended that GHG assessments provide a range of potential GHG effects, rather than a single value.

The contribution of this document is therefore to provide guidance on:

- a standardized procedure for determining the scope of GHG assessment;
- the assessment of data quality and choice of data values to ensure conservative results;
- integration of the data needs for GHG assessment with project M&E systems for ex post GHG assessment; and
- transparent reporting of key decisions in the GHG assessment process.

The focus is to ensure that GHG assessment results are credible and transparently justified.

2. Overview of the methodology

Key points:

- The general approach set out in this guidance document links results-based project cycle management to the calculation and reporting of GHG mitigation benefits.
- GHG quantification may occur ex ante during project preparation, and/or ex post during mid-term and terminal evaluations. Ex ante quantification primarily relies on project documentation, while ex post quantification uses data provided by project monitoring and evaluation and project management systems.
- Information on GHG mitigation benefits and non-GHG benefits estimated for individual projects can then be aggregated for analysis and reporting at programme, fund or organizational levels.
- This chapter also gives an overview of the main methodological steps and provides references to the key normative documents that underlie the GHG quantification approach.

2.1 GHG calculation in project cycle context

2.1.1 The project cycle, results frameworks and GHG quantification activities

Results-based management is now common practice in international development agencies. Individual projects are required to develop a theory of change (or ‘results framework’) describing how the project is expected to achieve its intended impacts. This theory of change is often represented in the form of a logical framework (‘logframe’), and individual logframes are required to demonstrate how the expected outcomes and impacts of individual projects align with the higher results-framework of the fund, programme or organization. Although specific terminology may differ between organizations, a generic logframe indicates the inputs required to implement activities, which produce outputs that contribute to outcomes aligned with the expected impact of the project (see Text Box 2).

Text Box 2: The Results Chain

Impacts: The actual or intended benefits for the target population or for global environmental services

Outcomes: Changes in behaviour of the target population or changes in development conditions (e.g., the state of natural resources)

Outputs: Products, capital goods or services resulting from project activities

Activities: Tasks undertaken to produce outputs

Inputs: Resources (financial, human, physical) required to implement project activities

Source: Adapted from UNDP (2009) Handbook on Planning, Monitoring and Evaluating for Development Results

Before approval, projects must also elaborate a monitoring and evaluation (M&E) plan. The M&E plan states how information will be generated to enable assessment of project performance and progress towards the stated project outcomes. The M&E plan also specifies the performance indicators to be tracked. These indicators may relate to any stage of the results chain (inputs, activities, outputs, outcomes or impacts). They may reflect the baseline situation, progress in project implementation (e.g., annual targets or intermediary milestones) or achievement of intended outcomes or impacts.

Monitoring periodically provides information on ongoing project implementation required by management, while evaluation involves in-depth assessments, most commonly at project mid-term (if a project is of sufficient duration) or in a terminal evaluation that takes place before closure of the project. Evaluation often uses data generated in monitoring activities, such as baseline data, information on the project implementation process, and data reflecting progress towards the planned results, but may also draw on data from specially designed surveys and studies.

Text Box 3: Monitoring and evaluation defined

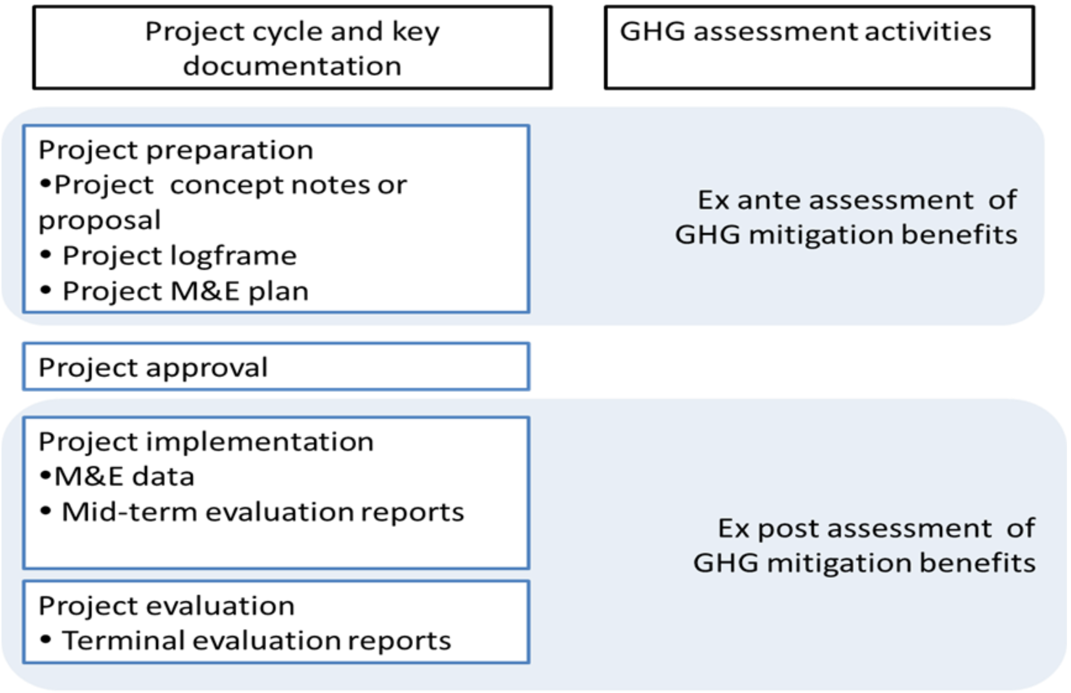
Monitoring refers to the systematic collection of data on specified indicators to provide project management and stakeholders of a project with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds.

Evaluation refers to the systematic and objective assessment of an on-going or completed project, its design, implementation and results, in order to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability.

Source: *OECD (2010) Glossary of Key terms in Evaluation and Results Based Management.*

Different organizations have different requirements for when GHG quantification should take place. It is now common to require an estimate of the expected impacts of project activities on GHGs as part of the project approval process (see Text Box 1). In this guidance document, this is referred to as *ex ante* assessment of GHG mitigation benefits. Ex ante assessment of GHG mitigation benefits primarily uses data in the project documents (including the project logframe) as the basis for quantifying the project activities and their possible GHG impacts. Some organizations also require tracking of GHG impacts during the project cycle, and/or reporting of GHG impacts after project implementation. Assessment of a project's GHG mitigation benefits up to mid-term evaluation or up to final evaluation is referred to as *ex post* assessment of GHG mitigation benefits. Data to enable ex post assessment should primarily derive from project M&E activities. This guidance document describes how ex ante assessment of GHG mitigation benefits can be conducted using data provided in initial project documentation and how ex post assessment can be conducted using data deriving from project M&E systems (see Figure 1).

Figure 1: Ex ante and ex post GHG mitigation benefit assessment in the project cycle



2.1.2 Project results frameworks and the estimation of GHG mitigation benefits

The general approach to the estimation of net GHG emissions can be expressed as follows:

$$E = EF \times AD \qquad \text{(Equation 1)}$$

where *E* represents net emissions from a particular project activity, *EF* is an emission or carbon stock change factor (expressed in metric tonnes of carbon dioxide equivalent [tCO_2e] per unit of activity), and *AD* is the quantity of the relevant activity performed (e.g., hectares planted or volumes of fuel used).[20] Net GHG emissions are separately estimated for a baseline scenario and a project scenario. The baseline scenario represents the AFOLU activities and net GHG emissions that would most likely have occurred in the absence of the project. The project scenario represents the net emissions due to AFOLU activities when the project is implemented. The difference between GHG emissions in the two scenarios is the GHG mitigation benefit of the project, i.e., the amount of net GHG emissions reduced due to project implementation:

$$ER = EB - EP \qquad \text{(Equation 2)}$$

where ER represents the total emission reductions attributed to a project activity, EB is the net GHG emissions in the baseline scenario and EP is the net GHG emissions in the project scenario. Emission reductions may be estimated ex ante (i.e., the expected GHG mitigation benefits) or ex post (i.e., the estimated actual GHG mitigation benefits).

Referring to Equation 1, to estimate net GHG emissions in either the baseline or project scenario, data is needed on both emission factors and AFOLU activities. Emission factors provide a quantitative estimate of how GHG emissions are affected by each unit of activity. For carbon sinks, emission factors estimate how much carbon stocks change per hectare, while for GHG emission sources they estimate how much carbon dioxide (CO_2), nitrous oxide (N_2O) or methane (CH_4) are emitted by each unit of agricultural activity. The *2006 IPCC Guidelines* provide estimated emission factors at global or regional level, known as Tier 1 emission factors, which are the default values contained in many GHG calculators. Because these are general estimates of how emissions are affected by specific activities, the values are associated with large uncertainty. Country- or site-specific emission factors (known as 'Tier 2' emission factors) are normally expected to be less uncertain, so where data is available, project analysts should use country- or site-specific emission or carbon stock change factors. Some GHG calculators, such as EX-ACT, allow users to specify Tier 2 emission factors.

In the approach presented in this guidance document, the activity data used to quantify AFOLU activities is primarily derived from project documents (for ex ante estimation) and project monitoring and evaluation data (for ex post estimation). Data on AFOLU activities is required that reflects the baseline situation, and that reflects project inputs, AFOLU activities and project outcomes described in the project results chain. Outcome indicators reflect changes in behaviour of the target population or of natural resources in the project area, such as numbers of farmers adopting improved management practices or numbers of hectares afforested (see Text Box 2).

Some inputs supported by the project may also cause GHG emissions (e.g., fuel or nitrogen fertilizer use), and emissions due to the use of these inputs should also be quantified. Text Box 4 provides an

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[20] Net emissions are total emissions of GHGs from all GHG sources minus the removal of atmospheric carbon by carbon sinks. See glossary.

example of how results chain indicators expressed in a project logframe and other data sources can provide the activity data required for GHG quantification.

Text Box 4: Links between results framework indicators and activity data for GHG assessment

The Livestock and Market Development Programme I, supported by IFAD in the Kyrgyz Republic aims to Improve livestock productivity and enhance climate resilience of pasture-dependent communities. There are three project outcomes: (i) More productive and resilient pastures, and increased availability of supplementary feed; (ii) Healthier livestock with lower levels of mortality; and (iii) Income from additional marketing of livestock products (e.g., milk). The project area has about 11,000 rural households, organized in 125 Pasture User Unions raising cattle, sheep and goats on an area of more than 5 million hectares of pasture.

Taking Output 1 as an example, the main outcome indicators and outputs in the project logframe are as follows:
Outcome indicator 1: 25% increase in average milk yields, 15% increase in average liveweight of cattle, sheep and goats
Outcome indicator 2: 240 tonnes of additional high quality barley and 48,000 tonnes of fodder available to programme communities by the end of the programme period.
Output 1.1: Combined pasture and animal health plans incorporating needs and priorities of poor and women
Output 1.2: Investments in prioritized community pasture management plans completed, functioning and sustainable
Output 1.3 Demarcated boundaries and pasture inventories facilitating more effective use of pastures
In the table below, the main activities described in project documentation are listed in the left hand column, and other columns indicate for each activity, the implied inputs and intermediate project effects (outputs and outcomes), with indicators reflecting GHG effects.

Activities	Implied inputs	Implied intermediate effects	Activity data reflecting GHG effects	Data sources
Legal & regulatory reform				
Boundary demarcation	Vehicle fuel use		Fuel use	Project budget or consultation with project experts or stakeholders
Elaboration of community pasture management plans	Vehicle fuel use		Fuel use	Project budget or consultation with project experts or stakeholders
Investments in pasture management plans		1. Restoration of degraded pastures 2. Access roads 3. Water points 4. Fodder production 5. Improved livestock productivity	1. Pasture area under restoration 2. Road area (m^2) 3. Number of water points, water extraction methods and estimates of energy use 4. Area of cropland or pasture converted to fodder production 5. Numbers and productivity (milk yield and live weight of livestock)	1. Targets in project documentation 2. Consultation with project experts or stakeholders 3. Consultation with project experts or stakeholders 4. Project outcome indicators and project doc on seed yields 5. Project outcome indicators and project documentation on livestock numbers and productivity

Community-based seed production	Fuel use in seed transport	Seed production bases	1. Fuel use 2. Area converted from cropland or pasture to seed cultivation	1. Project budget or consultation with project experts or stakeholders 2. Project outcome indicators and project documentation on seed yields

2.1.3 Reporting and aggregation of project GHG mitigation benefits

Reporting of GHG mitigation benefits at fund, programme or organization level is accomplished on the basis of the aggregated results of reporting at the project level. In general, the parameter reflecting GHG mitigation benefits to be reported is net emission reductions, but IFIs have agreed to report both gross emissions and net emission reductions compared to a baseline.[21] Specific reporting requirements vary between organizations, both in terms of how GHG mitigation benefits are to be reported and in terms of other mandatory reporting requirements for non-GHG project performance indicators. For example, some organizations also require reporting of numbers of hectares under improvement management, numbers of beneficiaries or other indicators that relate to the higher-level indicators of the fund or organization. Text Box 5 describes the requirements of the GEF as an example. Requirements of some other institutions are discussed in Chapter 4.

Text Box 5: The GEF Climate Change Mitigation Tracking Tool

The Global Environment Facility has decided that all projects endorsed by the Chief Executive Officer after December 2010 must use a climate change mitigation tracking tool. Projects are required to report expected climate change effects upon submission for endorsement, at mid-term evaluation and at terminal evaluation.

A Climate Change Mitigation Tracking Tool has been developed to simplify and standardize the reporting process. The tool facilitates reporting of lifetime GHG emissions avoided due to investments during the project implementation period, lifetime post-project emissions avoided due to financial facilities put in place by a GEF project, and lifetime GHG emissions avoided attributable to long-term changes in the enabling environment due to the GEF project.

For AFOLU projects, users can input data on the number of hectares of forest or non-forest land under protection or improved management, whether the project supports interventions to promote good management practices, whether carbon stock monitoring systems are established in the project, and quantitative estimates of lifetime GHG emissions avoided and carbon sequestration effects. These indications of project outcomes and GHG effects are reported along with data on finance from GEF and other sources at key stages in the project lifetime, enabling management to track individual project effects and to aggregate the effects of multiple projects for reporting on progress in relation to the programmatic objectives stated in the GEF Results Framework.

GHG quantification methodologies have been adopted for transport, energy efficiency and renewable energy projects in order to standardize procedures for estimation of GHG effects. A recent consultation also recommended development of a standardized methodology for AFOLU projects. This present guidance document takes account of key recommendations presented to the GEF Council.

Sources: https://www.thegef.org/gef/tracking_tool_CCM; https://www.thegef.org/gef/ghg-accounting

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[21] See IFI harmonized framework. In that document, "gross emissions" refer to total emissions in the project scenario net of atmospheric carbon removals, while "net emission reductions" refers to emission reductions in the project scenario compared to a baseline or alternative scenario.

2.2 Overview of the methodology in this guidance document

2.2.1 Main methodological steps

The core of this guidance document (Chapters 3 and 4) provides general guidance on quantification of GHG emission reductions attributable to a project, primarily using activity data derived from project documents (for ex ante estimation) and project monitoring and evaluation reports (for ex post estimation). Specific guidance is provided for the use of the EX-ACT tool in the estimation process. Figure 2 provides a summary of the main methodological steps for ex ante and ex post calculation and reporting of GHG mitigation benefits.

Figure 2: Methodological steps in quantification of AFOLU project GHG mitigation benefits

Define the scope of GHG assessment	•Identify possible GHG effects •Clarify organizational GHG quantification policy •Assess measurability and significance of GHG effects • Define spatial and temporal boundaries of the assessment
Estimate baseline emissions	•Select a baseline scenario approach •Describe the baseline scenario •Input data describing the baseline scenario into EX-ACT
Ex ante estimate of project emissions & emission reductions	•Describe the project scenario on the basis of project documentation •Input data describing the project scenario into EX-ACT
Include indicators for GHG estimation in project M&E systems	•Plan to include indicators reflecting project GHG effects along with indicators of non-GHG project performance in project M&E systems, or •Screen existing project M&E plans and adjust as required • Plan data quality control and quality assurance activities
Ex post estimation of GHG emission reductions	•Describe project implementation on the basis of M&E data •Input data describing the project scenario into EX-ACT
Reporting	•Report the main results of GHG mitigation benefit estimation and other non-GHG effects •Document and report key assumptions, methods and data sources

2.2.2 Key normative documents

The approach to calculation of emissions and net emission reductions presented in this document is consistent with guidance in the following key reference sources.

2006 IPCC Guidelines for National Greenhouse Gas Inventories:[22] Since 1995, the UNFCCC has been requiring and encouraging the use of IPCC Guidelines and Good Practice Guidance for the preparation of national GHG inventories. The *2006 IPCC Guidelines* contain a chapter on GHG calculation in the AFOLU sector, and a supplement on Wetlands has also been produced.[23] As of 2015, Annex 1 Parties to the UNFCCC are required to use the *2006 IPCC Guidelines* for reporting their national inventories. Although most projects using this present guidance document will be in developing countries (i.e., non-Annex 1 parties to the UNFCCC), the *2006 IPCC Guidelines* represent best practice and are recommended for use in the AFOLU sector. In addition to specific guidance on the AFOLU sector, the

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[22] http://www.ipcc-nggip.iges.or.jp/public/2006gl/

[23] http://www.ipcc-nggip.iges.or.jp/home/wetlands.html

2006 IPCC Guidelines and earlier IPCC publications[24] present guidance on ensuring the quality of GHG inventories, much of which is relevant also to GHG measurement, calculation and reporting at the project level.

GHG Protocol for Project Accounting:[25]The *GHG Protocol for Project Accounting*, produced by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), is widely referred to as a source of methodological guidance for GHG quantification at project level. It provides general guidance on principles and methodological approaches and is often taken as a source for standard terminology.

The Policy and Action Standard:[26] The *Policy and Action Standard*, produced by WRI, provides methodological guidance for quantifying the GHG effects of policies and policy actions. The principle and guidance it provides are useful for assessing issues framing the quantification of GHGs at the project level, and for assessing the GHG effects of project activities targeting a sector, such as activities to develop policies, strengthen institutions or establish long-lasting finance mechanisms.

IFI Framework for a Harmonised Approach to Greenhouse Gas Accounting:[27] This document records the main agreements among IFIs on their approach to GHG accounting and reporting, and is taken as the basis for minimum requirements to be met through the application of this present guidance document. The *Common Principles for Climate Mitigation Finance Tracking* by multilateral development banks are also referred to.

In addition to the above normative references, draft recommendations to the GEF on GHG calculation in the AFOLU sector have been considered.[28] This guidance document has also drawn extensively on the *EX-ACT User Manual* in order to illustrate the application of the methodological approach using the EX-ACT tool.[29]

Since specific requirements for GHG quantification and reporting vary between individual finance institutions, the focus of this guidance document is on presenting generally applicable principles, requirements and procedures, but methodological steps are also highlighted where different institutions may have specific requirements that imply different specific procedures.

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[24] IPCC (1996) Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, and IPCC (2000) Good Practice Guidance for Land Use, Land-Use Change and Forestry. Both are available at http://www.ipcc-nggip.iges.or.jp/public/index.html

[25] http://www.ghgprotocol.org/standards/project-protocol

[26] http://ghgprotocol.org/policy-and-action-standard

[27] http://www.worldbank.org/content/dam/Worldbank/document/IFI_Framework_for_Harmonized_Approach%20to_Greenhouse_Gas_Accounting.pdf

[28] https://www.thegef.org/gef/sites/thegef.org/files/documents/EN_GEF.C.48.Inf_.09_Guideline_on_GHG_Accounting_and_Reporting_for_GEF_Projects.pdf

[29] http://www.fao.org/tc/exact/user-guidelines/en/

3. Estimating project GHG mitigation benefits

3.1 General guidance

Key points:

- When implementing a low-cost approach to GHG quantification, project analysts should be able to demonstrate that the approach applied conforms to the general principles of credible GHG quantification: relevance, completeness, consistency, balance of accuracy and conservativeness, transparency and comparability.
- For data on emission factors, Tier 1 emission factors may be used, but Tier 2 emission factors should be used where they are available in the scientific literature.
- For activity data, general guidance is given on the use of data from secondary sources, including project documentation; on the approach to deriving unbiased and reliable estimates of activity data from surveys; and on incorporating data requirements for ex post GHG assessment in project monitoring and evaluation activities.

3.1.1 General principles for GHG quantification and reporting

The application of any specific tool (e.g., EX-ACT) for GHG mitigation benefit calculation must be adapted to the specific project context, but users should be able to demonstrate that the application conforms to the following general principles.[30] These principles are intended to ensure the credibility of reported GHG emissions and emission reductions.

Relevance: Ensure that the GHG assessment appropriately reflects the GHG impacts of the project and serves the needs of users and stakeholders (see Chapter 3.2 on defining the scope of GHG assessment).

Completeness: Include all significant impacts of the project on GHG sinks and sources in the defined GHG assessment boundary. Where project components, sinks or sources are excluded or omitted from assessment, clear justification for their exclusion should be given (see Chapter 3.2 on defining the scope of GHG assessment and Chapter 4 on reporting).

Consistency: Consistent data sources and calculation methods should be used to estimate GHG emissions and emission reductions at different time periods so that the results reflect real differences in emissions, not simply accounting artefacts. Where there are changes to the GHG assessment boundary, data sources or calculation methods, these should be clearly documented (see Chapter 4 on reporting).

Balance of accuracy and conservativeness: Efforts should be made to ensure that the data used are not biased and that they are as reliable as is practical, bearing in mind that there is likely to be a trade-off between resource input requirements and the accuracy and precision of data (see Section 3.5 on deriving data from project M&E systems). Conservativeness – the principle that data sources, calculation methods and other assumptions should not tend to overestimate emission reductions – may serve as a moderator to accuracy (see Section 3.1.2 below).

Transparency: There should be sufficient, clear documentation to enable internal or external reviewers to understand how the estimates of project GHG emissions and emission reductions were made. It is good practice to document and present all relevant methods, data sources, calculations, assumptions and uncertainties used in the calculation process (see Chapter 4 on reporting).

Comparability: Efforts should be made to ensure that common methodologies and assumptions are used when calculating and reporting GHG emissions and emission reductions from similar types of project. This refers in particular to GHG calculation within the same organization, but the use of this guidance document and other efforts to harmonize approaches between organizations can also assist in ensuring that reported impacts on GHG emissions are comparable between organizations.

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[30] See http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_1_Ch1_Introduction.pdf, WRI (2014) Policy and Action Standard. WRI: Washington D.C.

There may be trade-offs between some of these principles, such as when efforts to ensure accuracy require that some project components are excluded, thus affecting completeness. Project analysts should use their best judgement in making related decisions and transparently document the justification of key decisions in the GHG assessment report.

3.1.2 General guidance on emission factors and activity data

This guidance document applies to situations where organizations seek to estimate mitigation benefits in a transparent and credible manner with low minimum requirements for investment of resources in GHG quantification (see Section 1.3). Equation 1 above indicates that net GHG emission estimates are a product of an emission factor and activity data, although many equations presented in the *2006 IPCC Guidelines* also use conversion factors and other parameters to derive the emission factor.

The use of higher-tier emission factors may increase reliability, reducing uncertainty in the estimation of GHG emissions.[31] However, a balance should be struck between accuracy or precision and the costs of GHG quantification. Emission factors and other intermediate parameters used in derivation of an emission factor may be adopted from the Tier 1 default values recommended by the IPCC. Tier 2 emission factors should be used where they are available, derived from reliable research, and can reasonably be justified as representing the conditions and management practices in the project. Tier 2 emission factors can generally be obtained from peer reviewed scientific literature or references in related studies in the project region. Some relevant emission factors may be found in the IPCC emission factor database,[32] and other global databases.[33] In general, projects are not expected to invest funds in direct measurement of carbon stocks or GHG emissions.[34] Many countries are undertaking related research through scientific programmes or as part of efforts to improve national inventories. A number of global initiatives are also supporting related research (see Text Box 6).

Text Box 6: Selected global initiatives to improve the availability of emission factors in the AFOLU sector

Global Research Alliance on Agricultural Greenhouse Gases (GRA): GRA was launched in December 2009 and now has 46 member countries from all regions of the world. Members undertake and coordinate their research on GHG mitigation in the agricultural sub-sectors of paddy rice, cropping and livestock, and the cross-cutting themes of soil carbon and nitrogen cycling. Groups have been set up to address these areas of work. In addition to research targeting these topics, the GRA has a group working on inventories and measurement issues that aims to produce good practice guidance on GHG measurement techniques as well as development of activity data. See http://globalresearchalliance.org/

Climate Change, Agriculture and Food Security Programme of the CGIAR (CCAFS): CCAFS works in 5 priority regions in Africa, Asia and Latin America. It supports research to improve estimates of farm emissions in small holder systems and is supporting the development of tools to facilitate access to relevant information and data. See https://ccafs.cgiar.org/themes/low-emissions-agriculture

Global Forest Observations Initiative (GFOI): GFOI is being developed by the Group on Earth Observations, led by Australia, Norway, the USA, FAO, and the Committee on Earth Observation Satellites. GFOI has 5 main components: methods and guidance documentation relating to the use of ground observations and remote sensing data; coordination of satellite data supply; capacity building; research and development; and administration and coordination. See http://www.gfoi.org/

Forest Carbon Partnership Facility: As with many other initiatives to support countries to implement activities for REDD+, the Forest Carbon Partnership Facility is working with 47 countries on various

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[31] However, note that higher tier emission factors may have greater uncertainty, depending on the specific results of research used to derive the emission factor.

[32] http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_main.php

[33] E.g. country reports of the Global Forest Resource Assessment (http://www.fao.org/forest-resources-assessment/explore-data/en/), http://www.globallometree.org/,

[34] Where projects do invest in direct measurements, IPCC guidance should be followed. See IPCC 2006 Vol 4.

aspects of national REDD+ processes, including carbon accounting. See https://www.forestcarbonpartnership.org/carbon-accounting

The resource inputs required for GHG estimation primarily depend on the cost of generating or accessing accurate activity data. General guidance on sources of activity data and data collection is given in the *2006 IPCC Guidelines*.[35] The use of existing data on AFOLU activities in the project area minimizes the cost of data collection, but is only appropriate where data sources are representative of practices in the project area. Data from international sources (e.g., FAOSTAT), national statistical agencies, sub-national government agencies, academic surveys or other sources referred to in project documentation may be used if the data has been generated through good practice in planning and conducting surveys.[36] Project analysts should assess the quality of available data in order to ensure that data derives from relevant, representative and reliable sources (see Table 2).

Table 2: Data quality indicators

Indicator	Description
Geographical representativeness	The degree to which the data are statistically representative of land uses and management practices across the project area
Temporal representativeness	The degree to which the data reflect the relevant time period (e.g., are they likely to be representative throughout the baseline or project scenario period?)
Technological representativeness	The degree to which the data reflects the adoption of technologies and management practices in the project area
Completeness	The degree to which the data are statistically representative of the relevant land uses and management practices (i.e., proportion of locations for which data are available and used)
Reliability	The degree to which data sources and data collection methods are dependable. Data used should represent the most likely value of the parameter in the relevant time period.
Conservativeness	A conservative estimate of the baseline scenario is one that does not tend to overestimate baseline GHG emissions and does not tend to underestimate carbon sinks in the baseline scenario. A conservative estimate of the project scenario is one that does not tend to overestimate project GHG removals (carbon sequestration) and does not tend to underestimate project scenario GHG emissions.

Source: Adapted from WRI (2014) Policy and Action Standard

In general, data from sources where the survey methodology is documented and provides unbiased and reliable estimates of population parameters is preferred. Survey results reported in other sources (e.g., project documentation) may also be used where the source is documented. Where sources or methods used to produce data reported in project documentation are not indicated, it is recommended to cross-check data with other sources, and/or to consult with experts to derive a conservative estimate based on expert judgment.[37]

Net GHG emission reductions are calculated as the difference between net GHG emissions in the baseline and project scenarios (see glossary). Conservativeness is the principle that data sources, calculation methods and other assumptions should not tend to overestimate net emission reductions. This means that it is conservative to underestimate GHG emissions or overestimate carbon stocks in

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[35] Guidance on data collection is given in http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf

[36] See general guidance on the conduct of agriculture and forestry surveys in http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf, Annex 2A.2.

[37] General guidance on expert elicitation is provided in http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf, Annex 2A.1.

the baseline scenario, or to overestimate GHG emissions or underestimate carbon stock changes in the project scenario. Survey results that report standard deviations can be used to derive conservative estimates of population parameters. For example, for an emission source in the baseline, subtracting one standard deviation from the sample mean, or for a GHG sink adding one standard deviation to the sample mean, will provide a conservative estimate of the population mean. Where data are not available from sample surveys with reported standard deviations, comparing data between multiple data sources and/or expert judgment can be used to identify conservative values. In such situations, project analysts should identify and justify indisputably conservative estimates of the parameter value. Where AFOLU management activity surveys are conducted for the purpose of ex ante or ex post GHG quantification, or where GHG quantification is considered in the planning and design of project monitoring and evaluation (M&E) systems, users should consider good practice guidance in the conduct of surveys and the conduct of project monitoring and evaluation activities. Where possible, surveys undertaken to estimate mean parameters for the population should aim to provide unbiased and reliable estimates. Unbiased estimates are those that do not systematically underestimate or overestimate a parameter value. Reliability refers to the probability that a population parameter estimate falls within a specified distance from the sample-based estimate. Commonly used criteria for reliability are a precision of ±10% within a 90 or 95% confidence interval.[38] Good practice in project evaluation is also relevant, for example, where treatment and comparison groups are surveyed or monitored to replace missing baseline data or to update baselines while also collecting data representing the project scenario.[39]

3.2 Defining the scope of GHG assessment

Key points:

- The purpose of the methodological steps in this section is to define what is included in and what is excluded from the GHG assessment.
- The scope of GHG assessment can be defined by decisions along five main dimensions: (1) the GHG sinks and sources affected by a project; (2) the inclusion or exclusion of direct, indirect and consequential GHG emissions on the basis of organizational policies; (3) the inclusion or exclusion of specific project activities on the basis of their measurability (i.e., quantifiability and data availability), and the likelihood and significance of their GHG effects; (4) the geographical boundary of GHG assessment; and (5) the time period for GHG assessment.

The effects of AFOLU projects on GHGs will mainly derive from the effects of project investments on land users and their use of natural resources, which will have direct effects on project GHG emissions. Some project inputs and activities (e.g., fuel use or fertilizer) will also generate GHG additional emissions within the project area. These emissions (sometimes referred to as ‘project emissions’), must also be accounted for.

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[38] See for example guidance in https://cdm.unfccc.int/filestorage/I/J/9/IJ9FVMQKZ2BU4YSE1RH370WXCG6P8A/eb75_repan08.pdf?t=ZWl8bnhsZWd6fDA9SpoVjhLq9os522sKEJH6.

[39] See e.g. http://www.oecd.org/dac/evaluation/dcdndep/37671602.pdf; Leeuw and Vaessen (2009) *Impact Evaluations and Development: NONIE Guidance on Impact Evaluation*; http://www.fao.org/docrep/013/am292e/am292e00.pdf; http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35529432

Text Box 7: Direct, indirect and consequential emissions and other types of GHG impact

The main categorization of different types of GHG impact used in this guidance is the distinction between ***direct***, ***indirect*** and ***consequential*** GHG impacts. Another common terminology that is used in some key reference documents and in the IFI framework for a harmonized approach to GHG accounting distinguishes between ***scope 1***, ***scope 2***, and ***scope 3*** emissions.[40] This text box explains these terms, maps terminologies from different categorization approaches onto each other, and also explains other key terms, such as project emissions, leakage, intended and unintended effects.

Direct emissions: Direct emissions refer to GHG emissions that occur from sources that are controlled by the project implementation agencies or by participants in a project. Examples include the GHG emissions from fossil fuel consumption by farm machinery provided by the project to participating farmers, or carbon sequestration by newly planted forests in the project area. Changes in direct emissions most often reflect the intended effects of a project, but may also include unintended effects on land use or management practices by project participants within the project area. Direct emissions may occur during project implementation, or in the post-project period (e.g., due to continued operation of a mechanism established during the project). Direct emissions are also referred to as Scope 1 emissions.

Indirect emissions: Indirect emissions are GHG emissions that are a consequence of the project's activities, but that occur at sources not controlled by project implementation agencies or project participants. In AFOLU projects, there are two general types of indirect GHG emission:

(i) emissions due to the use of purchased electricity by project participants, where the emissions occur at the electricity plant. These are also referred to as Scope 2 emissions.

(ii) emissions generated in the process of the manufacture of inputs or infrastructure used in a project. Examples include the GHG emissions from production, transport and storage of fertilizers and pesticides, or emissions caused in the construction of steel or cement used for agricultural machinery or infrastructure. These emissions are also referred to as Scope 3 emissions.

Consequential emissions: In AFOLU projects, there are two general types of consequential GHG emission:

(i) During the project period, a project may have effects on non-beneficiary land users or other stakeholders. These effects may be intended or unintended. Examples of unintended effects include leakage emissions, which refers to the displacement of GHG emitting activities from within the project area to outside the project area, and market leakage or 'rebound' effects whereby the reduction in prices of a product due to project implementation leads consumers to increase their demand for a product, resulting in an increase in absolute levels of production and GHG emission. An example of intended consequential effects during the project period would be the GHG effects of adoption of project practices by non-beneficiaries or by land users outside the project area (i.e., 'spillover' or replication effects) during the project period. These emissions are referred to as consequential emissions during the project period.

(ii) After project closure, during the post-project period, emissions may result from longer-term behavioural change among project participants that is attributable to project outcomes or from broader adoption of the outcomes of a project. These emissions are referred to as consequential emissions in the post-project period.

Sources: WRI and WBCSD (2005) GHG Protocol for Project Accounting; IFI Framework for a Harmonised Approach to Greenhouse Gas Accounting; GEF Council (2015) Guidelines for Greenhouse Gas Emissions Accounting and Reporting for GEF Projects.

In addition to the direct effects within the project area during the project period, some projects may have effects on other land users outside the project's geographical boundary during the project period, and some projects will also have consequential effects on GHG emissions after project closure due to

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[40] IFIs have agreed on mandatory reporting for Scope 1 and Scope 2 emissions, while individual organizations may define their own policies on reporting of Scope 3 emissions.

creation of an enabling environment, such as through policy and institutional development or capacity building activities (see Text Box 7). Decisions will have to be made as to what to include and what to exclude in the scope of GHG assessment.

Some organizations specifically exclude these 'non-site specific' activities from the scope of GHG quantification. Other organizations require that consequential effects are estimated. However, compared to site-specific effects during the project period, post-project consequential emission reductions are more speculative and must be reported separately from direct or indirect GHG impacts

The scope of GHG assessment can be defined by initial assessment along five main dimensions:
(1) Identify the possible direct, indirect and consequential effects of project activities on GHG sinks and sources;
(2) Clarify the GHG quantification policy;
(3) Assess the measurability and significance of GHG impacts;
(4) Define the geographical boundary of GHG assessment;
(5) Define a time period for GHG assessment.

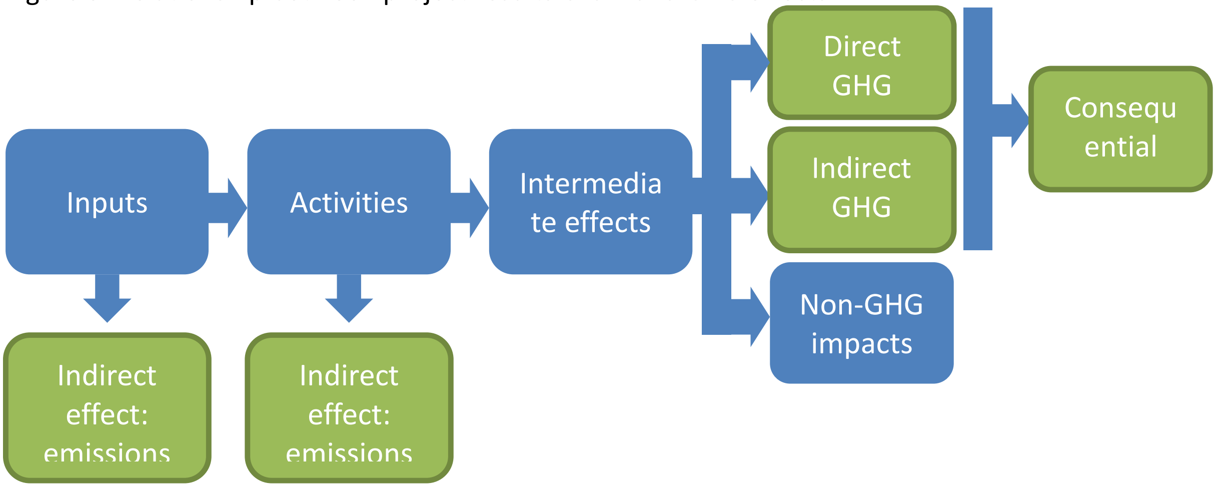
Some of these decisions will be guided by organizational requirements, while others will depend on the judgement of project analysts following the guidance below. Since organizational policies regarding these decisions differ, not all GHG assessments will be directly comparable. However, these decisions should be documented transparently (see Chapter 4 on reporting).

3.2.1 Identify the possible effects of project activities on GHG sinks and sources

The first step is to assess the project components and individual activities in order to identify which project components and activities can be expected to have impacts on GHGs. It is good practice to identify and document all the possible impacts, even if some GHG effects or impact pathways will not be subsequently quantified in detail, since this increases the completeness of the assessment and the transparency of the final assessment results. The output of this step should be a comprehensive list of the possible effects of project activities on GHG emissions.

The primary source of information is project documentation, in particular the project logframe, including (where relevant) any revised logframes adopted subsequent to project initiation. Project impacts on GHGs initially occur through inputs and activities. These activities will be intended to have intermediate effects on the behaviour of land users and other stakeholders and the state of natural resources. These effects will be recorded in the project logframe as outputs or outcomes. These outputs or outcomes will have impacts on GHGs from land use and other related activities, as shown in Figure 3.

Figure 3: Relationship between project results-chain and GHG effects



A variety of different GHG effects should be considered, as described in Table 3. These include intended effects during and after the project period and unintended effects. These different types of effect should all be considered. The initial assessment of GHG effects should consider both possible reductions in GHG emissions (or increases in carbon stocks) and possible increases in GHG emissions (or decreases in carbon stocks) due to project activities.

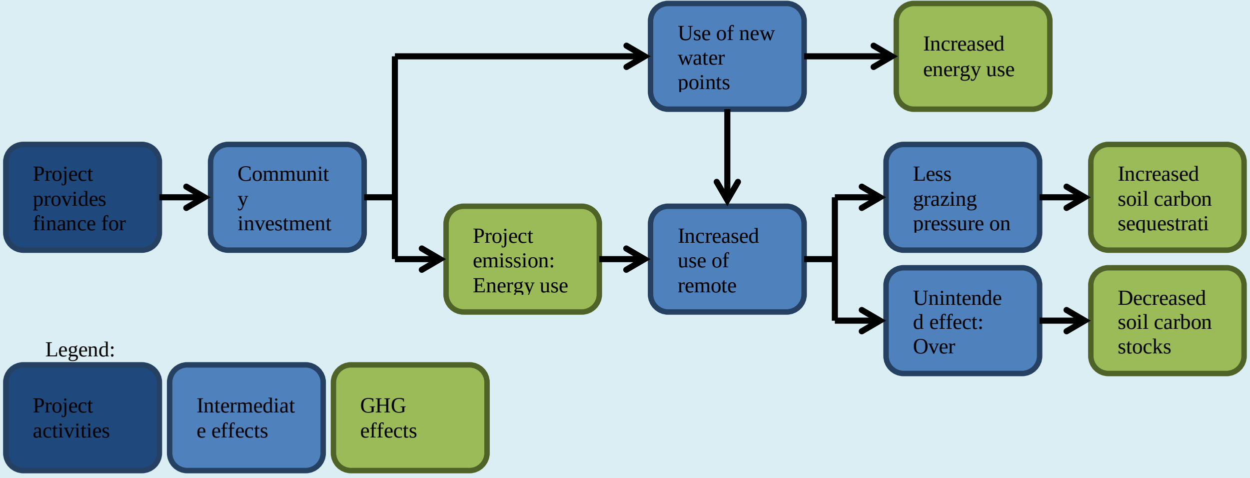
Table 3: Types of GHG effect to consider when identifying a project's possible GHG effects

Type of effect	Explanation and examples
1. Intended effects	• The intended effects of the project on land use and GHG emissions will be documented in the project logframe.
1.1 Effects during the project period	• Change in AFOLU activities implies a change in ***direct GHG emissions*** from land use and farming activities conducted by farmers during the project implementation period. • Increased use of energy, fuel or agricultural inputs may result in an increase in ***direct project emissions*** and Scope 2 or 3 ***indirect emissions***. • Demonstration activities and other project activities may have effects on the activities of other land users, and thus affect ***consequential GHG emissions during the project period***. • Project inputs or activities may imply an increase in GHG emissions by producers of agricultural inputs or other actors in agricultural supply chains (i.e., ***Scope 3 emissions***).
1.2 Post project effects	• Project activities (e.g., farming practices, forest harvest rotations) are intended to produce long-term change in land use practices beyond project completion. • Some project activities (e.g., institutional or policy development, capacity building or development of finance mechanisms) are intended to have ***post-project consequential GHG effects.*** • Some project activities (e.g., institutional or policy development, capacity building or development of finance mechanisms) are intended to be upscaled or replicated beyond the original project area and thus to have ***post-project consequential GHG effects.***
2. Unintended effects during the project period	• Some unintended project effects may be implied by the risks identified in the project documentation and project logframe, or reports from similar projects elsewhere. • Unintended GHG effects may result from displacement of agricultural activities to areas outside the project boundary (i.e., ***GHG leakage emissions***) either during project implementation or after project completion. • The effects of project interventions on production efficiency, costs and product prices may result in ***rebound effects***, whereby consumers increase their demand for a product, resulting in an increase in absolute levels of production and GHG emission.

Guidance on the GHG effects of particular activities and intermediate effects may derive from various sources, including previous assessments of similar project activities reported in scientific publications or the 'grey literature', GHG quantification methodologies, or consultations with experts and stakeholders. A useful approach to clarifying a project's GHG effects is to map a causal chain, as shown in the example in Text Box 8. Table 4 indicates the main GHG sinks and sources that are likely to be directly affected by common types of AFOLU project activity. The following paragraphs provide further suggestions on other GHG effects that might need to be considered.

Text Box 8: Example of mapping causal chains to identify possible GHG effects of a project

Drawing on the case of the pasture management project introduced in Text Box 4, the figure below illustrates how a causal chain can be constructed to represent the possible GHG effects of a project intervention. This example includes both intended effects and unintended effects of the project intervention during the project period. Subsequent analysis should consider whether the likelihood of the unintended effects is sufficient to warrant their inclusion in the GHG assessment (see Section 3.2.3).



<u>Project activities to reduce deforestation and forest degradation</u>: In general, activities to reduce deforestation and forest degradation may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon, non-tree vegetation and harvested wood products). Depending on site-specific conditions, the main GHG effects may be expected to be on above- and below-ground woody biomass.[41] If forest fires are a major issue in the project region, project activities to reduce the occurrence of forest fires may also directly affect N_2O and CH_4 emissions from biomass burning. Globally, agriculture is the main proximate driver of most deforestation.[42] In some regions, commercial agriculture is the most important driver, while in others subsistence agriculture is the main driver. Commercial timber extraction and logging are responsible for forest degradation and deforestation in some areas, while in others fuel wood collection, charcoal production and possibly also livestock grazing in forests are important drivers of deforestation and degradation. This means that efforts to address deforestation and forest degradation may also have direct, indirect or consequential effects on other land use and energy activities. Project activities and outcomes having intended direct effects on GHG sinks and sources will be documented in the project logframe and results framework. These may include the direct effects of reforestation or agricultural extension programmes on land use, or on crop structure and agricultural productivity outside forest areas, or the effects of rural energy initiatives on sources of energy and related GHG emissions. Project activities that support agricultural intensification may also increase project emissions. The potential for displacement of deforestation to other areas (i.e., leakage emissions) is a major concern in these kinds of projects, for example if logging activities are shifted to other areas, or if agricultural expansion is shifted elsewhere, representing consequential emissions during or after the project period. These risks should be considered.[43]

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[41] For additional information, see e.g. http://theredddesk.org/sites/default/files/resources/pdf/Module%20EF-D.%20Emissions%20Factors%20for%20Deforestation.pdf

[42] Kissinger G. et al. (2012) Drivers of deforestation and forest degradation: a synthesis report for REDD+ policy makers. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66151/Drivers_of_deforestation_and_forest_degradation.pdf

[43] For additional information on leakage, see e.g. http://theredddesk.org/sites/default/files/resources/pdf/2012/2012_brief_no1_carbon_leakage_tema1_final.pdf

Table 4: Main direct GHG effects of common types of activity promoted by AFOLU projects

Types of activity promoted by AFOLU projects	Main carbon pools and GHG sources directly affected	Main GHGs directly affected
A1 Reduction in rate of deforestation	Above- and below-ground woody biomass carbon; forest soil carbon	CO_2
A2 Reduction in forest degradation	Above- and below-ground woody biomass carbon	CO_2
A3 Adoption of improved cropland management	Soil carbon	CO_2
A4 Introduction of renewable energy and energy saving technologies	Fuel combustion, wood or animal manure used in energy production	CO_2 (CH_4 and N_2O for animal dung)
B1 Improved animal production	Enteric fermentation	CH_4
B2 Improved management of livestock waste	Livestock waste management, replaced energy sources	CH_4 and N_2O (CO_2 for replaced energy sources)
B3 More efficient management of irrigation water in rice	Anaerobic decomposition of organic material in flooded rice paddies	CH_4
B4 Improved nutrient management	Nitrogen nutrients in fertilizer	N_2O
C1 Conservation farming practices	Soil carbon	CO_2
C2 Improved forest management practices	Above- and below-ground woody biomass carbon	CO_2
C3 Afforestation and reforestation	Above- and below-ground woody biomass carbon; forest soil carbon	CO_2
C4 Adoption of agroforestry	Above- and below-ground woody biomass carbon	CO_2
C5 Improved grassland management	Soil carbon	CO_2
C6 Restoration of degraded land	Soil carbon	CO_2
D1 Increased livestock production	Enteric fermentation	CH_4
D2 Increased irrigated rice production	Anaerobic decomposition of organic material in flooded rice paddies	CH_4
D3 Increased fertilizer use	Nitrogen nutrients in fertilizer	N_2O
D4 Production, transport, storage and provision of agricultural chemicals	Fuel combustion and energy use	CO_2
D5 Increased electricity consumption	Fuel combustion	CO_2
D6 Increased fuel consumption	Fuel combustion	CO_2
D7 Installation of irrigation systems	Fuel combustion and energy use, embodied emissions in cement or steel production	CO_2
D8 Building other infrastructure	Fuel combustion and energy use, embodied emissions in cement or steel production	CO_2
E1 Timber logging	Above- and below-ground woody biomass carbon	CO_2
E2 Cropland expansion	Above- and below-ground woody biomass carbon in forest	CO_2
E3 change in crop residue management	Soil carbon	CO_2

Afforestation and reforestation: In general, afforestation and reforestation activities may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon and non-tree vegetation).[44] Depending on site-specific conditions, the main GHG effects may be expected to be on above- and below-ground woody biomass. Afforestation and reforestation will most likely affect land use in the targeted sites, and may induce land use change. Direct effects of land use change may include loss of biomass carbon in vegetation existing prior to afforestation or reforestation. Land clearing by biomass burning may also cause N_2O and CH_4 emissions. Other consequential effects may include land use change outside the newly planted forest locations, such as leakage emissions due to displacement of prior land uses (e.g., livestock grazing, fuel wood collection, timber harvesting or agricultural production).[45] Because of these risks, afforestation and reforestation projects may also include activities to address rural energy and agricultural production. These activities may have direct effects on project GHG emissions, which should also be considered.

Forest management: Project activities to support sustainable forest management, change silvicultural practices or harvest regimes or other forest management activities may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon, non-tree vegetation, and harvested wood products).[46] Community-based forest management initiatives may also affect prior forest uses, such as fuel wood collection, charcoal production, livestock grazing, timber harvesting or agricultural production. Displacement of these activities may cause leakage emissions, and activities to address rural energy or agricultural production may cause additional project emissions that should be accounted for.

Perennial crops and agroforestry: Trees in agricultural systems, whether perennial crops or other agroforestry systems, may be expected to primarily have direct effects on woody biomass carbon pools, but soil carbon pools may also be affected.[47] Perennial tree crops are often intercropped with other crops or vegetation, and project activities to improve perennial tree crop management may also impact on the crop structure and management of accompanying crops, having direct effects on related GHG sinks and sources. Project activities to expand the area under perennial tree crops may involve biomass burning for clearing, causing N_2O and CH_4 emissions, and displacing prior agricultural activities (e.g., annual crops, livestock grazing), potentially causing leakage emissions. Agroforestry systems closely integrate trees with crop production, and agroforestry activities may affect annual crop management (see next section).

Annual crop management: Project activities to improve crop production are quite diverse, and may have diverse impacts on GHG sinks and sources. Sustainable land management practices (e.g., changes in crop type or variety, nutrient management, water management, crop residue management, tillage practices) may have direct effects on soil carbon stocks.[48] They may also directly affect N_2O emissions from organic manure or synthetic fertilizers, by increasing nitrogen use efficiency and reducing emissions to the environment. Where crop residues are burned, improved management of crop residues may reduce N_2O and CH_4 emissions from burning and also increase soil carbon stocks. In wet rice production systems, the main source of GHG emissions is CH_4, which may be affected by changing

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[44] For additional information, see e.g. https://cdm.unfccc.int/filestorage/e/x/t/extfile-20140929185122152-draft-field-manual.pdf/draft-field-manual.pdf?t=b2J8bnlraWZ6fDCH7SEcoQL3wuZSSURneD2P

[45] For additional information on leakage, see e.g. https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf

[46] For additional information, see various methodologies at http://www.v-c-s.org/methodologies/find

[47] For additional information, see e.g. http://library.uniteddiversity.coop/Permaculture/Agroforestry/Carbon_Sequestration_Potential_of_Agroforestry_Systems-Opportunities_and_Challenges.pdf and http://worldcocoafoundation.org/wp-content/files_mf/somarriba2013environmentsustainabilityagroforestrycarbon.pdf

[48] http://www.researchgate.net/profile/Maria_Jolejole/publication/265276466_Climate_Smart_Agriculture_A_Synthesis_of_Empirical_Evidence_of_Food_Security_and_Mitigation_Benefits_from_Improved_Cropland_Management/links/54a24bbd0cf256bf8baf8018.pdf

irrigation practices. Agroforestry practices may also directly affect woody biomass carbon pools. Some cropland management practices may increase project emissions, for example if use of synthetic fertilizers, agricultural machinery or pumped irrigation water is increased. Energy used in irrigation pumping will either cause direct emissions (e.g., if diesel pumps are used) or indirect emissions (e.g., if electricity is the main energy source), and it may be determined whether off-site emissions in production of electricity and other agricultural inputs are included in the scope of the GHG assessment. Extension programmes may also involve considerable increase in fuel use by extension workers. Extension programmes may also have consequential effects during or after the project period, such as when agricultural practices among farmers not taking part in the project also change due to diffusion of knowledge from project participants and other spillover effects.

Grassland and livestock management: Grasslands and other grazing lands are very diverse, both in their initial vegetation types and in their responses to management practices. Where grassy vegetation is dominant, improved management or restoration may primarily be expected to impact on soil carbon pools.[49] Where bushes or trees are common, the main impacts may be on woody biomass carbon pools. Changes in livestock density will affect CH_4 emissions from enteric fermentation and N_2O and CH_4 emissions from manure deposited on pasture. Improved availability and quality of forage after adoption of improved grassland management, or improved livestock management and feeding practices, may also affect CH_4 emissions from livestock enteric fermentation. However, in extensively grazed systems, because of low livestock densities, these effects may be relatively small. In intensive livestock systems, improved livestock management and feeding practices may affect both CH_4 emissions from enteric fermentation and N_2O and CH_4 emissions from manure management, especially if manure management systems change (e.g., with a shift from grazing to stall-fed systems). Where animal dung is an energy source, change in grazing or manure management practices may also have direct effects on household energy use. Changes in fodder and feed production on-farm will affect direct GHG emissions from land use and crop cultivation. Where feeds are imported, they will cause indirect GHG emissions in the production, processing and transport of feeds, and it should be assessed whether these emissions are included in the scope of the GHG assessment. Where grassland restoration involves resting of degraded areas from grazing, leakage emissions due to displacement of livestock grazing activities to other areas is a risk, and where livestock densities are reduced, market leakage effects may occur whereby producers in other areas increase their livestock numbers to meet market demand.

Infrastructure: Improvements in agricultural infrastructure are often critical components of initiatives to support agricultural and rural development. Construction of roads, buildings and facilities and irrigation systems all involve direct emissions from energy use by machinery in the construction process, and also cause indirect emissions in the production of cement, steel and other inputs to the construction process.[50] It should be determined whether these indirect effects should be included in the scope of GHG assessment. After installation of infrastructure, direct GHG emissions will also arise from the increase in vehicle use by project participants, the use of energy for lighting, processing and other functions once farm buildings and facilities are operational, and from the use of energy for water pumping in irrigation systems. Installation of infrastructure may also be associated with change in agronomic practices, and thus change in emissions from the use of agricultural machinery, fertilizer inputs and other agricultural processes. The impacts of these changes on GHG emissions should be considered.

Agribusiness support: Support to agribusiness is an important type of intervention to support the development of commercial agriculture. Investments in agribusiness that increase processing capacity

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[49] For additional information, see http://www.fao.org/docrep/013/i1880e/i1880e00.htm

[50] See http://siteresources.worldbank.org/INTEAPASTAE/Resources/GHG-ExecSummary.pdf; http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter6.pdf;

may increase total energy use by project beneficiaries, while investment in more efficient technologies in existing firms may reduce energy consumption. Fuel and energy use are likely to be the main direct emissions affected by project activities supporting agribusiness development.[51] Support to agri-processing may cause changes in agricultural production practices among suppliers and thus consequential GHG emissions, and vice versa, support to agricultural production may also cause increased consequential GHG emissions from product transport, storage and processing by agri-businesses, either as intended or unintended project effects.

3.2.2 Clarify the GHG quantification policy

All IFI's have agreed to report direct and indirect GHG effects falling within Scope 1 and Scope 2 emissions (see Text Box 7 for definitions). Some organizations may also require assessment of Scope 3 emissions and consequential emissions during the project period.[52] Organizations also differ in the extent to which consequential emissions in the post-project period should be quantified and whether whole project emissions or only emissions attributable to the incremental finance provided should be assessed. Table 5 presents a set of related questions to aid in identifying the implications of organizational policies for clarifying which of the identified project GHG effects should be included in the GHG assessment. The outcome of this methodological step is the identification of possible GHG effects that conform to the information user's organizational policies for GHG quantification.

Where possible GHG effects have been identified, but organizational policies do not provide related guidance, it is recommended to include *at a minimum* all direct GHG effects (i.e., Scope 1 emissions) and emissions from energy use (i.e., Scope 2 emissions). Consequential emissions in the post-project period may dominate emissions and emission reductions in the project implementation phase, so the needs of information users should be clarified before deciding whether to include consequential emissions in the GHG assessment. Where organizational policies do not provide specific guidance, it is recommended to include all possible GHG effects.

Table 5: Assessment of organizational policies for inclusion or exclusion of possible GHG effects in the GHG assessment

Question	Responses		
	Yes	No	No guidance
Does the organizational policy require reporting of Scope 1 and Scope 2 emissions?	Include GHG effects	–	Include GHG effects
Does the organization explicitly exclude Scope 3 emissions?	Exclude GHG effects	Include GHG effects	Include GHG effects
Does the organization explicitly exclude consequential emissions during the project period?	Exclude GHG effects	Include GHG effects	Clarify information users' needs
Does the organization explicitly exclude consequential emissions during the post-project period?	Exclude GHG effects	Include GHG effects	Clarify information users' needs
Does the organization explicitly require quantification of GHG effects of incremental finance to the project	Estimate incremental effects	Estimate GHG effects of the whole project	Estimate GHG effects of the whole project

3.2.3 Assess the measurability, significance and likelihood of project GHG effects

Even if an organization explicitly requires that a particular type of GHG effect is assessed, it may not be feasible in all situations to assess all possible GHG effects. In particular:

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[51] See, e.g. Notamicola et al. (2015) Life cycle assessment in the agri-food sector: case studies, methodological issues and best practices. Springer Verlag.

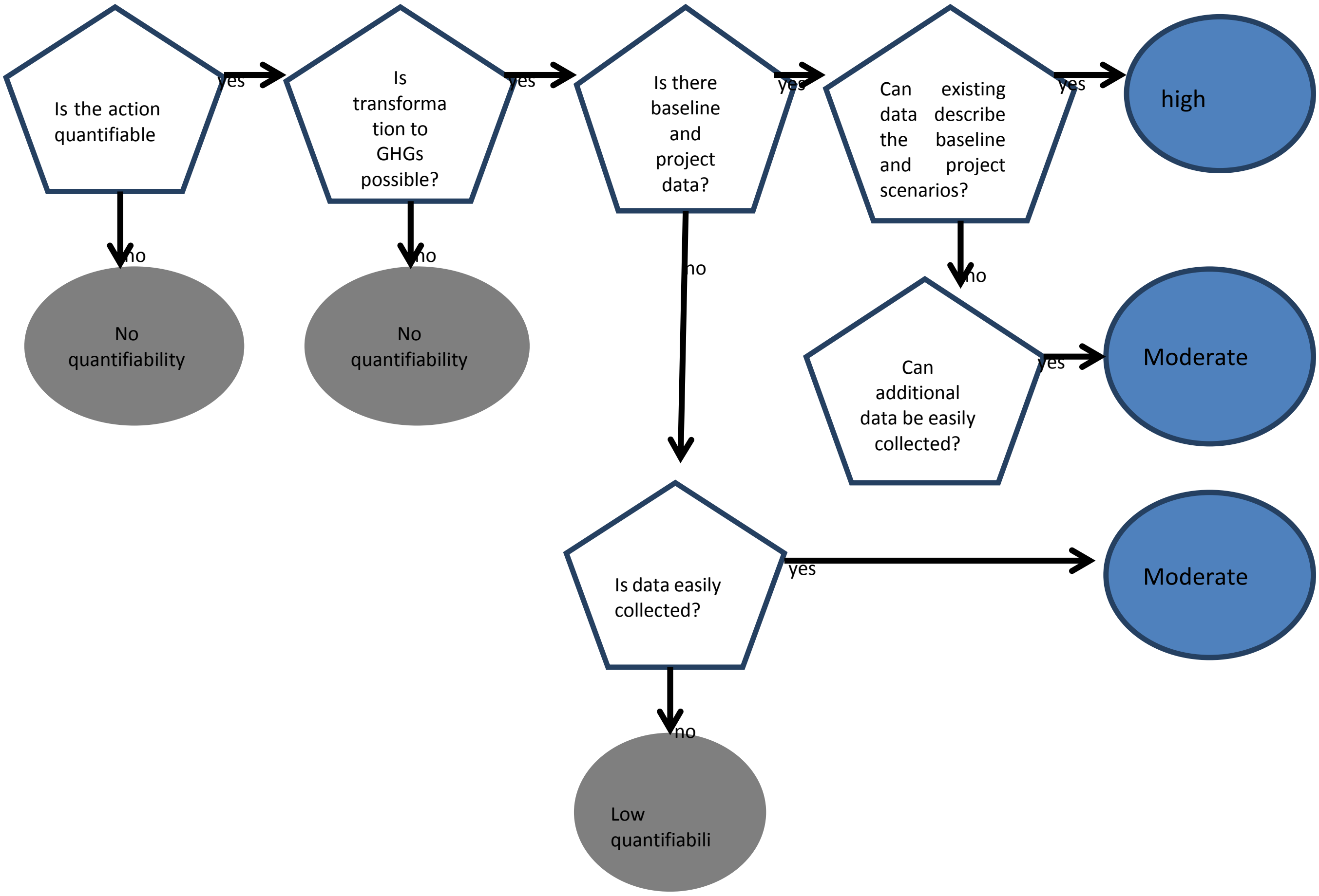
[52] Note, that when using EX-ACT, Scope 3 emissions due to agricultural inputs and inputs in infrastructure construction are automatically accounted for if data on input use is entered into the tool.

1. the nature of some project activities and their intermediate effects may prevent identification of specific GHG effects, or data may be lacking to support sufficiently reliable quantification of activities in the baseline and project scenarios; and
2. some of the identified GHG effects may be too small or too uncertain to warrant expenditure of resources on in-depth assessment.

The purpose of this methodological step is to exclude from the assessment project effects **that cannot reasonably be represented or that are not sufficiently likely or significant** to include in the assessment.

Firstly, can the activity or direct outcome of the activity be represented in a manner that enables quantification n of GHG effects? Figure 4 presents a decision-tree that enables project analysts to characterize the measurability of the GHG effects of project activities and outcomes as 'high', 'moderate' or 'low', or 'not quantifiable'.

Figure 4: Decision tree to assess the measurability of the GHG effects of project activities



Source: Adapted from Bakker et al. (2010) Monitoring emissions and actions in the post-2012 regime. ECN

The GHG effects of a project activity or outcome can only be estimated if the action can be represented in a quantifiable way and if the quantified action can be related to specific GHG effects. If adequate data to represent the activity or outcome in the baseline and project scenarios is available, then the measurability of the activity or outcome is 'high'. If additional data collection is required but data either for the baseline or project scenario is easily collected, then the measurability of the project activity or outcome is 'moderate'. If baseline or project scenario data is missing and not easily collected, the measurability is 'low'.[53] For project activities and outcomes with moderate or low measurability, project analysts will have to decide whether to exclude them from the GHG assessment. Note, that it is conservative to exclude activities that increase GHG emissions or reduce carbon stocks in the baseline scenario, or activities that reduce GHG emissions or increase carbon stocks in the project scenario. Any exclusions on grounds of measurability should be transparently documented (see Chapter 4 on reporting).

Secondly, even if project actions, outcomes and their GHG effects can be measured, some possible GHG effects may be too uncertain or not sufficiently significant in magnitude to warrant quantification. Following the *Policy and Action Standard*, a GHG effect is defined as 'minor' if it accounts for <1% of the expected absolute change in emissions due to the project. A GHG effect is of 'moderate' significance if the effect is 1-10% of absolute change in emissions. 'Major' effects account for >10% of project net GHG emissions. Minor GHG effects may be excluded from the GHG assessment.

It may be possible to identify some minor GHG effects on the basis of existing literature (e.g., studies from the project area indicating the relative size of different carbon pools), or from previous GHG assessments and related publications. In other cases, ex ante assessment of the significance of a GHG effect will require that initially all GHG effects are quantified. During the quantification process it may become apparent that the scale of a particular activity and its GHG effects is insufficiently significant to warrant inclusion. Alternatively, insignificant effects may be identified only when all GHG effects have been quantified. In this case, the project analyst may choose to retain or exclude minor effects. Identification of minor GHG effects may assist in streamlining subsequent ex post GHG assessment, in which particular GHG effects may be excluded on the basis that ex ante assessment identified them as minor GHG effects.

Thirdly, in ex ante GHG assessment, and in the planning of ex post GHG assessment, some GHG effects identified in previous methodological steps may be considered to be possible but unlikely to occur.[54] All intended direct GHG effects of a project should be included. For unintended direct GHG effects and indirect GHG effects, GHG effects that are possible but are thought to be most likely not to occur, and effects that probably will not happen, may be excluded from the GHG assessment. The recommended scope of GHG assessment in terms of the significance and likelihood of GHG effects is illustrated in Table 6, which also presents definitions of criteria for likelihood.

Information on the likelihood of particular GHG effects may derive from a variety of sources. Project documents generally present statements of the intended effects of a project. Project logframes may identify assumptions and risks indicating the possibility that an activity, output or outcome may not be achieved. Evaluations and reports from or on other, similar projects (including previous phases of a project) and similar activities may document whether the project effect of interest has previously been known to occur, and may provide other indications of the likelihood that intended or unintended project effects actually occur. Consultation with experts and stakeholders may also provide an indication of whether a project effect is likely to occur. Sources of assumptions about the likelihood of a project effect should be transparently documented.

Any project activities, outcomes or GHG effects excluded on grounds of measurability, significance or likelihood should be transparently documented (see Chapter 4 on reporting).

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[53] For guidance on the specific data parameters required to represent GHG effects of different common AFOLU project activities using Tier 1 and Tier 2 approaches in the EX-ACT tool, please refer to Table 9.

[54] The focus at this stage is on characterizing the likelihood that a given effect may occur somewhere, which is distinct from the question of the scale at which it occurs. Issues regarding assumed adoption rates in ex ante assessment are addressed in Section 3.4.1.

Table 6: Recommended scope of GHG assessment based on assessment of significance and likelihood of GHG effects

Likelihood	**Significance**		
	minor	**moderate**	**major**
Very likely	may exclude	should include	
Likely			
Possible			
Unlikely		may exclude	
Very unlikely			
Definitions			
Very likely	*Reason to believe the effect will happen as a result of the project (e.g., a probability of 90-100%)*		
Likely	*Reason to believe the effect will probably happen as a result of the project (e.g., a probability of 66-99%)*		
Possible	*Reason to believe the effect may or may not happen as a result of the project (e.g., a probability of 33-66%)*		
Unlikely	*Reason to believe the effect probably will not happen as a result of the project (e.g., a probability of 10-33%)*		
Very unlikely	*Reason to believe the effect will not happen as a result of the project (e.g., a probability of 0-10%)*		

Source: WRI (2014) Policy and Action Standard, pp.62-65

3.2.4 Define the geographical boundary for GHG assessment

Project documentation will almost always identify the location (e.g. region) of project implementation. There are three purposes in defining the geographical boundary for GHG assessment.

Firstly, in order to clearly define the scope of GHG assessment, a distinction must be made between the area in which direct emission effects will be accounted for, and the areas in which consequential emissions that may occur during the project period and in the post-project period will be accounted for. Direct GHG emission effects will occur on land under the control of project participants. In some projects, these will be clearly identified as land users within a specified region (or specific locations within that region). If consequential emissions during the project period are not included in the scope of GHG assessment (see Section 3.2.2 above), then the geographical scope of the GHG assessment is the identified project locations or region.[55]

If consequential emissions during the project period are included in the scope of GHG assessment, and consequential emissions such as change in management practices by non-beneficiary land users have been identified as a possible GHG effect, then it will be necessary to define the area or region within which such effects are to be accounted for. This will be the geographical area within which it is considered possible for these effects to occur. For example, a project in Province A has plans to support demonstration farms in locations Q, R and S within Province A. Q, R and S are identified as the area in which direct emissions will occur. Neighbouring locations O, P, T and U are identified as areas where spillover effects due to knowledge diffusion are likely to occur, while other locations in the province are excluded from the scope of assessment on the basis that these spillover effects are unlikely.

For the post-project period, the geographical scope of GHG assessment may either be determined to be the same as the assessment scope during the project period, or (depending on the type of project

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[55] Indirect (i.e., Scope 2) emissions from energy production occur at other specific sites outside the project area, but these locations need not be identified, unless the country has more than one electricity grid and Tier 2 grid electricity emission factors area used.

intervention) may be determined to include the area during the project period plus a wider area where uptake of project outcomes is determined as possible to occur. For example, a project plan states that it will work with banks to establish revolving funds for agribusiness energy efficiency investments, piloting these funds in specified provinces during the project period, but intending that the banks then roll-out the credit facilities to the remaining provinces in the country after the end of the project period. In this case, the geographical scope for assessment in the post-project period will be all provinces in the country, while the geographical scope for assessment in the project period will be those provinces with pilot activities. Since baseline and project GHG emissions during the project and post-project periods should be separately estimated and reported, the geographical scope of GHG assessment for emissions in these two periods may differ.

Secondly, where project activities include the transport of agricultural inputs or construction materials to the project area, and where these GHG effects have been included in the scope of GHG assessment, it will be necessary to identify the likely location of production of these inputs in order to estimate transport distances and fuel consumption.

Thirdly, definition of the geographical boundaries of the GHG assessment has implications not only for the scale of project activities assessed, but also for the quantification of the GHG effects of project activities and outcomes. For several GHG sinks and sources, emission factors and activity data (e.g., volume of woody biomass per hectare) vary by climatic region, soil type and other spatially distributed factors. When using GHG calculators such as EX-ACT, project analysts will be required to input information on the location, climate type and dominant soil type in the project area.[56] Definition of the geographical location of the project area should be sufficiently precise so as to enable characterization of climate types and dominant soil types within the project area.

The outcome of this step should be that the geographical scope of assessment of direct (and, where relevant, consequential) GHG effects has been clearly identified. The source of information for identification of the geographical area, and where relevant any assumptions used in identifying the geographical area, should be transparently documented (see Chapter 4 on reporting).

3.2.5 Define the time period for GHG assessment

The effects of a project on GHGs may occur during the implementation period of a project, and/or after project completion during a post-project period. Some organizations explicitly include or exclude the post-project period from GHG assessment. Some organizations also mandate the time period that should be considered in the GHG assessment.[57] In addition, the nature of the project activities may also determine the appropriate duration of the GHG assessment period. For example, forest harvest rotations or expected lifetime of infrastructure may indicate the appropriate duration of the GHG assessment period.

Table 7 presents a set of related questions to aid in identifying the appropriate time period for assessment of project GHG effects. Where organizational policies do not specify a time period for GHG assessment, and the project activities, outputs or outcomes do not have a defined lifetime, the appropriate period for GHG assessment should be the period in which the assumptions justifying the choice of baseline scenario can reasonably be expected to hold.[58]

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[56] See EX-ACT User Manual, pp. 36-39.

[57] E.g., World Bank (2014) GHG Accounting Guidance Note for agriculture sector investment projects mandates an assessment period of 30 years, which is in line with organizational requirements for economic and financial analysis. The GEF Climate Change Mitigation Tracking Tool defines that for LULUCF projects, a default period of 20 years should be used unless a different number of years is deemed appropriate.

[58] See WRI and WBCSD (2005) GHG Protocol for Project Accounting, Section 10.2.1.

Table 7: Guiding questions to identify the appropriate time period for GHG assessment

Question	Responses		
	Yes	**No**	**No guidance**
Does the organizational policy explicitly require quantification of GHG effects only during the project implementation period?	Select project implementation period	(proceed)	(proceed)
Do the project outputs or outcomes have a defined lifetime period?	Select lifetime period	(proceed)	–
Can a time period be defined after which assumptions affecting the baseline scenario can no longer be reasonably justified?	Select time period in which assumptions are likely to hold	(proceed)	–
Is the answer to all of questions 1-3 'no'?	Use a default period of 20 years	–	–

If economic conditions, technologies or management practices related to the project activities are changing rapidly, then a shorter GHG assessment period would be justified. If the conditions that led to identification of the project area or project beneficiaries are likely to change, then the GHG assessment period should only cover the period during which the original conditions are expected to hold. Where GHG emissions during the post-project period are to be included in the GHG assessment, project analysts should apply the conservativeness principle, and seek to ensure that net GHG emission reductions from the project are not overestimated. In absence of specific reason to limit GHG assessment period, which is the most common situation, a default period of 20 years (including project implementation period and post-project period) is recommended, since this time period is consistent with the default transition period used in developing Tier 1 carbon stock change factors for land use activities by the IPCC.[59]

3.2.6 Define what to include and what to exclude in the GHG assessment

By this point, project analysts should be able to define which project inputs, activities and outcomes to include in the GHG assessment, and the geographical and temporal scope of the assessment in way that meets the organizational policies of the user of the GHG assessment and with clear justification for which potential GHG effects are excluded from the GHG assessment. The results of screening the possible GHG effects of the project can be recorded in a matrix (see example in Table 8) to ensure the transparency of the decisions taken and the resulting GHG mitigation benefit estimates.

Table 8: Matrix for recording justifications for the exclusion of possible GHG effects

GHG effect	Criteria on which possible GHG effects were excluded					
	Organizational policy on reporting scope	Measurability	Significance	Likelihood	Outside geographical scope of assessment	Outside temporal scope of assessment
Effect 1						
Effect 2						
Effect 3						
…						

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[59] The IPCC Tier 1 default value for relative soil carbon stock change factors in forest, cropland and grassland soils is 20 years, which represents an estimate of the length of transition period for carbon stock changes following land-use change or land degradation. See 2006 IPCC Guidelines, Volume 4, Chapters 4, 5 and 6.

3.3 Estimating baseline emissions

Key points:
- Three options for characterizing the baseline scenario are presented, including (1) 'no change' compared to the pre-project situation; (2) extrapolation of historical trends, and (3) modelling future trends.
- Guidance on selection of data sources for emission factors and activity data in the baseline scenario is presented.
- The main procedures for representing land use and management activities in the baseline scenario using the EX-ACT tool are described.
- The main outputs of baseline scenario estimation using EX-ACT are described.

3.3.1 General guidance on selecting a baseline scenario approach

GHG mitigation benefits (i.e., net emission reductions) are calculated as the difference between GHG emissions in the baseline and project scenarios. The baseline scenario represents the land use and management practices that are most likely to occur in the absence of the project in the geographical region assessed. In general, there are three alternative approaches to characterizing a baseline scenario:

Option 1 ('no change' or continuation of current practices scenario): The situation in the project area immediately prior to the start of the project (e.g., as described in project documentation) is taken as the baseline and it is assumed that this situation would not change throughout the GHG assessment period.

Option 2 (extrapolation of historical trends): Recent historical data prior to the start of the project is used to make a projection of trends that would be expected to happen in the project area in the absence of the project. This approach to baseline estimation assumes that the factors driving trends before the project started would continue in the absence of the project. If this option is used, it should be justified that the main factors driving trends before the project started continue to be in place during the GHG assessment period.

Option 3 (modelling future trends): Data on factors affecting GHG emission trends are used to make a projection of trends in factors (e.g., national policies or investment plans, changes in population, economic activity or other drivers of GHG emissions) that would be likely to happen in the project area in the absence of the project. Modelling future trends involves many assumptions, and should only be used where these assumptions can be justified as robust.[60]

Figure 5 provides an illustration of these three baseline scenario approaches and Text Box 9 provides an example from a grassland management project.

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[60] For an example, see Cervigni R. et al (2013) Assessing low-carbon development in Nigeria: an analysis of four sectors. World Bank Study 78281.

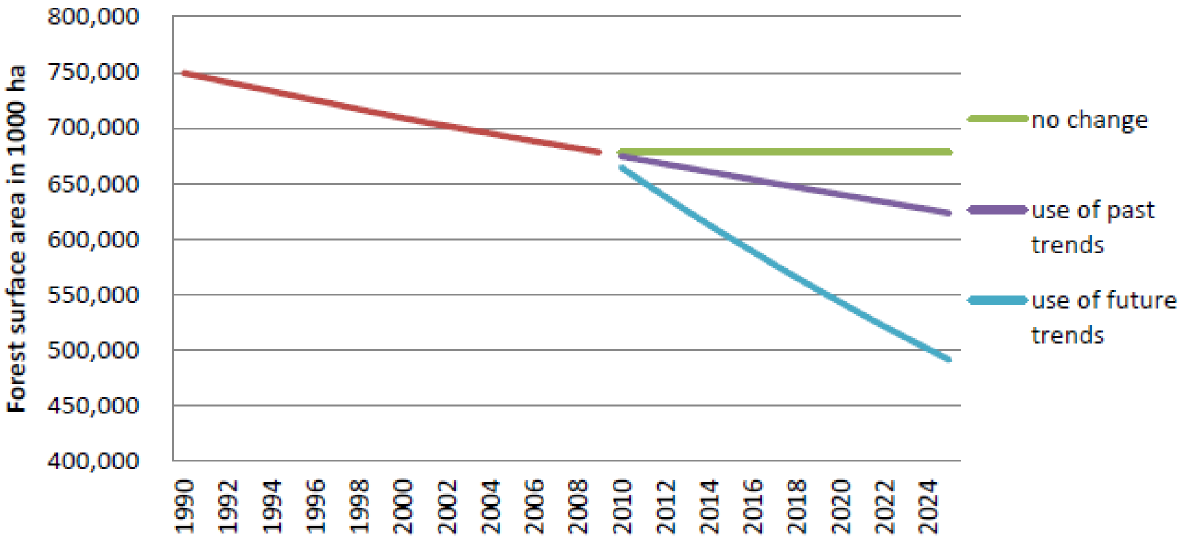

Figure 5: Illustration of three alternative baseline scenarios for the evolution of forest area in Africa

Source: Bernoux et al. (2011) Main recommendations for the elaboration of the baseline scenario. FAO, Rome.

The approach to characterizing the baseline scenario depends on the availability of data and judgment as to its quality. A key principle is that the baseline scenario should be conservative. A baseline scenario is conservative if the methods used to quantify GHG emissions in the baseline do not tend to overestimate baseline GHG emissions and do not tend to underestimate removals of atmospheric CO_2 by carbon sinks in the baseline scenario (see Section 3.1.2). The choice of approach to baseline scenario setting and the main assumptions underlying the baseline scenario should be justified transparently (see Chapter 4 on reporting). In situations where data to support quantification of a dynamic baseline (i.e., Options 2 or 3) are limited, the use of Option 1 (i.e., 'no change' scenario) is a pragmatic choice, although this will not always be the most conservative scenario.

In most cases, a single baseline scenario will be identified as the most plausible and feasible for land users to implement. In some cases, more than one equally plausible alternative may be identified. In this case, conduct a sensitivity analysis, and select the scenario that gives the more conservative estimate of baseline emissions and removals.[61] Where organizational policies require that GHG assessment identifies the GHG mitigation benefits of incremental finance to the project, the baseline scenario should include the effects of national policies, programmes and investments and the effects of any co-finance investments from implementing agencies or finance partners.

Where the scope of GHG assessment includes post-project consequential emissions (see Section 3.2.2), because project effects on consequential emissions are likely to be more speculative than effects occurring during the project implementation period, and may refer to different geographical regions, the baseline for the project period and post-project period should be described separately and baseline emissions should be separately estimated for the project and post-project periods.

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[61] See WRI (2014) Policy and Action Standard, Chapter 12 for guidance on sensitivity analysis.

Text Box 9: Alternative baseline scenarios for the Three Rivers Grassland Carbon Sequestration project

The Three Rivers Grassland Carbon Sequestration Project, developed with support of FAO, aims to restore degraded pastures in an area of more than 20,000 hectares (ha) in Qinghai Province, P.R. China. One area of investment would be reseeding of degraded grasslands. A baseline survey identified 3100 ha as heavily or severely degraded. Some heavily and severely degraded plots had already been sown with grasses. A survey of 244 households covering the years 2007-2009 identified that the area of reseeded severely and heavily degraded plots was gradually increasing, from 489 ha in 2007 to 540 ha in 2008 and 781 ha in 2009. Households are unable to afford seeds, so all reseeding activities had been funded by local government. How could the baseline for severely and heavily degraded lands in the project area be determined?

Extrapolation of historical trends: The data clearly show a increasing trend in the proportion of heavily and severely degraded lands that have been reseeded. The average increase is 146 ha per year. It could be assumed that this trend would continue in the future, so that in the absence of additional project funds, over a 10 year period 1460 ha or about 47% of the area suitable for reseeding would be reseeded. However, local government indicates that while annual funding for reseeding activities has been obtained in recent years, it is not certain to be funded in the future.

Dynamic baseline: Since reseeding activities are funded by government, an examination of government plans could inform characterization of the baseline. Although local government does not know what funds will be available for reseeding in the project site, a provincial government plan set out targets to reseed 7.6% of the total area suitable for reseeding within the coming 5 years, or 1.5% per year. Assuming that the same proportion of degraded land in the project area would be reseeded and that the investment would continue in the next 5 year plan, the total additional area reseeded in 10 years would be 465 ha, or 15% of the area suitable for reseeding.

Static baseline: The data from the household survey for 2007-2009 could be used to quantify a static baseline. One option would be to take the average reseeded area in the 3 years of the survey as the baseline value (i.e., 604 ha) and assume that this value would not change in the coming 10 years (e.g. assuming that no further government investment would be available). Another option would be to take the latest value (i.e., 781 ha) and assume that this would not change in the coming 10 years.
Given that reseeding is funded by government, and a higher level of government has a target to reseed degraded grasslands, the assumptions underlying the static baseline seem untenable. Since reseeding degraded grasslands can sequester soil carbon, it would be more conservative to set a baseline that assumes a greater area of degraded land will be reseeded. In the example given here, the most conservative scenario would be result from extrapolation of historical trends, although judgement as to how likely the scenario is would depend on some knowledge of how government programmes target investments.

3.3.2 Guidance on elaboration of the baseline scenario

The baseline scenario should be described for all GHG sinks and sources that are expected to be affected by project inputs, activities and outcomes and that are included in the scope of the GHG assessment (see Section 3.2). In the EX-ACT tool, these sinks and sources are represented as:

- land use change;
- management practices applied to land use in croplands, grasslands and degraded lands (including forests);
- livestock, livestock and manure management practices;
- agricultural inputs, energy consumption and infrastructure.

For each type of land use, livestock, input (including agricultural inputs and energy) and each type of infrastructure, a quantitative description of the change that is most likely to occur in the absence of the project should be provided. That is, a specific baseline scenario should be described for each land use, type of livestock, input and type of infrastructure included in the scope of GHG assessment. When elaborating the baseline scenario, factors affecting change in land use, adoption of management practices in different land use types, livestock production and management, manure management and the use of inputs should be identified. The factors affecting one land use may differ from factors affecting another land use, and should be separately identified, assessed and justified. Assumptions underlying the baseline scenario can influence the credibility of the baseline and resulting estimate of GHG mitigation benefits, and should be transparently documented (see Chapter 4 on reporting).

Some generic factors to consider in quantifying the baseline scenario include:

- Demographic trends: Population numbers and the structure of the population (e.g., by urban-rural residence, age structure of the agricultural workforce) may affect the intensity of land use.
- Trends in the regional economy or economic sector: Trends in the structure of the rural economy and development of commodity value chains may provide indications of future demand for land uses and adoption of management practices. Commodity prices may also affect land use, but are difficult to project reliably, especially for particular regions. Assessment of the net returns to alternative land uses under different economic assumptions may provide an indication of potential changes in land use and management practices.[62] Analysis of barriers to change in land use may also be useful to justify the choice of likely land uses in the baseline scenario.[63]
- Trends in technologies: The pace of agricultural or energy technology adoption is affected by a number of factors, including factors affecting the supply, demand and economic feasibility of technology adoption. Assessment of net returns to technology adoption and barriers to technology adoption can both be useful in selecting likely scenarios for technology adoption in the baseline.
- Trends in infrastructure: Development of rural infrastructure can reduce transaction costs of marketing forest or agricultural products and may be a direct driver of change in land use.[64]
- National or sub-national policies: The likely effects of policies and programmes implemented by national governments in the absence of the project should be included baseline scenario. However, assumptions regarding policy delivery or enforcement should be explicit and justified.

Baseline scenarios are a hypothetical counterfactual and are necessarily subjective. The credibility of baseline scenarios (particularly scenarios constructed using projected or extrapolated historical) can be strengthened by transparent documentation of underlying assumptions and provision of clear justifications. Consultation with relevant experts and stakeholders can help to ensure that the assumptions underlying the baseline scenario are reasonable. Sensitivity analysis can help identify key factors with significant impacts on the baseline scenario, and aid in identification of a conservative baseline scenario.

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[62] For general guidance on the use of net benefit assessment in establishing baselines, see WRI and WBCSD (2005) Section 8.2.

[63] For general guidance on barrier analysis, see WRI and WBCSD (2005), Section 8.2.

[64] Ahmed, S. E., Souza Jr, C. M., Riberio, J., & Ewers, R. M. (2013). Temporal patterns of road network development in the Brazilian Amazon. *Regional Environmental Change*, *13*(5), 927-937.

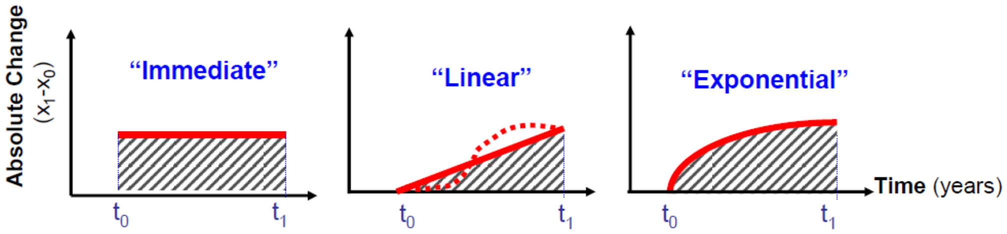
3.3.3 Representing the baseline scenario

The following sub-sections provide general guidance on the main steps required to represent a baseline scenario, illustrating the process with reference to the EX-ACT tool. Since most other similar tools are also based on IPCC guidance, the procedure will be similar when other tools are used. Specific guidance on use of the EX-ACT tool is provided in the EX-ACT User Manual. An important feature of scenario representation in EX-ACT is the facility to represent three alternative dynamics of change from the start to the end of the baseline scenario (see Text Box 10).

Text Box 10: Representation of dynamics of change in baseline and project scenarios in EX-ACT

The EX-ACT tool accommodates the three options for baseline scenario approaches outlined in Section 3.3.1. For land use, land use changes and forest or land degradation, the different modules allow entry of land areas, management practices and inputs reflecting an initial state and a final state in the baseline scenario (referred to as "start" and "without" in the user interface). It also allows entry of area and management data for land uses subject to land use change between the baseline and project scenarios. For land use changes, management changes and degradation processes, users can select whether the changes between the initial and final state occur linearly (the default setting), immediately at the beginning of the GHG assessment period or exponentially through the GHG assessment period (see Figure 6). Where the 'no-change' baseline scenario approach (Option 1) is adopted, the "start" and "without" values are the same. The same approach is applied to characterization of baseline and project scenarios in ex ante and ex post estimations using EX-ACT.

Figure 6: Dynamics of change represented in EX-ACT



Source: FAO (2013) User-Friendly manual of the EX-ACT tool

3.3.3.1 Characterize the project area

Based on decisions regarding the geographical scope of GHG assessment (see Section 3.2.4), all land in the baseline scenario should be characterized in terms of its location (continent), climate type and dominant soil type following IPCC guidance. For specific instructions on characterization of climate and soil types in line with the IPCC guidance, refer to the *EX-ACT User Manual*, Chapter 5. Where a project area includes more than one climatic region or more than one dominant soil type, EX-ACT should be run separately for each climatic region or soil type region in order to ensure that the correct emission factors are applied.

3.3.3.2 Stratify land use in the project area

Land uses in the project area that will not be affected by the project do not need to be included in the baseline scenario. Identify all land uses for which GHG effects due to project inputs, activities and outcomes have been included in the scope of GHG assessment (see Section 3.2.6). For the baseline scenario during the project implementation phase, this should include all land uses for which direct and indirect GHG effects have been included in the scope of GHG assessment (see Text Box 7 for definitions). Where the scope of GHG assessment includes consequential emissions, during the post-project phase, this should include land uses for which direct, indirect and consequential GHG effects have been identified.

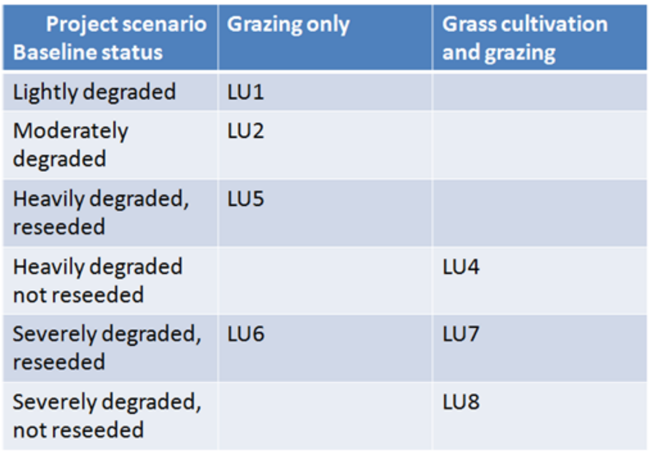
The EX-ACT tool follows IPCC guidance on categorization of land use and land use changes. For each type of land use and land use change for which GHG effects have been included in the scope of GHG assessment, data is required to estimate

- the area (in hectares) under each type of land use in the baseline; and
- management practices applied to each type of land use in baseline.

The EX-ACT tool separately represents land uses that remain the same in the baseline and in the project scenarios, and land uses that will change between the two scenarios. However, it is also possible that while land uses will not change, land management practices (e.g., agronomic practices, nutrient or water management practices) may change between the baseline and project scenarios. If these management practice changes are expected to be applied in the project scenario to all of the land in one land use stratum, then that land use stratum may be represented by only one land use category in the baseline. But if these management practices are expected to be applied in the project scenario to only part of the land in a land use stratum, then that land use stratum should be represented in the EX-ACT user interface by two (or more) separate land uses in the baseline, even though their characteristics in the baseline scenario are identical. It is thus necessary to prepare a land use change matrix (see example in Text Box 11).

Text Box 11: A land use change matrix for the Three Rivers Grassland Carbon Sequestration project

The Three Rivers Grassland Carbon Sequestration Project, developed with support of FAO, aims to restore degraded pastures in an area of more than 20,000 hectares in Qinghai Province, P.R. China. 80% of the project area is alpine meadow. These were classed on the basis of visual inspection as lightly, moderately, heavily or severely degraded. Some heavily and severely degraded plots had already been sown with grasses, and the project intends to sow much of the untreated heavily and degraded plots with grass, including some already reseeded plots that require reseeding. Based on these baseline and project scenario land uses, all lands in the project area were categorized into 8 land uses, as shown in the table below.



Project scenario Baseline status	Grazing only	Grass cultivation and grazing
Lightly degraded	LU1	
Moderately degraded	LU2	
Heavily degraded, reseeded	LU5	
Heavily degraded not reseeded		LU4
Severely degraded, reseeded	LU6	LU7
Severely degraded, not reseeded		LU8

3.3.3.3 Procuring the data required for baseline GHG estimation

The data required to quantify the baseline scenario will vary depending on the activities supported in the AFOLU project and the GHG effects included in the scope of GHG assessment, and also depending on whether a Tier 1 or Tier 2 approach is taken to assessing the GHG effects. Table 9 provides illustrations for each major type of AFOLU project activity of the specific activities, their direct GHG effects and the data requirements for representing these effects when using Tier 1 or Tier 2 approaches. The data requirements presented in Table 9 are based on IPCC guidance and will be similar for all tools based on that guidance. For further details of how to represent baseline land uses and management practices in the EX-ACT tool, please refer to the EX-ACT User Manual Chapters 6-9 and Annex 9.

As noted in Section, 3.2.1 in addition to the main direct GHG effects of AFOLU project activities (i.e., those represented in Table 9), other GHG effects may also be caused that may need to be accounted for. Two types of GHG effect that may be relevant to several AFOLU activities are leakage due to the shifting of forest use and agricultural activities and the effects of changes in forest or agricultural management on rural energy sources. Forest protection or afforestation may shift prior land and forest use (e.g. fuel wood collection, agricultural activities) to locations outside the area targeted for protection or afforestation. Similarly, change in agricultural crops (e.g. plantation of perennials) may shift prior agricultural activities elsewhere. The impacts of these changes on carbon stocks and GHG sources in the locations to which activities are shifted can be difficult to quantify, but may be a significant source of GHG emissions attributable to project implementation. A number of tools have been developed to facilitate estimation of such leakage effects, and may be of use in estimating leakage effects from AFOLU projects.[65]

Forest protection or changes in silvicultural management may alter the availability of rural energy sources, either changing the supply of wood sources, creating demand for more efficient wood combustion methods, or leading to switches in energy source (e.g. switch to non-wood energy sources).[66] Forest management projects may explicitly promote such changes (e.g. adoption of fuel efficient stoves), but some projects may not have explicitly accounted for impacts on energy. Nevertheless, changes in GHG emissions from rural energy may be significant and it should be considered whether these GHG effects are within the scope of GHG assessment.

As described in Equation 1, quantification of the baseline scenario requires data on emission factors and activity data. The EX-ACT tool contains the IPCC default values for Tier 1 emission factors, and allows users to input Tier 2 emission factors. Project analysts should follow the general guidance in Section 3.1.2 for selection of Tier 2 emission factors and should transparently document the source of data and justification for the choice of emission factor (see Chapter 4 on reporting).

For activity data on the main land uses and management activities, project documentation and references therein may provide the data required to quantify the baseline scenario. This includes project appraisal documents, project proposals, project design documents, and project result frameworks, where the baseline values for project outcome indicators may be given. Where these documents do not contain data on required parameters, data may also be obtained from statistical reports by national or sub-national agencies, forest or land use inventories, peer reviewed scientific literature or other research studies. Project analysts should follow the general guidance in Section 3.1.2 for selection or generation of activity data. Data sources should be documented and, where necessary, it should be justified that the data values selected give a conservative estimate of baseline emissions.

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[65] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf, https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-09-v2.pdf .

[66] REDD-net (2011) REDD+ and energy: a cross-sectoral approach to REDD+ and implications for the poor.

Table 9: Common direct GHG effects of AFOLU projects and Tier 1 and Tier 2 data requirements

AFOLU project activity type	**Illustrative project activities and results**	**Main pathway for direct GHG**	**Main direct GHG effects**	**Input data required for GHG assessment***	
				Tier 1	**Tier 2**
Forestry and land use change					
Reducing deforestation	· Support local institutions for community forest management (e.g. forest user groups); · Strengthen value chains for non-timber forest products; · Decrease incentives for shifting cultivation or illegal timber harvesting; ·Strengthen *enforcement by forest rangers and wardens	Area affected by deforestation	Above- and below-ground biomass carbon stocks; soil carbon stocks; CH_4 and N_2O emissions from biomass burning	Forest area affected by deforestation (ha)	Above-ground biomass carbon stocks before and after deforestation (t C/ha)
				Remaining forest area (ha)	Below-ground biomass carbon stocks before and after deforestation (t C/ha)
				Forest type (IPCC forest category)	Soil carbon stocks before and after deforestation (t C/ha)
				Type of subsequent land use (IPCC LU category)	Litter and dead wood carbon stocks before and after deforestation (t C/ha)
				Fire use for land conversion?	Quantity of wood affected by burning (t dry matter/ha)
Afforestation	· Support community watershed management plans; ·Support private and/or communal afforestation on degraded lands; · Support forest tree nursery enterprises; · Improve land tenure rights to provide incentives for long-term investment	Area affected by afforestation	Above- and below-ground biomass carbon stocks; soil carbon stocks; CH_4 and N_2O emissions from biomass burning	Area affected by afforestation (ha)	Above-ground growth rate of biomass carbon stocks (t C/ha yr)
				Previous land use type (IPCC LU category)	Below-ground growth rate of biomass carbon stocks (t C/ha yr)
				Type of planted forest (IPCC forest/plantation category)	Soil carbon stocks before and after afforestation (t C/ha)
					Litter and dead wood carbon stocks before and after afforestation (t C/ha)
Forest management	· Forest management planning · Strengthening forest enterprise management · Change in timber harvest rotations · capacity building in improved silvicultural management	Area under improved forest management	Above- and below-ground biomass carbon stocks; soil carbon stocks; CH_4 and N_2O emissions from biomass burning	Forest area affected by changes in management (ha)	Above-ground growth rate of biomass carbon stocks (t C/ha yr)
				Forest type (IPCC forest category)	Below-ground growth rate of biomass carbon stocks (t C/ha yr)
				% of biomass lost through degradation or gained with improved management	Soil carbon stocks before and after improved management (t C/ha)
				fire occurrence and % of biomass affected by burning	Litter / dead wood carbon stocks before and after improved management (t C/ha)
					Volume of wood affected by burning (t dry matter/ha)
Other Land Use Change	·Improve land tenure rights to provide incentives for long-term investments;		Above- and below-ground biomass carbon stocks;	Area concerned by Other Land Use Change (ha)	Biomass carbon stocks of initial and final land use (t C/ha)

AFOLU project activity type	Illustrative project activities and results	Main pathway for direct GHG	Main direct GHG effects	Input data required for GHG assessment*	
				Tier 1	Tier 2
	· Land rehabilitation activities; ·Support agroforestry tree nursery enterprises	Area affected by non-forest land use change	soil carbon stocks; CH4 and N2O emissions from biomass burning	Previous land use type (IPCC LU category)	Soil carbon stocks of initial and final land use (t C/ha)
				Final land use type (IPCC LU category)	N2O emissions following N mineralisation from soil organic matter
				Fire use for land conversion?	Quantity of biomass affected by burning (t dry matter/ha)
Perennial crops and agroforestry					
Perennial crops and agroforestry	· Farmer training on agroforestry and perennial tree crops; · R&D on locally adapted agroforestry species; · Financial support for planting agroforestry species ·Support agroforestry nursery enterpr.	Area affected by tree crop establishment	Above- and below-ground biomass carbon stocks; soil carbon stocks	Agroforestry area concerned by changed management (ha)	Above-ground growth rate of biomass carbon stocks (t C/ha yr)
				Type of tree species concerned	Below-ground growth rate of biomass carbon stocks (t C/ha yr)
				Tree density per hectare	Soil carbon sequestration or loss rate (t C/ha yr)
Annual Cropland Management					
Management of synthetic nutrient inputs	·Farmer training on nutrient management; ·Support soil testing for fertilizer recommendations; · Increased access to fertilizer products; · Fertilizer subsidy schemes	Change in types and quantities of synthetic fertilizers used	Soil carbon stocks Direct field N_2O emissions from N use; indirect N_2O emissions from ammonia, nitrogen leaching /runoff; CO_2 emissions from prodn, transport and application	Area under improved management (ha) Quantity of active fertilizer contents (kg/ha) Type of fertilizer placement practice (tool specific category)	Soil carbon sequestration or loss rate (t C/ha yr) N_2O emission factors ($N\text{-}N_2O/N$) for direct and indirect N_2O emissions; CO_2 emission factor for production, transport and application (tCO_2/t)
Management of organic nutrient inputs	·Improve the availability and utilization of organic matter; ·Protect crop residues from burning and grazing; · Promotion of composting techniques	Change in type and quantity of organic nutrient inputs (crop residues, compost, legumes)	Soil Carbon stocks Direct field N_2O emissions from N application; Indirect N_2O emissions from volatilization of ammonia, nitrogen leaching and runoff;	Area under improved management (ha) Nutrient quantities applied through organic inputs (kg/ha) Area and croptype affected by crop residue burning (ha)	Soil carbon sequestration or loss rate (t C/ha yr) N_2O emission factors ($N\text{-}N_2O/N$) for direct and indirect N_2O emissions Quantity of crop residue affected by crop residue burning (t dry matter/ha)
Pesticide Use	· Farmer training on Integrated Pest Management; · Expansion of pesticide retail networks; · Training on safe pesticide handling, application and disposal	Change in type and quantity of synthetic pesticides	CO_2 emissions from production, transport and application	Quantity of active pesticide substances (l/ha)	Quantity of active pesticide substances (l/ha) CO_2 emission factor for production, transport and application (tCO_2/t)

AFOLU project activity type	**Illustrative project activities and results**	**Main pathway for direct GHG**	**Main direct GHG effects**	**Input data required for GHG assessment***	
				Tier 1	**Tier 2**
Flooded Rice Management	·Rehabilitate irrigation infrastructure; ·Strengthening water user groups; ·Training in alternative wetting and drying techniques	Area affected by improved flooded rice management	CH_4 emissions from flooded rice fields; Soil carbon stocks	Area concerned by flooded rice systems (ha)	CH_4 emission factor during pre-season (kg CH_4/ha day)
				Duration of flooding days per crop cycle	CH_4 emission factor during growing season (kg CH_4/ha day)
				Pre-season water mgt practices (IPCC category)	CH_4 emission factor from flooded organic amendments (kg CH_4/ha day)
				In-season water mgt practices (IPCC category)	Quantity of biomass affected by burning (t dry matter/ha)
				Type of management practice of rice straw.	Soil carbon sequestration or loss rate (t C/ha yr)
Agricultural mechanization	·Support to commercial providers of agricultural machinery; ·Support the installation of irrigation infrastructure; ·Improve the efficiency of energy consumption devices	Change in type and quantity of utilized energy carriers	Direct CO_2, N_2O and CH_4 emissions from energy combustion	Type of energy carrier (IPCC category) Quantity of energy carrier consumed (mass or volume)	Emission factor for respective energy carrier (t CO_2-e/mass or volume)
Grassland & livestock management					
Grassland management	·Support community pasture management institutions; ·Promote grassland improvement (e.g. reseeding); ·Support to the adoption of fodder crops as supplementary feed source	Area under improved grassland management	Soil carbon stocks Above ground biomass carbon pools	Area under improved grassland management (ha)	Soil carbon stock before and after degradation/rehabilitation
				Type of improved grassland management (tool specific)	Above ground biomass available for grassland burning (t dry matter/ha)
				Periodicity of grassland fires	
				Percentage of biomass burned through grassland fires	
Livestock management	·Train livestock keepers on improved fodder cultivation, storage and treatment; · Improve local service provision on veterinary health services and breeding	Livestock numbers; livestock feeding and health practices; manure management practices	CH_4 emissions from enteric fermentation; N_2O and CH_4 emissions from manure management; direct and indirect N_2O emissions from manure deposition	Evolution of livestock herd size (number by animal type)	Methane emission rate from enteric fermentation (kg CH_4 per head/yr)
				Livestock weight at maturity/at slaughtering (kg/head)	Nitrous oxide emission rate from manure management (kg N-N_2O/N of manure)
				Time period to reach maturity/slaughtering weight	Methane emission rate from manure management (kg CH_4 per head head/yr)

AFOLU project activity type	**Illustrative project activities and results**	**Main pathway for direct GHG**	**Main direct GHG effects**	**Input data required for GHG assessment***	
				Tier 1	**Tier 2**
				Average age at slaughtering	Nitrous oxide emission rate from manure deposition (kg $N-N_2O/N$)
				Average daily gross energy intake (MJ per animal per day)	
				Feed digestibility (%) or type of feed (tool specific)	
Agribusiness development					
Agribusiness development	· Improving market linkages; · Support to processing enterprises; · Energy efficiency in agri-food product processing	Change in type and quantity of utilized energy carriers	Direct CO_2, N_2O and CH_4 emissions from energy combustion	Type of energy carrier (IPCC category)	Emission factor for respective energy carrier (t CO2-e/mass or volume)
				Quantity of energy carrier consumed (mass or volume)	
Organic soils management					
Organic soils management	·Promote the protection of coastal wetlands and mangrove forests; ·Provide capacity support to conservation programmes; ·Provide access to alternative livelihood activities for rural population in conservation area	Area affected by management of organic soils	CO_2, N_2O and CH_4 emissions from management of organic soils	Area of organic soils concerned (ha)	CO_2, N_2O and CH_4 emission factors from specific practice
				Type of vegetation with organic soils concerned (IPCC category)	
				Type of mgt practice: a) drainage, b) rewetting, c) burning, d) peat extraction	
Fisheries and aquaculture					
Fisheries and aquaculture	·Support to community-based or commercial fishing fleets; · Protection of fishing zones; ·Improvements in energy efficiency of boats and equipment	Change in type and quantity of utilized energy carriers	Direct CO_2, N_2O and CH_4 emissions from energy combustion	Type of energy carrier (IPCC category) Quantity of energy carrier consumed (mass or volume)	Emission factor for respective energy carrier (t CO2-e/mass or volume)

*Notes: *Tier 1 data is also required when Tier 2 approach is adopted.*

3.3.4 Baseline scenario outputs

The output required from estimation for each land use and AFOLU management activity of the baseline is an estimate of net GHG emissions in the baseline scenario, i.e., emissions from GHG sources minus GHG removals from carbon sinks. The estimates from each land use and AFOLU management activity can be aggregated to provide an estimate of total baseline net GHG emissions.

When using the EX-ACT tool, the 'results' module provides the results of baseline scenario estimation. Estimates are given of:

- the net emissions from all land uses and management activities in the baseline scenario (i.e., gross GHG emissions minus gross carbon sequestration).
- the net emissions from each land use and management activity in the baseline scenario; and
- the net emissions from the main land use categories in the baseline scenario.

In the EX-ACT tool, net emissions are referred to as 'gross fluxes', with positive values representing a net GHG source and negative values representing a net GHG sink.

3.4 Ex ante estimation of project GHG emissions & emission reductions

Key points:

• General guidance is provided on representing a project scenario on the basis of project documentation.

• Guidance on selection of data sources for emission factors and activity data in the project scenario is presented.

• The main procedures for representing land use and management activities in the project scenario using the EX-ACT tool are described.

• The main outputs of project scenario estimation using EX-ACT, including an estimate of project emission reductions, are described.

3.4.1 Guidance on ex ante elaboration of the project scenario

Whereas the baseline scenario is a hypothetical counterfactual, in ex ante estimation the project scenario represents the intended inputs, activities and outcomes of the project. The estimate of project scenario emissions is the GHG emissions most likely to occur if the project is implemented as intended. Where project analysts determine that the effects of the whole project are within the scope of GHG assessment, the project scenario is characterized by data describing the planned implementation of the whole project. Where users require quantification of the incremental benefits of part-finance to a project, the project scenario represents only the activities supported by part-finance, while other project activities should be represented in the baseline scenario. Where users determine that consequential emissions in the post-project period are included in the scope of GHG assessment, these should be estimated separately from direct and indirect emissions during the project implementation period.

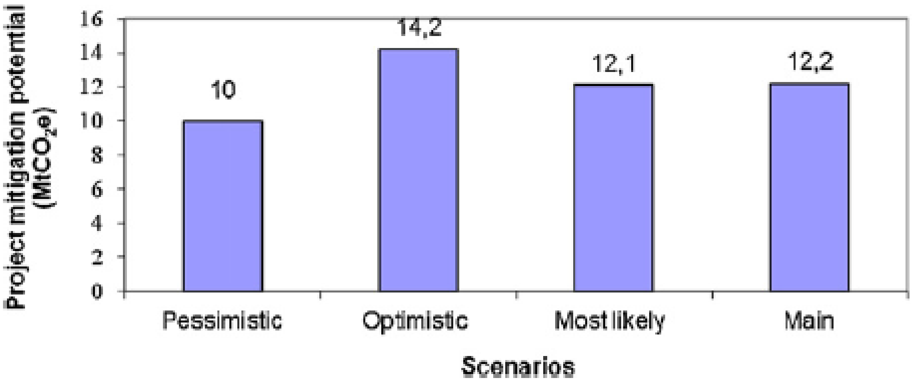
The project scenario should be described for all GHG sinks and sources that are expected to be affected by project inputs, activities and outcomes and that are included in the scope of the GHG assessment (see Section 3.2). As with the baseline scenario, in the EX-ACT tool these sinks and sources are represented in the project scenario as land use change, land use and management practices, livestock and manure management practices, and agricultural, energy and infrastructure inputs. In ex ante estimation, the project scenario is elaborated using assumptions that are consistent with the project design.

Where required data are not provided in project documentation, consultation with relevant experts and stakeholders can help ensure that assumptions underlying the project scenario are reasonable. Sensitivity analysis can also be applied to test the sensitivity of the project scenario emission and resulting estimates of GHG mitigation benefits to alternative assumptions regarding adoption rates or other risk factors identified in the project documentation. This may aid in the identification of a conservative estimate of project GHG emissions and emission reductions, and may result in presentation of a range of possible GHG effects of the project based on alternative likely project scenarios, rather than presentation of a single result (Text Box 12).

Text Box 12: Sensitivity analysis applied to adoption rates in the Santa Catarina Rural Competitiveness project

The Santa Catarina Rural Competitiveness Project, financed by the World Bank, aims to increase the competitiveness of Family Agriculture Producer Organizations in Santa Catarina State in northern Brazil. It has 3 main components: (1) Family agriculture competitiveness and increased access to markets, (2) Complementary public investments for rural competitiveness, and (3) support to the rural competitiveness institutional framework. Taking the example of component 1, the project activities will include "pre-investment activities" to provide technical training and support business proposal development by FAPOs, and "productive investments" to support implementation of business plans, including improvements in farming systems, such as agroforestry, improved grassland and cropland management and livestock production.

Ex ante GHG assessment produced three scenarios with different assumptions regarding the adoption of changes in land management practices. The main scenario was based on targets in the project documentation, and assumed a linear change in adoption of improved land management practices from the project start date to the project end date. A "pessimistic" scenario assumed a 30% decrease in the cropland area under improved management; a 50% reduction in the grassland area under improved management; a reduction in the percentage of livestock population under improved feed and breed management, and a 20% increase in fuel consumption in the "pre-investment activities". The "optimistic scenario" assumed faster than planned adoption rates following an exponential function and a lower value for fuel and energy consumption in the transport, storage and delivery of agrochemicals. An average of the optimistic and pessimistic scenarios was assumed to be the "most likely" scenario. Results are shown in Figure 12a.



Source: Branca et al. (2013) Capturing synergies between rural development and agricultural mitigation in Brazil. Land Use Policy 30: 507-518

3.4.2 Representing the project scenario

3.4.2.1 Stratification of land use in the project area

Since the EX-ACT tool separately represents land uses that remain the same in the baseline and project scenarios and land uses that change between the two scenarios, the stratification of land uses in the baseline should be the same as the stratification of land uses in the project scenario (see Section 3.3.2.2). However, management practices applied to each land use stratum may differ between the baseline and project scenarios. As noted in Section 3.3.2.2, land use strata to which different management practices will be applied in the project scenario should be represented as distinct land uses in the EX-ACT user interface.

For each type of land use and land use change for which GHG effects have been included in the scope of GHG assessment, Table 9 indicates the data requirements for representing these effects when using Tier 1 or Tier 2 approaches. When using the EX-ACT tool, data should be input following the technical instructions in the EX-ACT User Manual Chapters 6-9 and Annex 9, and an option for the dynamic of change in the project scenario selected (see Text Box 10).

3.4.2.2 Data sources for ex ante estimation of the project scenario

As described in Equation 1, quantification of the project scenario requires data on emission factors and activity data. The EX-ACT tool contains the IPCC default values for Tier 1 emission factors, and allows users to input Tier 2 emission factors. Emission factors applied in the project scenario may differ from those applied in the baseline scenario. Project analysts should follow the general guidance in Section 3.1.2 for selection of Tier 2 emission factors and should transparently document the source of data and justification for the choice of emission factor (see Chapter 4 on reporting).

For activity data on the main land uses and management activities in the project scenario, project documentation should provide the main source of data. This includes project appraisal documents, project proposals, project design documents, and project result frameworks, where the values for project outcome indicators will be given. Where these documents do not contain data on required parameters, data may also be obtained from reports of similar projects, peer reviewed scientific literature or other research studies, or through consultation with experts and stakeholders. Project analysts should follow the general guidance in Section 3.1.2 for selection or generation of activity data in the project scenario. Data sources should be documented and, where necessary, it should be justified that the data values selected give a conservative estimate of project GHG emissions.

3.4.3 Project scenario outputs and ex ante estimate of emission reductions

The output required from estimation for each land use and AFOLU management activity of the project scenario is an estimate of net GHG emissions in the project scenario, i.e., emissions from GHG sources minus GHG removals from carbon sinks. The estimates from each land use and AFOLU management activity can be aggregated to provide an estimate of total project net GHG emissions. If a given GHG effect accounts for less than 1% of total emission reductions, then it may be excluded from analysis and reporting. This is most relevant to situations where the ex ante assessment is used as a reference for the design of project monitoring and ex post GHG assessment activities. If ex ante assessment identifies a minor source, then it may be justifiable not to include that source in project monitoring and ex post GHG assessment.

When using EX-ACT, the 'results' module provides the results of project scenario estimation. Estimates are given of:

- the net emissions from all land uses and management activities in the project scenario (i.e., gross GHG emissions minus gross carbon sequestration).
- the net emissions from each land use and management activity in the project scenario; and
- the net emissions from the main land use categories in the project scenario.

In the EX-ACT tool, net emissions are referred to as 'gross fluxes', with positive values representing a net GHG source and negative values representing a net GHG sink.

The results module also automatically calculates project emission reductions as baseline net emissions minus project net emissions (see Equation 2). In the EX-ACT tool, this is referred to as the project carbon 'balance', where a net reduction in GHG emissions is represented by a negative value.

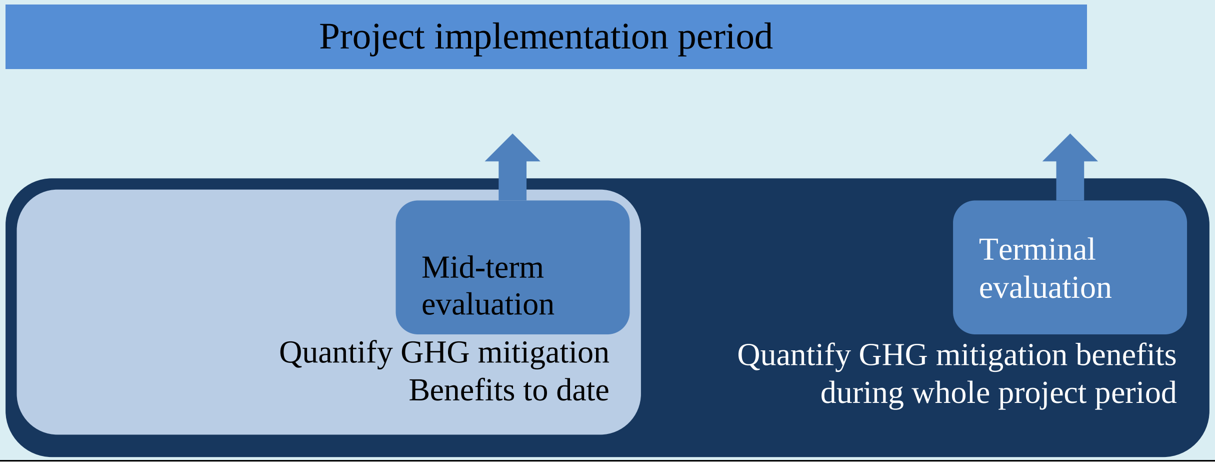
In general, projects are required to report the absolute value of project scenario net GHG emissions[67] as well as net emission reductions, both of which are reported in the 'results' module of EX-ACT.

3.5 Including indicators required for ex post GHG estimation in a project M&E system

Key points:
- This section provides guidance on ex post estimation of project GHG effects.
- Guidance is provided on planning M&E activities for ex post GHG estimation, screening of existing project M&E plans for their utility in GHG estimation, and data sources for ex post GHG estimation where GHG quantification has not been considered in project M&E plans.
- Guidance is provided on representing ex post data in the EX-ACT tool, highlighting aspects that may differ from the use of that tool for ex ante assessment.

The approach presented in this guidance document suggests that ex post estimation of the GHG effects of project activities should be accomplished on the basis of data from project monitoring and evaluation activities. Unlike carbon market monitoring and quantification methodologies, which typically focus on regular collection of monitoring data and annual reporting of GHG mitigation benefits, the approach here focuses on ex post estimation of project GHG effects at the project mid-term and terminal evaluation stages (see Figure 7). Ex post estimates elaborated at these points in the project cycle may include estimates of annual GHG mitigation benefits to date as well as mitigation benefits throughout the whole period assessed. Assessment at these key points in the project cycle and deriving data from project M&E systems are likely to provide a relatively low cost approach to GHG quantification.

Figure 7: Ex post GHG quantification activities in the project cycle



3.5.1 General guidance on monitoring for ex post GHG estimation

As with ex ante estimation procedures (see Section 3.4), ex post estimation of project GHG emissions will require data both on emission factors and on inputs, activities and outputs attributable to the project.

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[67] Referred to in the IFI Harmonized framework as 'gross emissions'.

Emission factors used in ex post estimation may be the same as or different from the emission factors used in ex ante estimation of the baseline and project scenarios. For determining emission factors, there are three main options:

1. Use the same emission factor as in the baseline;
2. Use an emission factor that reflects the change in practices introduced by the project; or
3. Collect data to quantify emission factors.

In general, projects are not expected to invest funds in direct measurement of carbon stocks or GHG emissions, and guidance on the choice of emission factors in Section 3.1.2 is also relevant to the use of emission factors in ex post GHG estimation. In particular, if different emission factors are used compared to the ex ante assessment or compared to the baseline scenario, it should be justified that these result in a conservative estimate of project emission reductions.

For activity data, there will be many overlaps between the considerations relevant to project M&E and to project GHG quantification, because both processes are concerned with relating project inputs and activities to outcomes and their impacts. However, from the particular perspective of GHG quantification, the following general issues should be considered.

- **Accounting for direct, indirect and consequential GHG effects:** Direct and indirect emissions are defined in Text Box 7. Sources of direct emissions that ex ante assessment identified as significant (i.e., >1% of the absolute change in emissions due to the project), and indirect emissions from energy use should be accounted for. Direct emissions will most often be emissions due to the use of land users directly participating in the project. Where ex ante estimation identified significant indirect emissions or consequential emissions during the project period (e.g., due to adoption of project practices by entities not participating in the project, or changes in activities of suppliers or processors linked to project participants), these should also be accounted for insofar as is practical.
- **Monitoring and updating the baseline:** Ex ante estimation describes a baseline scenario which is a hypothetical counterfactual. The most credible approach to ex post estimation of project GHG effects would involve ex post monitoring and estimation of parameters reflecting key assumptions in the baseline scenario, since this can generate evidence to test assumptions made in ex ante assessment and to update the baseline. Where deemed necessary, project M&E plans should include activities to enable the baseline scenario to be validated or updated when GHG effects are quantified at mid-term or terminal evaluation stages. In practice, this is similar to the need in some projects to demonstrate project impacts by comparing the outcomes for project participants with a control group (Text Box 13).

Text Box 13: Use of control groups in project evaluation

The comparison between project and ‘control’ groups is increasingly common in project impact evaluation. If the initial characteristics of the two groups are the same, then the difference between the outcome in the project group and control group may be considered a valid representation of project effects. However, if the initial characteristics are not the same, then the estimate of project effects will be biased. Regression analysis can be used to control for the factors affecting the difference between groups in change over time and the change in the difference between project and control groups. This requires that data on factors influencing the project outcomes is also collected.

Source: IEG (2006) Impact evaluation: the experience of the Independent Evaluation Group of the World Bank

- **Generating data for GHG estimation through monitoring or evaluation activities:** The general expectation is that where there are overlaps between the data needs of project managers and stakeholders and the data needs for GHG quantification, data required for GHG quantification may be collected at no additional cost through the project monitoring and evaluation system. However, there may be situations in which data required for ex post GHG estimation is not also required by project managers or stakeholders. It should be considered whether data on baseline conditions, direct and indirect GHG effects (and where required, consequential effects) are best collected through regular monitoring systems, as part of mid-term and terminal evaluations or through separate data collection activities to support GHG assessment.

- **Costs of GHG estimation:** Collection of data additional to that required for other monitoring and evaluation purposes has a cost. Achieving high levels of precision in surveys can also increase the costs of GHG estimation. On the other hand, the demand for data for GHG estimation can also increase the availability of relevant knowledge in a project area, and provide opportunities for extension staff to interact more closely with project participants (Text Box 14). Where it is judged that it is too costly to collect data required to estimate GHG emissions associated with a likely project GHG effect, this should be justified and any estimates made through alternative methods should be conservative.

Text Box 14: GHG quantification built on project M&E systems can support extension work

The Kenya Agricultural Soil Carbon Project, financed by the World Bank Biocarbon Fund, supports farmers, organized into farmer groups, to adopt agroforestry and sustainable land management practices. It uses a monitoring approach that strengthens communication among farmers and between farmers and project extension staff. The basis of M&E is an Activity and Baseline Monitoring Survey. Each year, community facilitators support farmer group leaders to collect data from a sample of farmers within their groups by filling out a survey form that records details of farm operations. The data are then aggregated across farmers and input into a pre-prepared model to estimate the GHG effects of farmers' practices.

Source: Tennigkeit et al. (2013) Carbon intensification and poverty reduction in Kenya: lessons from the Kenya agricultural carbon project. Field Actions Science Reports. The journal of field actions, (Special Issue 7).

3.5.2 Planning monitoring for ex post GHG estimation

Specific data requirements will vary between projects, but in all cases the generic procedures for planning GHG estimation through M&E include defining the key performance indicators, defining the parameters for which data are required, and elaborating a monitoring plan. In the project context, data collection for GHG estimation should also be linked to data collection for other purposes, such as reporting of non-GHG effects, and for meeting the information needs of project managers and project stakeholders (see Text Box 15).

Text Box 15: Potential functions of monitoring and evaluation in AFOLU projects

In a global survey of more than 200 agriculture and M&E professionals, more than half of respondents characterized agricultural M&E as 'weak' or 'very weak', and just over a third characterized it as adequate or better. Functions of M&E that were viewed by a majority as strong were its functions in supporting practical improvements in projects, donor accountability and ensuring alignment of interventions with policy and strategy, while accountability to and empowerment of beneficiaries were typically characterized as weak. Factors seen as contributing to the weak performance of agricultural M&E included the limited capacity of implementing agencies, insufficient funding and weak incentives to invest time and resources in M&E.

Functions	Examples
Tracking progress	• Inform on the implementation status of specific actions • enable assessment of progress towards organizational targets

Ensuring accountability	• Provide management with information on activities conducted and expenditures by implementers • Provide donors with information on project implementation • Assess compliance with mitigation targets • Enhance ability of beneficiaries to make informed decisions
Supporting learning	• Identifying what is working well and what not • enhance action by providing an opportunity for expert inputs • enable comparisons between countries, sectors and projects
Knowledge production	• identify and share best practices • create and share knowledge on the impacts of interventions • increase understanding of context-specific outcomes and impacts

Source: Lindstrom (2009) What is the state of M&E in agriculture?

3.5.2.1 Define key performance indictors

Since M&E has multiple functions, it should consider both non-GHG effects and GHG effects. Since GHGs will not be directly measured, but will be estimated on the basis of proxy indicators (e.g., land use, management practices), some of the indicators to track implementation and outcomes and the data required for GHG estimation may be the same. However, the data requirements for GHG estimation using the Tier 1 or Tier 2 approaches (see Table 9) are specific to the IPCC GHG quantification approach and require that data on specific parameters is collected, which may be additional to data required for other M&E purposes.

Table 10: Types of key performance indicators with examples for AFOLU projects

Indicator type	Definition	AFOLU examples
Inputs	Resources used in implementing the project	Project finance disbursement Extension staff recruited
Activities	Activities undertaken by project implementers during the project process	Number of grants administered to agri-businesses Total grants provided to community groups Proportion of farmers receiving extension advice
Intermediate effects	Changes in the behaviour of project stakeholders and in the condition of natural resources due to project activities	Amount of forest or land under improved management Number of households adopting improved practices Number of enterprises receiving small-grant support Increase in crop yield in the project area Increase in vegetation biomass in the project area

It is recommended to start by defining the project key performance indicators (KPIs) in terms of the relevant inputs, activities, outputs, outcomes and impacts of the project, which may already be found in project documentation, such as the project logframe or project results framework (see Table 10). These indicators can then be reviewed for their suitability as proxy indicators for GHG estimation and to identify which performance indicators also meet relevant mandatory reporting requirements for non-GHG effects of the organization. Further guidance on the elaboration of performance indicators in the AFOLU context can be found in publications of international organizations.[68]

3.5.2.2 Define parameters for ex post assessment

Ex post M&E should provide data on changes in all the GHG sinks and sources identified within the scope of GHG assessment. The land uses and management activities relevant to each project, and hence the required parameters will differ. Project analysts should clearly identify all the parameters required by the project as input data into the GHG calculator used (e.g., EX-ACT) to represent changes in the related sinks and sources in the project scenario, and (where relevant) in the baseline scenario. These parameters can then be screened alongside the list of project performance indicators to identify areas of overlap between project performance indicators and parameters required for GHG estimation, and to identify additional parameters required for GHG estimation purposes from project M&E activities. In some cases, it may be pragmatic to identify proxy data from which the required parameter can be estimated (see example in Text Box 16).

Text Box 16: Examples of proxy data used to estimate parameter values for GHG estimation

Referring to the example of the fodder production output indicators in Text Box 4, the project target is to support farming households to produce an additional 48,000 tonnes of fodder through investments in community pasture management plans. Fodder production will either occur on cropland or grassland converted to fodder production, and these land uses represent the main GHG effects of the project activity. Project management systems will provide data on the number of grants to community members for fodder production. Additional data should be collected through monitoring or evaluation on the average area planted to fodder by grantees on cropland and on former grassland. The product of number of grantees and average area of each land use change by the average grantee gives an estimate of the total area of land affected by each land use change due to the project activity. Collecting at the same time data on average yields can aid in providing an indication of progress towards the project outcome indicator.

3.5.2.3 Create a monitoring plan

Data collection to support ex post GHG estimation and collection of data on other mandatorily reported non-GHG effects and project key performance indicators should be incorporated in project M&E plans. Table 11 shows a generic M&E planning matrix commonly used in international organizations. The project M&E plan should provide information on:

- indicators (and the unit of measurement);
- data collection methods or data sources (including sampling procedures, whether data is directly measured or calculated from proxy indicators or through other approaches);
- measures to ensure data quality;
- frequency of data collection;
- responsibilities; and
- resources required.

Table 11: Generic project M&E planning matrix

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[68] E.g. World Bank (2005) Monitoring and evaluation for World Bank agricultural research and extension projects: a good practice note; IFAD (2002) A Guide for Project M&E.

Results chain	Indicators to monitor	M&E data collection methods	Schedule and frequency	Responsible	Means of verification	Resources	Risks
Obtained from project plan and results framework	From results framework, including KPIs and GHG parameters	How is data to be obtained?	Frequency of data collection for monitoring; timing of data collection for evaluation events	Who is responsible to organize data collection, verifying data quality and sources?	Source where the data can be obtained	Estimate resources required	Risks for carrying out the planned M&E activities

Source: Adapted from UNDP M&E handbook

When preparing the M&E plan, users should consider how the principles for GHG quantification (see Section 3.1.1) are reflected in the monitoring plan. Text Box 17 gives some guidance on implementing these principles in monitoring activities.

Text Box 17: Implementing GHG quantification principles in monitoring activities

Relevance: The levels of accuracy and uncertainty associated with monitoring methods should reflect the intended use of the data and the objectives of the GHG project; some intended uses may require more accuracy than others.
Completeness: All primary effects and all significant secondary effects should be monitored or estimated. All monitoring methods and data collection procedures should be fully documented.
Consistency: Methods used to monitor, check, and store data should be consistent over time to ensure comparability and verifiability.
Transparency: All monitoring methods, calculations, and associated uncertainties should be explained. Monitoring must be sufficient to allow the transparent quantification of GHG reductions.
Accuracy: Measurements, estimates, and calculations should be unbiased, and uncertainties reduced as far as practical. Calculations and measurements should be conducted in a manner that minimizes uncertainty.
Conservativeness: Where there are uncertainties in monitored data, the values used to quantify GHG reductions should err on the side of underestimating GHG reductions.

Source: WRI and WBCSD (2005) GHG Project Accounting Protocol, p.75

3.5.2.3 Ensuring data quality

Good practice in both GHG quantification and project M&E requires that measures are put in place to ensure data quality. The reliability of data collected can be ensured by following good practice in sampling, survey design and survey implementation methods.[69] In addition, quality management systems and procedures should be in place to provide quality assurance and quality control in order to ensure the credibility of data and subsequent estimations of project effects. This applies both to GHG estimation and management of other M&E data and processes. General guidance on quality assurance and quality control for GHG data is available in a number of sources,[70] and for monitoring

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[69] See e.g. https://cdm.unfccc.int/filestorage/c/f/79VT3SIRXECDLGO8YNB01HJZMUF6K4.pdf/eb74_repan06.pdf?t=eEd8bnlsMmkxfDBZGzdardIAAf8pA-q1nnzs; http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35529432

[70] IPCC (2006) *2006 IPCC Guidelines*, Vol 1 Chapter 6; WRI and WBCSD (2005) *GHG Protocol for Project Accounting*.

and evaluation by organizational policies and general guidance provided by a number of international groups working on evaluation.[71]

Text Box 18: Quality assurance and quality control defined

Quality control (QC) is a system of routine technical activities to control the quality of data used to make GHG emission estimates. This is done by routinely checking the correctness and completeness of data, identifying and addressing errors or omissions and to document and record QC activities.
Quality assurance (QA) involves a planned system of review procedures conducted by staff, consultants or peer reviewers, to verify that data quality procedures were followed and quality criteria are met.

Source: http://www.ipcc-nggip.iges.or.jp/public/gp/english/8_QA-QC.pdf

The purpose of quality assurance and quality control (QA/QC, see Text Box 18 for definitions) is to ensure that data and data management processes used in GHG estimation conforms to the principles for good GHG quantification (see Section 3.1.1). The main elements of a QA/QC system include the following.[72]

- Clear allocation of responsibilities for QA/QC activities: Responsibilities for QA/QC should be allocated to staff of the organization with similar responsibilities in respect of monitoring and evaluation activities who have an overview of the process of data management from M&E planning, data collection, documentation, data checking, data storage, and reporting to users for analysis.
- A QA/QC plan: The QA/QC plan is an internal document to organise, plan, and implement QA/QC activities. The plan should outline QA/QC activities to be implemented and a schedule for their implementation through to the reporting of final ex post GHG mitigation benefits.
- General QC procedures: Examples of the focus of QC procedures are given in Table 13. There should be written guidance for the conduct of QC activities, and compliance with QA/QC procedures should be checked, with a focus on data and processes with the largest impact on estimates of GHG mitigation benefits.
- QA review procedures: The conduct of QA reviews (e.g., by staff, consultants or peer reviewers) procedures should be integrated with organizational processes for reviews of monitoring and evaluation data.
- Documentation archiving and reporting procedures: All the data required to produce a final GHG mitigation benefit estimate should be documented and archived, including the assumptions used, data sources for emission factors and activity data and any justifications documented. Good documentation and archiving will facilitate updating of emission reduction estimates at different stages of the project cycle. It is also good practice to record when QA/QC activities were performed and any corrections that were made as a result of QA/QC activities.

Table 12: Examples of data quality control procedures

QA activity	Procedures

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[71] http://www.fao.org/docrep/013/am292e/am292e00.pdf; http://siteresources.worldbank.org/INTARD/Resources/ARD_DP20.pdf

[72] http://www.ipcc-nggip.iges.or.jp/public/gp/english/8_QA-QC.pdf

Check that assumptions for selection of emission factors and activity data are documented	Cross-check descriptions of data
Check for transcription errors in data input	Cross-check a sample of input data for major GHG sinks or sources
Check for calculation errors	Cross-check data calculations
Check for errors in data units and conversion factors	Check that data units are correctly labelled in spreadsheets and that conversion factors are appropriately applied
Check the consistency of data between sources	Cross-check data input in spreadsheets with referenced sources
Check conservativeness of values chosen	Check that documentation justifies the conservativeness of chosen values for Tier 2 emission factors and activity data
Undertake completeness checks	Confirm that all GHG effects and represented in the spreadsheet. Check that known data gaps are documented.

Source: http://www.ipcc-nggip.iges.or.jp/public/gp/english/8_QA-QC.pdf

3.5.3 Screening existing M&E systems for GHG quantification potential

In some situations, a project M&E plan will already have been produced considering project managers' and stakeholders' information needs, but not considering the data required for GHG estimation. This section provides general guidance on how to assess whether a project M&E plan contains activities that will produce data required for GHG estimation.

(1) **Identify the GHG effects of the project that are included in the scope of the GHG assessment:** This can be accomplished following procedures described in Section 3.2.1. These GHG effects may relate to inputs, activities or outcomes of the project.

(2) **Assess whether the project M&E plan contains indicators related to the identified GHG effects:** Compare the list of project performance indicators with the list of GHG effects to identify performance indicators that relate to the listed GHG effects.

(3) **Assess whether the performance indicators are sufficient to represent proxy indicators of GHG effects:** There may be direct overlap between some performance indicators and data required to estimate GHG emissions (e.g., "hectares of forest protected from deforestation"). In other cases, some identified performance indicators may relate to GHG effects, but the precise indicator and parameters to be measured may not be suitable to serve as a proxy indicator of GHG effects. Proposed data parameters may require transformation before the GHG effects can be adequately represented. For example, "number of households adopting nutrient management practices" will not on its own provide data on the total area on which these practices are adopted, unless data is also collected on the average land area to which each household applies these practices.

(4) Identify GHG effects for which there is no related performance indicator in the M&E plan.

The results of assessment can be summarized and the implications for revising or supplementing the project M&E plan can quickly be drawn (see Table 13). Where column two of the table indicates there is no relevant KPI, then additional data collection will be required. Where column 3 indicates that a KPI is insufficient to represent a proxy indicator of GHG effects, columns 4 and 5 can indicate whether other data in the M&E plan can be used to transform the KPI to a more suitable form, or whether additional data collection would be required in order to accomplish the data transformation.

Table 13: Tabular format for summary of assessment of existing project M&E plan

GHG effects	Is there a relevant KPI?	Is the KPI sufficient to represent a proxy for GHG effects?	Can the KPI be easily transformed to represent a proxy for GHG effects using other data in the M&E plan?	Is supplementary data required to transform the KPI to represent a proxy for GHG effects?
GHG effect 1				
GHG effect 2				
GHG effect 3				
…				

3.6 Ex post estimation of GHG emissions and emission reductions

3.6.1 Data sources for ex post GHG estimation

The sources of data for ex post GHG estimation should be documented in the project M&E plan. Where ex post GHG estimation is applied to projects that had not previously planned data collection for GHG quantification purposes, the following guidance applies.

Guidance on the use of emission factors is the same as for ex ante estimation of the baseline and project scenarios (see Sections 3.1.2, 3.3.3 and 3.4.2). For activity data on the main land uses and management activities in the ex post baseline scenario, these may be the same as for ex ante assessment, and will generally derive from project documentation, including project appraisal documents, project proposals, project design documents, and project result frameworks, but may also be supplemented by ex post baseline data collected through the project monitoring system (e.g., if evaluation activities collected data on control groups) or from peer reviewed scientific literature or other research studies conducted since the project began.

Activity data on the main land uses and management activities in the ex post project scenario will mainly derive from project monitoring data and reporting templates, progress reports and other data from the project management system, and project evaluation reports, or from peer reviewed scientific literature or other research studies conducted since the project began. Where data is not provided by these sources, expert judgement may be used to produce conservative estimates through consultation with experts and stakeholders.
As with ex ante estimation, the methods, assumptions and data sources used to estimate project scenario GHG emissions should be clearly recorded in a way that allows a complete and transparent estimation of GHG emissions and emission reductions (see Chapter 4 on reporting).

3.6.2 Representing ex post data in EX-ACT

The specific procedures for representing ex post data in EX-ACT are the same as were previously described for ex ante representation of the baseline and project scenarios (see Section 3.3.3 and Section 3.4.2). However, some procedures differ from ex ante assessment for a project.

Firstly, the time period for the assessment should be revised in the project description module to reflect the time period between project initiation and the date of the ex post GHG assessment.

Secondly, if key assumptions underlying the baseline scenario were monitored during project implementation, the baseline scenario may need to be updated on the basis of ex post baseline data.
Thirdly, care should be taken regarding the stratification of land uses. In EX-ACT, categories of land to which different management practices are applied in the project scenario should be identified as separate land use in both the baseline and project scenarios. If the area of a given type of land to

which particular management practices are applied in the project is different from the assumed area in ex ante assessment (e.g., because adoption rates were higher or lower than originally planned), the area of that type of land represented in the EX-ACT user interface for the baseline should also be changed to reflect only the area to which the management practices are identified ex post as having been applied. This can be accomplished by updating the ex ante land use and land use change matrix so that baseline and project scenario land categories remain directly related (see Section 3.3.3.2).

Fourthly, the EX-ACT tool represents the dynamics of change (e.g., management practice adoption rates, changes in land use) through three alternative approaches (see Text Box 10). Ex post data on dynamics of change may show temporal patterns that do not strictly follow the assumed dynamics of change in any of these three approaches. Project analysts should ensure that the option selected to represent baseline or project scenario dynamics of change produce a conservative estimate of with-project GHG emission reductions.

In addition, mid-term evaluations or project reviews may lead to revision of the project logframe and results framework. Ex post GHG assessment subsequent to such revisions may need to consider the revised logframe, including any GHG effects not indicated by the previous logframe, and revisions to the baseline scenario for related GHG effects, where necessary.

3.6.3 Ex post estimation of project GHG emissions and emission reductions

As with ex ante estimation, the ‘results’ module in the EX-ACT tool provides the results of ex post project scenario estimation and estimates of ex post emission reductions (see Section 3.4.4). In general, projects are required to report the absolute value of project scenario emissions[73] as well as net emission reductions, both of which are reported in the ‘results’ module.

As with ex ante estimation, where consequential effects occurring outside the project boundary are accounted for, these should be reported separately from direct and indirect GHG effects occurring within the project boundary during the project implementation period. If ex post data are used to project consequential effects after the end of the project period, these should also be reported separately.

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[73] Referred to in the IFI Harmonized Framework as ‘gross emissions’

4. Reporting – Quality Management

Key points:

- Guidance is provided on the transparent reporting of GHG mitigation benefit estimations.
- The requirements of international organizations on GHG mitigation benefit reporting at organization, programme or fund level are presented.

4.1 Guidance on transparent reporting of GHG mitigation benefit estimations

The main result to be reported from each individual project is the estimate of GHG emission reductions due to project implementation. In addition, IFIs have agreed to also report the net GHG emissions (i.e., GHG emissions minus removals by carbon sinks) in the project scenario.[74] These estimates should be reported for the whole project period, and (where required) separately for the post-project period, and an estimate of annual project scenario net emissions and net emission reductions should be reported for a representative year.[75] Reports should clearly state whether the estimates reported are ex ante or ex post estimates.

GHG mitigation benefits, whether ex ante or ex post, are reported as the difference between estimated net GHG emissions in a project scenario and a baseline scenario. These two scenarios are representations and their contents, methods and data sources will be affected by organizational GHG accounting policies, subjective decisions, data availability and choices of data used in constructing the scenarios. There is no single, 'correct' estimate for GHG emission reductions. However, in order to communicate the credibility of the resulting estimates, definitions, assumptions, methodologies, and key decisions and (where necessary) their justification shall be transparently documented.[76]

The level of detail expected of methodological documentation should be sufficient to enable a third-party (e.g., colleagues within the same institution, external reviewers) to clearly understand how the resulting GHG estimates were derived and to be able to judge the extent to which the resulting estimates are relevant, complete, consistent, reliable and conservative (see Section 3.1.1).

Table 14 provides an indication of points in the estimation process where key decisions are likely to be made that should be documented and/or justified. Table 15 presents a template for reporting of specific data used in the GHG assessment.

Annex 1 of this document presents a standardized format for documentation and reporting of GHG assessments that meets the transparency requirements set out in this document.

Table 14: Key decisions affecting GHG estimation that should be documented and/or justified

Methodological step		Notes
1	The scope of GHG assessment	
1.1	Possible GHG effects of the project	It is good practice to present all possible GHG effects, including those later excluded from assessment
1.2	Are scope 1, 2 and 3 emissions included?	Clearly state which types of emissions are included or excluded

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[74] World Bank (2012) IFI Harmonized Framework. In that document, net (i.e., GHG sources minus GHG sinks) emissions are referred to as "gross emissions"

[75] IFI (2012) Harmonized Framework

[76] IFI (2012) Harmonized Framework…

1.3	Are consequential emissions included?	If consequential emissions are included, they should be reported separately from other GHG effects
1.4	Is the assessment for the whole project or for incremental finance only?	If incremental benefits are assessed, clearly state which project components are defined as part of baseline scenario and which are in the project scenario
1.5	GHG effects that were excluded due to lack of measurability, insignificance, lack of data or low likelihood	Clearly justify exclusion of any GHG effects
1.6	Geographical scope of the assessment boundary	Clearly state the geographical scope of the assessment, including any differences between the geographical scope of direct and consequential emissions and between the project period and post-project period
1.7	Time period for GHG assessment	Clearly state the time period for assessment, including the project period and post-project period (where relevant)
2	Baseline scenario	
2.1	Justification for choice of baseline scenario approach	Justify that the choice of baseline scenario approach is likely to produce a conservative estimate of emission reductions
2.2	Assumptions and data sources underlying description of baseline scenario	Explain all assumptions used in describing the baseline scenario
2.3	Data sources and values used in quantification of the baseline scenario	Describe data sources and data values, including assessment of data quality, and justification for the conservativeness of values chosen
3	Project scenario	
3.1	Assumptions and data sources underlying description of the project scenario	Explain all assumptions used in describing the project scenario
3.2	Data sources and values used in quantification of the project scenario	Describe data sources and data values, including assessment of data quality, and justification for the conservativeness of values chosen

Table 15: Template for reporting of data values used in the GHG assessment

Parameter	Data source	Assessment of data quality	Data value chosen	Justification of conservativeness
1. Baseline scenario				
Parameter 1				
Parameter 2				
Parameter 3				
…				
2. Project scenario				
Parameter 1				
Parameter 2				
Parameter 3				
…				

4.2 FAO Quality Standard: Assessing a quality level for GHG project appraisal

4.2.1 A FAO GHG quality Standard for AFOLU projects

As seen in this guidance document, there are many discriminating factors, which intervene in the final quality of the GHG appraisal process. Such factors concern (i) the quality of project documentation, (ii) the availability of quantified targets in project logframe, (iii) the country knowledge and access to information on domestic evolution trends, (iv) the availability of research work on Climate GHG impact of existing farming systems (tier 2), but also (v) the way the appraisal has been built (project border, baseline situation), (vi) the way the project objectives / targets were realistically discussed and reviewed with experts groups, (vi) the appropriate integration of main GHG emission / reduction factors, (vii) the appropriate analysis of probability of occurrence of theses GHG factors...

Such wide range of options opens a series of decisions of project designers, project formulation team or project design decision makers which drives to either privilege quick GH appraisal deskwork or to allow additional data collection and expert consultation to move to more in-depth appraisal. Such choices impact in term of quality of the GHG results and should be clearly tracked and associated to GHG results to make it transparent for future users of any GHG appraisal.

In this perspective, FAO proposes a standard of appraisal based on a series of qualitative discriminant criteria, which will allow at classifying every project appraisal in one of the following categories:

1. Below minimal request, to be reviewed
2. GHG Low standard quick desk appraisal work
3. GHG High Standard with good data base and tier 2
4. GHG Top standard with In-depth work with tier 2 and series of data control and reviews

Such standard design and the process of standard allocation are usual tasks managed by FAO in its role of norm and standard provider.Quality management will cover the following elements of the GHG appraisal process:

- First the pre appraisal phase where the experts establish a diagnosis , identifying GHG effects to consider in line with their relative importance and occurrence, decide on bordaries and on integration of indirect and consequential emissions
- The quality of project documentation and the current availability of quantified targtes in both logframe and economic analysis
- The quality of preparation of baseline scenario
- The degree of effort in data collection and data verification with partners and availability of project M-E data
- The quality of analysis in term of availability of carbon coefficients, of sensibility analysis on uncertain aspects (optimistic/ pessimistic, type of dominant soil, co-existence of two different climate zones) , of in depth of analysis (economic analysis, GHG intensity) and of assumption consultative reviewing
- The transparency and reporting which allows control and validation of results and facilitates further use of results and aggregation at national level within NAMA and NDC

4.2.2 Fact-based quality appraisal multi criteria index

Key aspects		Modalities - process of Project Carbon appraisal	0/1	*weight*
Pre-appraisal	1	Inventory of all possible GHG effects before appraisal		*1*
	2	Appropriate integration of indirect emission (inputs, energy used, consummables)		*1*
	3	Integration of consequential emissions (outside project area)		*1*
	4	Comprehensive review and selection of included emissions		*1*
	5	all consequential emissions included		*1*
Project documentation	6	Quantified logframe with activities and outputs in areas of improved practises, land use change, input and energy use		*2*
	7	Detailed economic analysis with impact assumptions available in project document		*2*
	8	Existence of baseline scenario information in project documentation		*1*
Baseline	9	The baseline assumptions were discussed and reviewed with national expert team		*1*
	10	baseline assumptions integrate either past trends or future trends		*1*
Data collection-field investigation	11	Appropriate partner consultation for data collection and documentation review		*1*
	12	Appropriate complimentary data with field investigation		*2*
	13	Appropriate consultation and use of official data sources		*1*
	14	The appraisal benefited from GPS and/ or satellite mapping to appraise project areas		*1*
Quality of Analysis	15	The appraisal benefitted from data collection of Monitoring Evaluation team (on-going project and ex –post appraisal)		*2*
	16	Effective integration of Tier 2 coefficients for main GHG effects		*2*
	17	Simulation of project scenario - sensibility analysis - appropriate analysis of uncertainty areas		*2*
	18	Consultative review of assumptions used in GHG appraisal		*1*
	19	Economic analysis		*1*
	20	Complementary analysis of GHG intensity (GHG/ ton of production)		*1*
Transparency - reporting	21	Consultative expert Peer review of GHG appraisal		*2*
	22	Appropriate reporting and files accessible to partners and on web		*1*
	23	Foreseen link with GHG national planning (NAMA, NDC)		*1*
Total weighted score		min 0 max 30	0	*30*

The sum of 0/1 questions multiplied by their weight (either 1 or 2) should provide a first indication of the degree of quality of the work. Being fact based, it should be neutral from any subjective judgment. This sum could range between 0 (no positive answer) and 30 (23 answers with 1 multiplied by own weights).

Ranges of score are proposed for every category. Below 7, the GHG appraisal should be considered below minimum standard and submitted to request for review work. From 7 to 14, the GHG appraisal is considered at a low quality standard which often fits with quick desk appraisal work. From 15 to 22 the GHG work is classified as High Standard with good database and tier 2. Over 22, the GHG appraisal is considered as a GHG Top standard In-depth work with tier 2 and series of data control and reviews. Such categorization still needs to scrutinized by an adequate consultation involving donors with the perspective of linking fund access to appropriate level of GHG quality standard.

4.3 Aggregating project GHG estimates for reporting at organization, programme or fund level

IFIs have agreed to report annually on the ex ante estimates of aggregate GHG emission reductions for screened mitigation projects estimated to arise from the previous year's approved or signed investments. Individual IFIs may also report project scenario net emissions[77], lifetime GHG emissions and other data aggregating individual project GHG emissions to sector or country level. MDBs have also agreed a set of common guidelines for reporting finance for projects or project components that directly contribute to mitigation.[78] Mitigation finance is reported by purpose (mitigation/adaptation, investment sector), funding recipient (public/private, country or region), funding instrument (e.g., grant, loan, equity, guarantees) and funding source (own resources / external resources).[79] Other funds targeting climate change mitigation may also have requirements for reporting other project effects (see Box 5 on the GEF Climate Change Mitigation Tracking Tool and Boxes 19 and 20).

These reporting requirements vary between organizations and funds. Organizational policies and requirements should therefore be followed. In general, however, the growing experience with the management of mitigation finance supports the approach of integrating reporting of GHG mitigation benefits with project M&E and project management systems.

Box 19: M&E requirements of the NAMA Facility

The NAMA Facility, established by the UK and German governments provides finance for the implementation of NAMA Support Projects (NSP). These are projects that have a catalytic role in the implementation of a NAMA objective of a developing country. Within the NAMA Facility, M&E serves two main functions: (a) promoting accountability for results, including GHG emissions, and (b) support learning and knowledge sharing as a basis for decision-making. The NAMA Facility has a system for M&E of the facility itself, and also makes M&E a mandatory component of all NSPs financed by the facility, with some elements of project-level M&E contributing to performance monitoring and evaluation of the facility itself.

The NAMA Facility was designed with a theory of change (or logframe) that specifies 6 outputs. Two of these outputs (establishment of the Facility and preparation of project pipeline) are the responsibility of the management unit. The other four outputs (leverage of finance, good practice examples, national capacities and development co-benefits) are delivered through NSPs. Therefore, at the project level, there are 5 mandatory monitoring indicators that all NSPs must monitor and report on. These mandatory indicators are:

- M1: Reduced GHG emissions

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[77] Referred to in the IFI Harmonized framework as "gross emissions".

[78] http://www.worldbank.org/content/dam/Worldbank/document/Climate/common-principles-for-climate-mitigation-finance-tracking.pdf

[79] See e.g., http://www.worldbank.org/content/dam/Worldbank/document/Climate/mdb-climate-finance-2014-joint-report-061615.pdf

- M2: Number of people directly benefitting from NSPs
- M3: Degree to which the supported activities catalyse impact beyond the NSP
- M4: Volume of public finance mobilized for low-carbon investment
- M5: Volume of private finance mobilized for low-carbon investment

Each NSP must report on these indicators, but is also required to develop its own indicators and system to monitor project specific indicators at the output and / or outcome levels in order to describe the results and effects of the project. These indicators can include indicators of implementation progress, direct outputs or outcomes attributed to project implementation, such as sustainable development benefits of the NSP. In some cases, M&E of NSPs will contribute to building national systems for MRV of low carbon development.

Sources: NAMA Facility (2015)

Text Box 20: Results framework for AFOLU projects of the Green Climate Fund

In 2014, the Board of the Green Climate Fund (GCF) approved performance measurement frameworks for supported mitigation and adaptation projects in different sectors. Some key points of the decisions are:

- In general, mitigation projects that also generate adaptation results should report on adaptation indicators, and vice-versa. Gender disaggregation should be applied for data were possible.
- Indicators of fund level mitigation impacts are: tCO_2e mitigated, cost per tCO_2e mitigated and volume of finance leveraged. Since the UNFCC decisions on REDD+ were to some extent predicated on the availability of international funding through the GCF, the GCF REDD+ performance measurement and results-based payment policies reflect the Warsaw Decisions on REDD+.[80] In this framework, REDD+ initiatives must report information on the national forest monitoring system, the national strategy or action plan, implementation of safeguards, and a reference emission level or reference level, and results in tCO_2e that have undergone technical analysis. Additional indicators may be identified on a case by case basis. Projects that intend to improve land and forest for mitigation purposes and to increase ecosystem resilience would report on both mitigation and adaptation indicators. The main mitigation indicator is “hectares of land or forest under improved and effective management that contributes to CO_2 emission reductions”.
- For adaptation projects, core fund-level performance indicators are “the total number of direct and indirect beneficiaries and the number of beneficiaries relative to the total population” and “the number and value of physical assets made more resilient to climate variability and change, considering human benefits”. The fund objective regarding improved resilience of ecosystems and ecosystem services is to be measured by the “coverage/scale of ecosystems protected and strengthened in response to climate variability and change” and “the value of ecosystem services generated or protected in response to climate change”. Depending on the particular focus of adaptation projects, project level performance indicators relate to the number of technologies or innovative solutions transferred, institutional and regulatory systems, use of climate information services and coverage by early warning systems, among others.

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[80] http://www.gcfund.org/fileadmin/00_customer/documents/Operations/GCF_B.08_45_Compendium_fin_20141206.pdf#page=88

Glossary of terms

Baseline scenario	The scenario that reasonably represents the net GHG emissions most likely to occur in the absence of the project activity.
Conservativeness	The principle that the assumptions, methods and data values used in the GHG assessment should not overestimate GHG emission reductions attributed to the project.
Consistency	The use of similar data sources and calculation methods at different periods in time so that GHG assessment results reflect real differences in emissions, not just accounting artefacts.
Gross emissions	GHG emissions from GHG sources and sinks without accounting for removals by carbon sinks. Note, this definition is different from that used in the IFI Harmonized Framework, where gross emissions refers to net GHG emissions (i.e., GHG emissions minus carbon removals).
Net GHG emissions	Total emissions of GHGs from all GHG sources minus the removal of atmospheric carbon by carbon sinks, which are separately estimated for a baseline and a project scenario.
Net GHG emission reductions	The difference between net GHG emissions in the baseline scenario and net emissions in the project scenario.
Project GHG mitigation benefits	Reductions in net GHG emissions attributable to a project (i.e., net emission reductions).
Project emissions	Additional GHG emissions directly caused by project inputs and the implementation of project activities
Project scenario	The scenario that reasonably represents the net GHG emissions most likely to occur due to implementation of the project activity
Removals	Carbon removed from the atmosphere by carbon sinks. The volume of removals is equivalent to carbon stock changes.
Transparency	Assumptions are made explicit and choices are clearly justified.

ANNEX: Standard reporting format for AFOLU project ex ante GHG assessments

1. Project Description
Project name: ____
Project ID: _________________
Implementing agency: ____
Funding agency: ____
Total project budget (USD): _______
Project duration: *Start date* _______ *End date* _______
Project location: *Country* _______ *Adm. level 2* _______
Adm. level 3 _______
Total project area (ha): _______

2. Summary of scope of GHG assessment
2.1 Duration of project period assessed in the GHG assessment: ________ years.
2.2 Were consequential effects outside the project area during the project period assessed? Yes____ No_____
2.3 Were post-project consequential effects assessed? Yes____ No_____
If yes, time period for assessment of post-project period: ________ years.
2.4 Did the assessment consider GHG effects of the whole investment or of incremental finance? Whole investment _____ Incremental finance only _____.
2.5 Methodology or GHG tool used to complete the assessment: ________________________

3. Summary GHG assessment results
3.1 GHG emissions and emission reductions *during the project period*:
Net GHG emission reductions[81] within the project area: __________ tCO_2-eq
Net GHG emission reductions due to consequential project effects during project period: __________ tCO_2-eq
Net GHG emissions[82] during the whole project period within the project area: ______ tCO_2-eq
Average annual net GHG emissions during the whole project period within the project area: _________ tCO_2-eq

3.2 GHG emissions and emission reductions during the *post-project period*:
Net GHG emission reductions[83] within the project area: __________ tCO_2-eq
Net GHG emission reductions due to consequential GHG effects during post-project period: __________ tCO_2-eq
Net GHG emissions[84] during the post-project period within the project area: ______ tCO_2-eq
Average annual net GHG emissions during the post-project period within the project area: _________ tCO_2-eq

3.3 Total GHG emission reductions attributable to the project:
Net GHG emission reductions [85] within the project area during project period: __________ tCO_2-eq
Net GHG emission reductions due to consequential project effects during project period: __________ tCO_2-eq

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[81] i.e., net GHG emissions in the baseline scenario minus net GHG emissions in the project scenario.

[82] i.e., GHG emissions minus removals by carbon sinks

[83] i.e., net GHG emissions in the baseline scenario minus net GHG emissions in the project scenario.

[84] i.e., GHG emissions minus removals by carbon sinks

[85] i.e., net GHG emissions in the baseline scenario minus net GHG emissions in the project scenario.

Net GHG emission reductions[86] within the project area during post-project period: __________ tCO_2-eq

Net GHG emission reductions due to consequential GHG effects during post-project period: __________ tCO_2-eq

Sum of net GHG emission reductions: __________ tCO_2-eq

4. Detailed summary of scope of GHG Assessment

4.1 Time period of GHG assessment

Project period considered for GHG assessment:

Start date _______ *End date* _______

Post-project period considered for GHG assessment:

Start date _______ *End date* _______ *N/A* _______

4.2 Geographical scope of GHG assessment:

Geographical scope of direct and indirect GHG effects during project period:

Total hectares: __________ ha, described as ____.

Geographical scope of consequential GHG effects during project period:

Total hectares: __________ ha, described as ____.

Geographical scope of consequential GHG effects during post-project period:

Total hectares: __________ ha, described as ____.

4.3 Did the assessment consider GHG effects of the whole investment or of incremental finance?

Whole investment _____ Incremental finance only _____.

If incremental finance only, briefly distinguish project components included in the baseline and project components included in the project scenario:

Project components included in baseline scenario:	Project components included in the project scenario:

4.4 Scope of GHG emissions assessed

Did the assessment include:	Response
(a) direct GHG emissions?[a]	Y___ N___
(b) indirect GHG emissions?[b]	Energy consumption: Y___ N___
	Energy embodied in inputs used: Y___ N___
(c) Consequential emissions during project period?[c]	Y___ N___
(d) Consequential emissions in post-project period?	Y___ N___

a: i.e. Scope 1 emissions; b: i.e. Scope 2 or scope 3 emissions; c: examples include leakage due to shifting of activities or 'positive' leakage due to replication of project practices by non-participants in the project.

4.5 GHG effects considered

List all the GHG effects considered, and justify the exclusion of any effects not subsequently quantified:

GHG effect	Included?	Justification for exclusion
1.		
2.		
3.		

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[86] i.e., net GHG emissions in the baseline scenario minus net GHG emissions in the project scenario.

4.		
5.		
6.		
(expand table if needed)		

5. Baseline scenario

5.1 Baseline scenario approach during project period

For each GHG effect quantified in the project period, explain the baseline scenario approach adopted and justify why the approach produces a conservative estimate of emission reductions:

GHG effect	Main GHG sink or source affected	Baseline scenario approach[a]	Justification for conservativeness
1.			
2.			
3.			
4.			
5.			
(expand table if needed)			

a: e.g. 'no change' scenario, extrapolation of historical trends, modelling future trends

5.2 Baseline data sources for quantification during project period

For each parameter used in quantifying the baseline scenario in the project period, briefly assess data quality and justify conservativeness of the values chosen:

Parameter	Data source	Assessment of data quality[a]	Data value chosen	Justification of conservativeness
GHG effect 1				
Parameter 1				
Parameter 2				
Parameter 3				
GHG effect 2				
Parameter 1				
Parameter 2				
Parameter 3				
…				

a: e.g. statistically representative survey, non-representative survey, remote sensing data, expert judgement, authoritative database, literature report representative of practices in the project region, literature report not fully representative of practices in the project region, etc.

5.3 Baseline scenario approach during post-project period

For each GHG effect quantified in the post-project period, explain the baseline scenario approach adopted and justify why the approach produces a conservative estimate of emission reductions:

GHG effect	Main GHG sink or source affected	Baseline scenario approach[a]	Justification for conservativeness

1.			
2.			
3.			
4.			
5.			
(expand table if needed)			

a: e.g. ‘no change’ scenario, extrapolation of historical trends, modelling future trends

5.4 Baseline data sources for quantification during post-project period

For each parameter used in quantifying the baseline scenario in the post-project period, briefly assess data quality and justify conservativeness of the values chosen:

Parameter	Data source	Assessment of data quality	Data value chosen	Justification of conservativeness
GHG effect 1				
Parameter 1				
Parameter 2				
Parameter 3				
GHG effect 2				
Parameter 1				
Parameter 2				
Parameter 3				
…				

6. Project scenario

6.1 Data sources for project scenario in project period

For each parameter used in quantifying the project scenario in the project period, briefly assess data quality and justify conservativeness of the values chosen:

Parameter	Data source	Assessment of data quality	Data value chosen	Justification of conservativeness
GHG effect 1				
Parameter 1				
Parameter 2				
Parameter 3				
GHG effect 2				
Parameter 1				
Parameter 2				
Parameter 3				
…				

6.2 Data sources for project scenario in post-project period

For each parameter used in quantifying the project scenario in the post-project period, briefly assess data quality and justify conservativeness of the values chosen:

Parameter	Data source	Assessment of data quality	Data value chosen	Justification of conservativeness
GHG effect 1				
Parameter 1				
Parameter 2				
Parameter 3				
GHG effect 2				
Parameter 1				
Parameter 2				
Parameter 3				
…				