WORKING PAPER

Standards and methods available for estimating project-level REDD+ carbon benefits

Reference guide for project developers

CIFOR

Working Paper 52

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Introduction

Aim and scope of this reference guide

The aim of this reference guide is to identify and recommend best practices and methodological guidance to project developers on how to design robust methodologies to account for the carbon benefits of project activities included under the REDD+ umbrella[1], namely:

1. reducing emissions from deforestation;
2. reducing emissions from forest degradation;
3. conservation of forest carbon stocks;
4. sustainable management of forests; and
5. enhancement of forest carbon stocks.

Although the role of early REDD+ project activities within the context of the post-2012 climate regime is still under debate, it is evident that projects applying robust carbon accounting methodologies and generating clear social and environmental benefits will have better chances of being accepted under regulated carbon markets at both international and national levels (e.g. under the UNFCCC and regional and national emissions trading schemes). Likewise, projects with such characteristics will be more likely to be successful, generate credible and long-term climate benefits and attain higher carbon prices in current and future voluntary carbon markets. Bearing this in mind, the reference guide introduces the basic guidance on the most relevant aspects of REDD+ projects provided by 3 well-established standards deemed to be the most representative of their kind:

1. the **Voluntary Carbon Standard (VCS)**, as the prototype of a methodologically robust carbon standard in the voluntary market;
2. the **Plan Vivo System**, as the model standard for socially focused, community-based forest carbon projects; and
3. the **Climate, Community and Biodiversity Project Design Standards (CCB)**, as the leading standard for the verification of social and environmental benefits (including adaptation) associated to forest carbon project activities.

The selection of the standards covered in this document responds to the idea of reaching a wide variety of potential project developers with different project sizes, resources and interests, so as to magnify the potential impact of this guide in facilitating the development of high-quality REDD+ activities. For each REDD+ project type, the guide presents the main requirements of these standards and identifies, summarises and offers references to the best practices available, as well as to validated and proposed methodologies to estimate the greenhouse gas (GHG) emissions and changes in carbon stocks, including for the development of baselines and project scenarios and for monitoring of net project results.

Finally, a summary of existing baseline and monitoring methodologies is provided, so that project designers may be able to identify and apply them or use parts of them in the development of their own methodologies.

Organisation of contents and approach

To achieve its aim, this guide first offers a summary of the main characteristics and requisites of the VCS, Plan Vivo and CCB Standards, and gives an overview of other forest carbon standards available in the voluntary carbon market, so as to provide information to project developers to enable them to decide which one—or which combination of them—may best respond to their project ideas, resources and interests. Box 1 summarises the principal criteria that project developers should take into account when selecting the standard(s) most suitable for them.

A brief description of the basic methods and best practices required for the design of robust REDD+ methodologies is then presented in Chapter 2 by introducing the elements of the 2006 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC) relevant to REDD+ projects and the guidance of the IPCC Good Practice Guidance on Land Use, Land-Use Change and Forestry (IPCC GPG-LULUCF) on project-based activities.

Chapters 3 to 10 introduce the requisites and guidance of the VCS and the Plan Vivo Standards for all the elements that should be included in a baseline and monitoring methodology (i.e. estimation of baselines, additionality, project emissions, leakage, monitoring, non-permanence, net carbon benefits and uncertainty) by REDD+ project type, point out the methodological issues associated to them and reference the best available methods and guidance to address such issues. In order to identify the REDD+ project types covered in this guide, the reader can follow the decision tree shown in Figure 1, which also signals the location in this document (chapter, section and subsection) of the guidance applicable to each specific project type. The chapters on additionality, monitoring, non-permanence, estimation of carbon benefits and uncertainty are not referenced in the figure because they are generally applicable to all project types.

It must be pointed out that the document frequently alludes to the ongoing REDD+ negotiation process under the UNFCCC and its outcomes. Although some readers may find this process disconnected from the development of methodologies and projects in the voluntary market, the authors considered it important to frame this guide around such a process (therefore the use of 'REDD+' terminology) to facilitate as much as possible the eventual integration of voluntary projects into any UNFCCC REDD+ mechanism and national initiatives that might arise from it. In this sense, it is important to note that the REDD+ categories 'conservation of forest carbon stocks' and 'enhancement of forest carbon stocks' are not included in this guide for the following reasons.

In the voluntary carbon markets the term 'conservation' has traditionally referred to activities reducing emissions from deforestation and degradation and therefore fit in the definition of REDD. However, in the context of the ongoing UNFCCC negotiations the 'conservation of carbon stocks' has a different meaning, since it has not been associated to an imminent emission of GHGs to the atmosphere due to forest degradation or loss, but to the recognition of continuous and successful national-level forest preservation efforts started in the past (for example, those carried out by India and Costa Rica) and to the generation of international incentives to ensure that such forests will remain protected in the future (e.g. from international and national displacement of emissions due to large-scale REDD implementation).

Nevertheless, it is not clear how baselines for these activities will be established, or how their carbon benefits will be estimated. Experts still have differing views on these matters—as can be noted by reading the report of the expert meeting on methodological issues relating to reference emission levels and reference levels organised by the UNFCCC Secretariat in March 2009[2]—and the Conference of the Parties is yet to adopt (or not) a political decision to define this issue. Consequently, it is not possible at this point to prescribe guidance for the development of methodologies for activities conserving forest carbon stocks that do not imply an imminent reduction in GHG emissions, and therefore they are not covered in this version of the reference guide.

Likewise, projects specifically aimed at increasing carbon stocks (as opposed to those meant to reduce emissions from deforestation and/or degradation that may also increase carbon stocks as a consequence of their activities) respond to baselines of degraded or low-stocking forests, or forests with a suboptimal management carbon-wise. Such activities are covered in the relevant chapters and sections on sustainable forest management projects of this guide, and consequently, activities enhancing forest carbon stocks are not considered as a separate project category.

It is worth mentioning that afforestation and reforestation (A/R) activities are also excluded from this reference guide, although they have been proposed by some UNFCCC Parties as potential REDD+ activities. The reasons for this exclusion are, on the one hand, that the Conference of the Parties has not decided on the inclusion of A/R as a REDD+ eligible activity, and, on the other hand, that following the definitions currently used in the forest carbon context (both in the Clean Development Mechanism (CDM) and in most of the voluntary carbon standards), A/R activities must take place in a project area that has a land use different from forest in the baseline; thus in principle it would not be possible to carry out such activities under the REDD+ umbrella (however, projects enriching forests through tree planting would fall under the category of 'sustainable forest management' of this guide).

It must be pointed out that the methods referred to in Chapters 3 to 10 of the guide come from the IPCC documents or from sources compatible with them, and represent the best practices available. Among the suggested sources are the baseline and monitoring methodologies that have been proposed

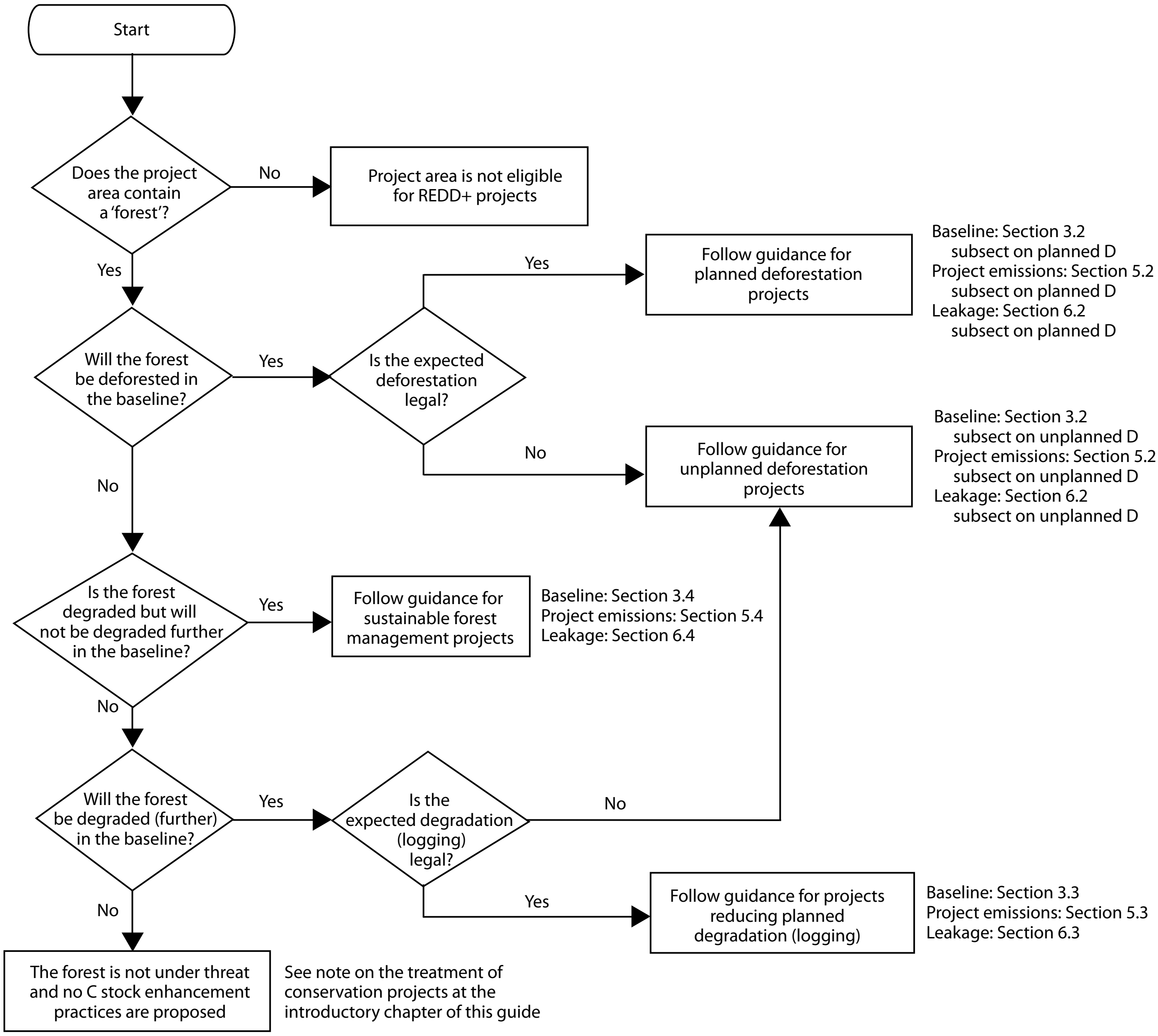


Figure 1. Decision tree to identify the REDD+ project types and locate specific guidance on each of them in this document

by project developers, as well as those that have already been approved by the relevant authorities of each standard, given their value as examples of how the provisions laid down by such standards may be translated into applicable methods. To facilitate their identification by the reader, Annex 1 summarises the VCS and Plan Vivo baseline and monitoring methodologies (approved and proposed) available at the time of writing. Nevertheless, the reader should keep in mind that proposed (i.e. not yet approved) methodologies are presented here only as potential sources of ideas, since they may significantly change as a result of the review processes required by each standard and some of them may end up not being approved by the relevant authorities. Therefore, until approved, such methodologies and their elements should be seen critically and used with reservations.

Finally, Chapter 11 describes the main features of the CCB Standards and explains how project developers may use this standard to ensure that their projects will be able to generate and verify social, biodiversity and adaptation co-benefits.

1. Introduction to the standards covered in this reference guide

1.1. Brief description of the standards covered in this reference guide

1.1.1. Rationale for the selection of the standards covered in this guide

As mentioned in the introduction, the selection of the standards included in this guide responds to the idea of reaching a wide variety of potential project developers with different project sizes, resources and interests, so as to magnify the potential impact of this guide in facilitating the development of high-quality REDD+ activities. The combination of the VCS, Plan Vivo and the CCB Standards fulfils this goal. Other important criteria for the selection of these standards relate to their quality and presence in the voluntary carbon market. As stated in the 'State of the forest carbon markets 2009: taking root and branching out'[3], produced by the Ecosystem Marketplace, the VCS, Plan Vivo and the CCB Standards currently represent significant shares of the forest carbon market, applied alone and in combination with other standards (see Figure 2), and qualify among the best forest standards available in the market according to the 'Review of forestry carbon standards' (2009) published by the Centre for Environmental Policy of the Imperial College of London[4] (see Figure 3 summarising the results of this review).

For the sake of simplicity and practicality, other methodologically robust standards currently available in the voluntary market are not covered in this version of the guide, although their methodologies and tools are referenced where relevant. Project designers are encouraged to review such standards to decide which of them are best suited to their project ideas. Section 1.3 below presents a short introduction to some of them; a more detailed review, including current and historical statistics on their performance in the carbon market, can be found in the 'State of the forest carbon markets 2009'.

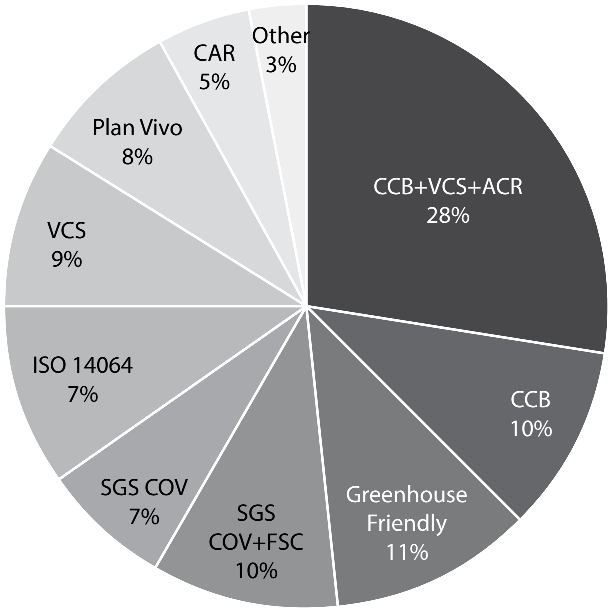


Figure 2. Historical breakdown of credits by standard in the voluntary carbon market (2002–2009)

Source: State of the forest carbon markets (2009)

1.1.2. The VCS

Efforts to develop the Voluntary Carbon Standard (http://www.v-c-s.org) were initiated by The Climate Group, the International Emissions Trading Association and the World Economic Forum in late 2005. Version 1 was released in March 2006 as a pilot standard and Version 2 emerged as a consultation document in October 2006. VCS 2007 was released in November of that year (2007) and the final rules for the VCS agriculture, forestry and other land use (AFOLU) were released and incorporated into the standard in November 2008, with the release of VCS 2007.1. VCS's AFOLU scopes cover afforestation, reforestation and revegetation (ARR), agricultural land management (ALM), improved forest management (IFM) and reducing emissions from deforestation and degradation (REDD). A new version of the standard is expected to be published in early 2011.

The VCS Program establishes different verification requirements for projects according to their size (micro projects: under 5000 tCO_2-eq per year; projects: 5000–1 000 000 tCO_2-eq per year; and mega projects: greater than 1 000 000 tCO_2-eq per year), and allows for Grouped Projects, which is similar to the CDM's programme of activities approach. Under project grouping, the project can bring together a number of similar activities into

Criteria	VCS	CCBS	Plan Vivo	Carbon fix	CCAR	CCX	ACR
AF/RF	5	5	5	5	5	5	5
REDD	5	5	5	1	5	5	5
Location	5	5	3	5	3	5	5
Additionality*	5	5	5	5	2	2	5
Methodology*	5	4	3	5	5	4	3
Permanence*	5	4	3	5	5	2	5
Leakage*	5	4	2	5	5	2	4
Co-benefits	2	5	4	5	1	1	4
Registry*	5	5	5	5	5	4	5
Transparency*	4	5	3	5	3	1	3
ICROA	5	1	1	1	1	1	1
US Market	5	3	2	2	5	5	5
Total	56	51	41	49	45	37	50
Essential Total	20	27	21	30	25	15	25

* Essential criteria

Figure 3. Summary of the results of the 'Review of forest carbon standards' published by the Centre for Environmental Policy of the Imperial College of London

Description of the criteria considered in the review

AR/RF: Checks if the standard accepts afforestation and reforestation projects.

REDD: Checks if the standard accepts REDD projects.

Location: Analyses any limitations in the location of projects.

Additionality: Looks at how projects must demonstrate additionality.

Methodology: Analyses how standards use methodologies to approve the projects. The more detailed methodologies receive the higher scores.

Permanence: Analysis of how well permanence is dealt with in the different standards.

Leakage: Examination on how well leakage is dealt with in the different standards.

Co-benefits: Assessment of co-benefits and how they are included in the standard.

Registry: Inspection of the mechanisms to reduce the possibility of double accounting; in addition an indication of where the carbon credits should be registered.

Transparency: Evaluation of how transparent a standard is by looking at the amount of information a project needs to provide publicly and if there is any public consultation as part of the process.

ICROA: Checks if the standard is accepted or not by the International Carbon Reduction Offset Alliance (ICROA). A standard that is not accepted by ICROA is deemed to produce credits that a large part of the market will not accept.

US Market: Analyses the likelihood for the standard to be widely accepted in the US market.

one Project Description, with the monitoring of the project undertaken through one central information system. The key flexibility introduced under project grouping is that not all activities need to be identified at the beginning of the project and indicated in the Project Description.

Credits verified to the standard are branded as Voluntary Carbon Units (VCUs). All VCUs are listed in the VCS Project Database. The VCS Registry System currently consists of the VCS Project Database and 3 international companies that are contracted to act as registries—APX Inc., Caisse des Dépôts and Markit Environmental Registry; the system could be expanded in the future to include additional registries. The VCS registries issue, hold, transfer and retire VCUs, and interact directly with the VCS Project Database to upload project documentation and obtain unique serial numbers for each VCU.

Although the VCS was created as a base carbon accounting standard, developers have the option of 'tagging' their VCUs with other standards such as the CCB or SOCIALCARBON to provide proof that projects generate co-benefits including enhanced community development and improved biodiversity.

1.1.3. The Plan Vivo Standards

The Plan Vivo System (http://www.planvivo.org) was developed in 1994 by the Edinburgh Centre for Carbon Management in partnership with El Colegio de la Frontera Sur. The actual standards are administered by the Plan Vivo Foundation, formerly BioClimate Research and Development, a registered charity based in Scotland.

Projects generally originate with a small community or group of landowners, following a bottom-up approach to increase the number of participating communities and land over time. In line with the grassroots approach, the foundation aims to increase local capacity through knowledge, skills and resources transfer to developing countries. Communities decide which land use activities (e.g. woodlots, agroforestry and forest conservation) will best address threats to local ecosystems and are of interest and value to them. Projects are generally managed by local NGOs that act as project developers/coordinators, facilitating sales with carbon buyers, as well as monitoring and community consultation. Plan Vivo sets a goal for at least 60% of carbon revenues directed towards communities with a minimum of US$6/t$CO_2$ needed to achieve this.

Plan Vivo accepts a range of land use, land use change and forestry (LULUCF) projects, including afforestation and reforestation, agroforestry, restoration, conservation, improved forest management and REDD. Projects are issued a Plan Vivo Certificate with a unique serial code for each tonne of carbon dioxide sequestered or reduced. In addition, Plan Vivo has begun to use the Markit Environmental Registry to issue, track and retire certificates. The latest version of the Plan Vivo Standards was released in August 2008.

1.1.4. The CCB Standards

The CCB Standards (http://www.climate-standards.org) differ from carbon accounting standards such as the VCS and Plan Vivo by, *inter alia*, ensuring that there are net community and biodiversity benefits to a planned project. The CCB Standards require projects to generate net reductions in GHG concentrations, but do not result in the issuance of emission reduction certificates, and combination with a carbon accounting standard is recommended. The standards comprise 14 required criteria and 3 optional 'Gold Level' criteria.

Once a project has been designed, a third-party evaluator will use indicators to determine if individual criteria are satisfied. Only projects that use best practices and deliver significant climate, community and biodiversity benefits will earn CCB approval. Gold status is awarded to projects that also satisfy one of the optional criteria by providing exceptional benefits including explicit design for adaptation to climate change, benefits for globally poorer communities or conservation of biodiversity at sites of global conservation significance.

1.1.5. Other relevant standards

In recent years, the voluntary carbon market has seen the appearance of numerous standards for accounting for project-scale forest carbon emission reductions and enhancement of sinks—among them, those presented above and explored in detail by this guide. However, as mentioned previously, project developers should consider all the options available in the market in order to choose the standard(s) that best suit their needs. Following is a brief introduction to the main features of some of the standards not covered in this manual. A more detailed description and analysis of these and other standards may be found in 'State of the forest carbon markets 2009'[5].

American Carbon Registry Forest Project Standard[6]**:** In 1996, experts at the Environmental Defense Fund founded the Environmental Resources Trust and launched the GHG Registry, now known as the American Carbon Registry. American Carbon Registry was the first private voluntary GHG emissions registry in the United States, and in 2007, both Environmental Resources Trust and American Carbon Registry joined Winrock International. American Carbon Registry provides carbon technical services for GHG accounting, protocol development, offset and corporate GHG inventory registration and over-the-counter (OTC) offset transactions and retirements. The Forest Carbon Project Standard, launched in March 2009, is available for A/R, IFM and REDD projects within the United States or non-Annex I countries.

The CarbonFix Standard (CFS)[7] is a product of the non-profit association CarbonFix, which was founded in 1999 and registered in Germany in 2007 to support the potential for climate forestation projects. The standard applies to afforestation and reforestation, but not to improved forest management or avoided deforestation (i.e. REDD) activities. In terms of methodology, CFS only accepts its own, which is based on IPCC good practice guidelines and aligned to the greatest extent possible with the CDM. For those project developers that want to maximise environmental and social benefits without duplicating validation costs, CFS recognises the certification schemes of the Forest Stewardship Council (FSC) and the CCB. CarbonFix has its own registry and delivers a unique certificate ID for each project. Moreover, CarbonFix has started to use Markit as a third-party registry.

Climate Action Reserve (CAR)[8] emerged from the California Climate Action Registry (CCAR), a non-profit organisation which emerged in 2001 through an initiative by the State of California to oversee entity emissions reporting and offsets in that state. In September 2009, CAR's Forest Project Protocol 3.0 was adopted to verify the carbon sequestration benefits of forestry projects in avoided conversion of forest land to other uses, improved forest management and reforestation of land. Credits verified to the standard are branded Climate Reserve Tonnes (CRTs), or 'carrots' for short. CRTs are only issued *ex-post*, and are held in the Reserve's own registry powered by APX. The CAR forest protocol takes a deliberately standardised approach, relying heavily on US Forest Service regional data and other official data sets for the calculation of baselines and establishing additionality.

ISO 14064[9] is a GHG project accounting standard developed by the International Organization for Standardization (ISO) beginning in 2002 and launched in the spring of 2006. The standard is meant to be applicable regardless of a country's current climate policy, and does not apply restrictions on project type, size, location or crediting period. The ISO 14064 standard consists of 3 parts, which can be used independently or as an integrated set. The first part (14064-1) specifies requirements for designing and developing organisation or entity-level GHG inventories. The second part (14064-2) details requirements for quantifying, monitoring and reporting emission reductions and removal enhancements from GHG projects. The third part (14064-3) provides requirements and guidance for GHG information validation and verification. Unlike standards approving scientific methodologies, ISO 14064 offers only general guidance. For instance, ISO mentions that additionality must be taken into account but does not require a specific tool or test. Tools used are defined by the GHG programme or regulation under which ISO 14064 is used.

SOCIALCARBON[10] is a standard designed to enhance social and environmental co-benefits of carbon offset projects, as well as to increase active participation of stakeholders. The SOCIALCARBON Methodology, developed by the Instituto Ecologica (Brazil) in 2000, is the key element of the standard and is comprised of a set of analytical tools that assess the social, environmental and economic performance of projects. At the base of the methodology is the sustainable livelihood approach, which guarantees that projects reducing GHG emissions can also encompass issues of sustainable development. To achieve this, it includes basic guidelines, a conceptual framework and indicators (ranging from worst to ideal scenarios). Through use of these tools and continual monitoring, developers can demonstrate a project's contribution to sustainable development. SOCIALCARBON is generally used in conjunction with another standard, such as the VCS, ISO 14064-2 or the CDM, and therefore does not set its own project type, size, location, crediting period, baseline or monitoring methodologies restrictions. Instead, developers must prove that projects comply with other SOCIALCARBON-approved standards (VCS, ISO, CDM, CAR, etc.). Credits certified to the standard produce SOCIALCARBON-certified Voluntary Emission Reductions (VERs) (together with another VER standard) and Certified Emission Reductions (CERs) (together with the CDM), which are assigned a unique serial number to address the risk of double-counting. All projects and VERs that have successfully completed the approval process are then posted to the Markit-managed SOCIALCARBON Registry.

1.1.6. General criteria for the selection of a standard

Taking into account the information presented above, some very general and simple recommendations are provided below to try to facilitate the decision-making process of project developers when selecting the most suitable type of standard to fulfil their needs and interests.

Project developers should use robust, carbon-focused standards such as the VCS if:

- they want to generate emission reductions that are real, verified, permanent, additional and unique;
- they want to be able to obtain relatively high prices and market acceptance for their carbon credits; and
- they can afford the transaction costs associated to methodology development and validation if no approved methodologies are available for their specific project type, as well as those arising from the use of a complementary standard to ensure social and wider environmental benefits.

Project developers should consider using community-centred standards with emphasis on social aspects, such as Plan Vivo, where:

- they operate/plan to operate in developing countries to promote sustainable livelihoods;
- they work with/plan to work with communities to deliver ecosystem services, specifically long-term carbon sequestration and/or emission reduction benefits; and
- they wish to minimise transaction costs and maximise social and overall environmental benefits through scalable small-scale projects.

Project developers should use the CCB Standards to:

- complement projects developed using other standards focused on carbon;
- identify projects that simultaneously address climate change, support local communities and conserve biodiversity; and
- mitigate risk for investors and increase funding opportunities for project developers.

1.2. Introduction to VCS, Plan Vivo and CCB project documents and methodologies

The project cycle encompasses all the stages a project activity must undergo in order to generate verified emission reductions, and usually implies the interaction of the project proponents, the authorities of the programme under which the project wants to be registered and third-party validators/verifiers. Generally, a project document represents the first step of the project cycle, and although the name and template of this document vary according to the programme, it usually requires the following information:

- a description of the project (e.g. name, location, activities to be implemented);
- the definition of the project boundary (including pools, sources, crediting period and project area);
- a description of the baseline and monitoring methodology used and a justification of why it is applicable to the project;
- the demonstration of the additionality of the project;
- a description of the environmental impacts of the project;
- a summary of stakeholder comments;
- a description of the monitoring plan; and
- calculations leading to the (*ex-ante* and *ex-post*) estimation of the project's emission reductions.

1.2.1. Under the VCS

In the case of the VCS, the project cycle (or VCS project process flowchart, in VCS jargon) starts by requiring project proponents to submit a VCS

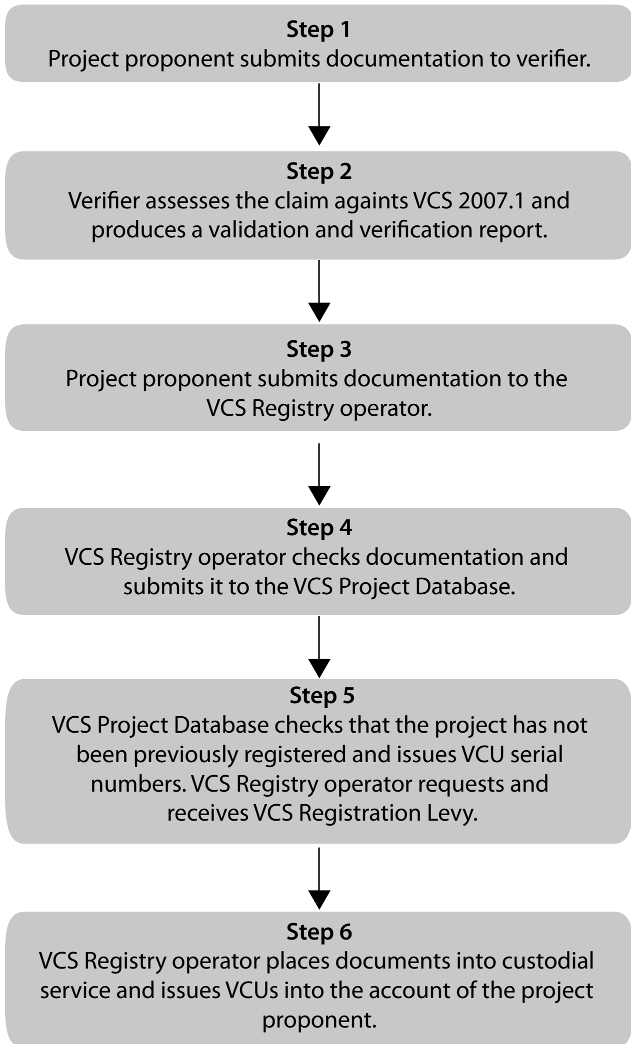


Figure 4. VCS project process flowchart

Project Description Template (VCS-PD[11]), together with a monitoring plan and reports, proof of title and, if already available, a validation report, and other information required, to the VCS Program accredited validation and verification body (see Figure 4).

The VCS-PD shall be elaborated by applying a VCS-approved methodology. The list of VCS-approved methodologies can be found at www.v-c-s.org. New methodologies may be proposed to the VCS by using a specific form[12] and subject to a double-approval process[13]. VCS Program methodologies shall include: applicability criteria that define the area of project eligibility;

- a process that determines whether the project is additional or not;
- determination criteria for the most likely baseline scenario; and
- all necessary monitoring aspects related to monitoring and reporting of accurate and reliable GHG emission reductions or removals.

CDM and Climate Action Reserve methodology elements are automatically approved under the VCS Program. For more detailed information on the project process flowchart, requirements for VCS-PDs and VCS methodologies, see the VCS 2007.1[14].

1.2.2. Under the Plan Vivo Standards

The Plan Vivo project registration steps begin with a Plan Vivo Project Idea Note (PV-PIN[15]), which, if approved by the Plan Vivo Foundation, shall be followed by the submission of technical specifications and a Plan Vivo Project Design Document (PV-PDD[16]) (see Figure 5). Technical specifications are methodologies that describe each land use system.

- They calculate the carbon sequestration or storage potential ('output') of an activity for a specified number of years (e.g. 100 years). By comparing producers' Plan Vivos with the technical specification figures, project technicians can quickly assess the carbon offset potential of the activity without the need for time-consuming biomass surveys and baseline studies for each individual landholding.
- They prescribe what species can be planted and assess ecosystem benefits. Species used in Plan Vivo projects must always be native or naturalised to ensure positive ecosystem outcomes.
- They specify the establishment and risk management actions required to achieve permanence and schedules and methods for monitoring.
- They contain analyses of the additionality of the activity and identify any other risks such as leakage.
- They set out measurable indicators to be used in monitoring progress towards fulfilment of carbon benefits.

The Plan Vivo Foundation coordinates peer reviews of technical specifications through its Technical Advisory Panel[17]. Technical specifications are working documents and must be reviewed every 5 years and subject to reapproval by the Plan Vivo Foundation. A project may choose to develop new technical specifications as it progresses and new target activities are identified by communities. For example, communities may initially wish to focus on tree-planting and require a technical specification for small-scale native woodlots, and then express a wish to extend activities to forest conservation, whereby a new technical specification would be required.

For more information on the Plan Vivo registration steps, PV-PIN and PV-PDD and technical specifications, refer to the Plan Vivo guidance manual[18].

1.2.3. Under the CCB Standards

The CCB Standards require the submission by project proponents of project design documentation (PDD), which is a detailed description of the project and the ways in which it meets the required and optional criteria of the standards. There is no mandatory format or template for the PDD, but it must be prepared in a way that facilitates assessment by the public and the auditor.

Project proponents may use formats required by other relevant standards such as the CDM Afforestation & Reforestation Project Design Document template or the VCS project description template. Where additional information is required for the purposes of a CCB validation, this can be inserted within the document or provided as appendices or as an additional CCB Standards Rules document. Alternatively, a CCB project document could describe how the project conforms to each

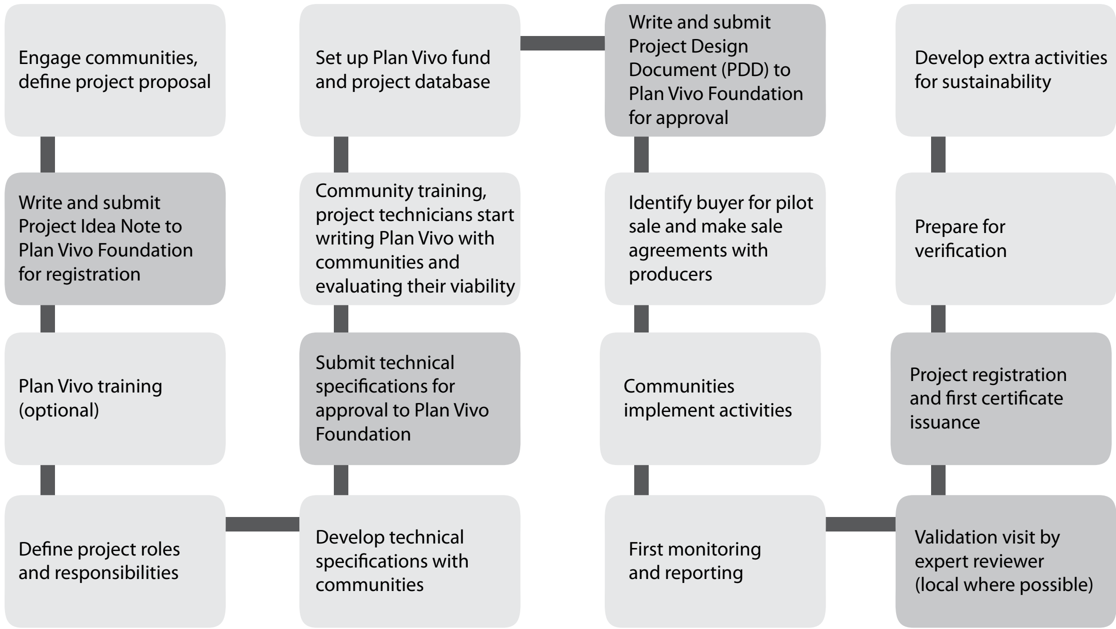


Figure 5. Stages of Plan Vivo project development and registration

criterion in the CCB Standards, cross-referencing to additional documents where appropriate.

If a project includes multiple activities to reduce emissions (i.e. an integrated REDD and ARR project), the project proponents may prepare a single PDD that describes each activity or may prepare a separate PDD for each activity. The steps to be taken in order to validate a PDD and verify its benefits (i.e. the CCB project cycle) are as follows.

Validation

1. Preparation of documentation that describes how the project meets the requirements of the CCB Standards
2. Engagement of a qualified auditor
3. Publication and dissemination of the PDD for public comment
4. Validation audit site visit
5. Preparation by the auditor of a Draft CCB Validation Report
6. Revision of the project design to address any identified deficiencies
7. Preparation by the auditor of the Final CCB Validation Report and CCB Validation Statement
8. Publication of the revised PDD, Final CCB Validation Report, CCB Validation Statement and the project's CCB status on the CCBA website

Verification

1. Publication and dissemination of climate, community and biodiversity monitoring plans and reports
2. Preparation of documentation that describes how the project met the requirements of the CCB Standards
3. Engagement of a qualified auditor
4. Publication and dissemination of the project implementation report for public comment
5. Verification audit site visit
6. Preparation by the auditor of a Draft CCB Verification Report
7. Response to deficiencies identified in the Draft CCB Verification Report
8. Preparation by the auditor of the Final CCB Verification Report and CCB Verification Statement
9. Posting of the Final CCB Verification Report, CCB Verification Statement and the project's CCB status to the CCBA website

2. Introduction to the methodological basis for REDD+ activities

2.1. Applying the IPCC guidance to REDD+ projects

The guidance documents produced by the IPCC represent the world's most authoritative source of methods to estimate GHG inventories. Such methods provide the methodological basis for the regulated and voluntary carbon markets, since they are applied by developed countries that are Parties to the UNFCCC and its Kyoto Protocol for reporting their emissions and demonstrating compliance with their emission reduction commitments, they are used to estimate emission reductions generated by the Protocol's flexibility mechanisms (i.e. the CDM, Joint Implementation and Emissions Trading) and they serve as the methodological reference for the most credible voluntary market standards. Moreover, by a recent request of the Conference of the Parties to the UNFCCC, the IPCC guidance will be used by developing countries as the basis for estimating anthropogenic forest-related GHG emissions by sources and removals by sinks, forest carbon stocks and forest area changes in the context of REDD+[19].

Consequently, this chapter of the reference guide briefly introduces the general approaches and concepts used in the IPCC guidance documents with the aim of facilitating their understanding and application to REDD+ projects by the reader. Particular methods and guidance for specific issues are addressed in the relevant chapters of the guide. It must be noted that the IPCC guidance described here provides best practices for building methodologies and developing projects under any carbon standard.

The IPCC methods relevant for REDD+ activities are mainly contained in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006 [20]GL) and the IPCC Good Practice Guidance for LULUCF (IPCC GPG-LULUCF)[21]. As explained below, the IPCC 2006 GL methods, intended to be used at the national level, may be adapted through the guidance provided by the IPCC GPG-LULUCF for their application at the project level.

The 2006 IPCC GL serve to estimate and report national inventories by dividing GHG emissions and removals into main sectors, which are groupings of related processes, sources and sinks, one of which is the agriculture, forestry and other land use (AFOLU) sector. Each sector comprises individual categories and sub-categories. For the AFOLU sector, anthropogenic GHG emissions and removals by sinks are defined as all those occurring on 'managed land'. The 6 land use categories in the 2006 IPCC Guidelines are:

- forest land
- cropland
- grassland
- wetlands
- settlements
- other land

Each land use category is further subdivided into land remaining in that category (e.g. 'Forest land remaining forest land') and land converted from one category to another (e.g. 'Forest land converted to cropland').

The IPCC 2006 GL methods are ranked by tiers. A tier represents a level of methodological complexity. Usually 3 tiers are provided: Tier 1 is the basic method, Tier 2 intermediate and Tier 3 most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as higher tier methods and are generally considered to be more accurate. Tier 2 and 3 methods use nationally derived data and more disaggregated approaches and (or) process models, which allow for more precise estimates of changes in carbon stocks in biomass.

As pointed out by the IPCC GPG-LULUCF, estimating and monitoring anthropogenic changes in carbon stocks and non-CO_2 GHG emissions and removals at the project level involve several challenges and specific circumstances, which may not be appropriately captured within good practice guidance developed for national inventories. Consequently at the project level it is recommended to apply higher-tier methods, based on field measurements or field measurements in combination with models (e.g. allometric equations, simulation models). Examples of how these measurements are carried out in REDD+ projects and of models applicable to such projects are provided in the relevant chapters and sections of this reference guide.

Particularly relevant to REDD+ projects are the methods provided by the IPCC 2006 GL to estimate the CO_2 emissions and removals on land converted to a new land use category (e.g. forest to other land use categories such as cropland or grassland), which consider the initial change in carbon stocks due to the land use conversion, as well as annual increases in biomass due to growth and annual decreases due to losses from harvesting, fuelwood gathering and disturbances on the converted land. The annual carbon stock changes are estimated separately for each land use (e.g. forest land, cropland, grassland) and management category (e.g. natural forest, plantation), by specific strata (e.g. climate or forest type). Likewise, the methods to estimate CO_2 emissions and removals on land remaining in the same category (i.e. Forest Land Remaining Forest Land) serve as the basis for developing approaches for projects reducing emissions from forest degradation and sustainable forest management projects. Table 1 presents simplified examples of cases where specific IPCC 2006 GL sections are relevant. Examples on how these methods have been incorporated into REDD+ project methodologies are provided later in this document.

For each land use category, carbon stock changes are estimated for all strata or subdivisions of land area (e.g. climate zone, ecotype, soil type, management regime, etc.) chosen for a land use category. Carbon stock changes within a stratum are estimated by considering carbon cycle processes between the 5 carbon pools: aboveground biomass, belowground biomass, dead wood, litter, soil organic matter. Overall, carbon stock changes within a stratum are estimated by adding up changes in all pools. Further, carbon stock changes in soil may be disaggregated as to changes in C stocks in mineral soils and emissions from organic soils. Harvested wood products are also included as an additional pool.

The IPCC 2006 GL provides 2 methods to estimate annual carbon stock changes in any pool:

The Gain–Loss Method, which includes all processes that bring about changes in a pool. Gains can be attributed to growth (increase of biomass) and to transfer of carbon from another pool (e.g. transfer of carbon from the live biomass carbon pool to the dead organic matter pool due to harvest or natural disturbances). Losses can be attributed to transfers of carbon from one pool to another (e.g. the carbon in the slash during a harvesting operation is a loss from the aboveground biomass pool), or emissions due to decay, harvest or burning. The Gain–Loss Method requires the biomass carbon loss to be subtracted from the biomass carbon gain.

The Stock-Difference Method requires carbon stock inventories for a given land area at 2 points in time. Annual stock change is the difference between the stock at time t2 and time t1, divided by the number of years between the inventories. The Stock-Difference Method requires greater resources and is suitable for Tier 3 and in some cases Tier 2 approaches, but may not be suitable for a Tier 1 approach due to limitations of data.

In applying the Gain–Loss or Stock-Difference Methods, the relevant area is the extension of land remaining in the relevant category (e.g. the area of forest remaining a forest) or in a conversion category (e.g. the area of forest that has been converted to agriculture) at the end of the year for which the inventory is being estimated. In REDD+ projects, these areas are estimated ex-ante through modelling and ex-post through monitoring (as explained in Chapter 3 of this reference guide on baselines and in Chapter 5 on how to estimate project emissions).

The IPCC 2006 GL also offers guidance on how to calculate non-CO_2 emissions. The non-CO_2 gases of primary concern for the AFOLU sector are methane (CH_4) and nitrous oxide (N_2O). Non-CO_2 emissions are derived from a variety of sources, including emissions from soils, livestock and manure, and from combustion of biomass, dead wood and litter. In contrast to the way CO_2 emissions are estimated from biomass stock changes, the estimate of non-CO_2 GHGs usually involves an emission rate

Table 1. Illustration of simplified land use and land cover change scenarios and the relevant sections of the IPCC 2006 GL applicable to them

Land use/land cover at t1	Land use/land cover at t2	Relevant IPCC 2006 GL sections
Primary forest	Degraded forest	Chapter 4 'Forest land'–Section 4.2. 'Forest land remaining forest land' Activity data: size of areas degraded from t1 to t2 (ha) Emission factor: difference in carbon stocks in relevant pools from the primary forest to the degraded forest (t/CO_2 per ha)
Forest	Agriculture	Chapter 5 'Crop land'–Section 5.3 'Land converted to cropland' Activity data: size of areas converted to cropland from t1 to t2 (ha) Emission factor: difference in carbon stocks in relevant pools from the primary forest to cropland (t/CO_2 per ha)
Degraded forest	Sustainably managed forest	Chapter 4 'Forest land'–Section 4.2. 'Forest land remaining forest land' Activity data: size of degraded areas enriched through sustainable forest management practices from t1 to t2 (ha) Emission factor: difference in carbon stocks in relevant pools from the degraded forest to the sustainably managed forest (t/CO_2 per ha)

from a source directly to the atmosphere. The rate is generally determined by an emission factor for a specific gas (e.g. CH_4, N_2O) and source category and activity data, which may be expressed in terms of area (e.g. for soil or area burnt), population (e.g. for livestock) or mass (e.g. for biomass or manure).

Additionally, the GPG-LULUCF provides good practice guidance for defining project boundaries, measuring, monitoring and estimating changes in carbon stocks and non-CO_2 GHGs, implementing plans to measure and monitor, and developing quality assurance and quality control plans, all of which are important when designing the different elements of REDD+ methodologies, as explained in the relevant chapters of this reference guide.

3. Estimating baselines for REDD+ projects

3.1. Basic concepts about baselines

In broad terms, the baseline for a REDD+ project activity is the scenario that reasonably represents the anthropogenic changes in carbon stocks in pools and emissions of GHGs by sources that would occur in the absence of the proposed project activity. A baseline shall cover both significant carbon stock changes in all relevant pools and significant emissions by sources of all GHGs that would occur within the project boundary.

Baselines are estimated *ex-ante* and usually remain fixed during the crediting period or for the period during which the projection of the baseline conditions may be deemed reliable; for instance, in the case of projects reducing emissions from deforestation and degradation, baseline projections may need to be revised several times during the crediting period (e.g. every 10 years) in order to reflect changes that might have happened in the project context affecting the rates of deforestation. Moreover, in some cases—particularly when *ex-ante* assumptions and estimates contain high levels of uncertainty—baselines may be revised *ex-post,* when estimating the actual carbon benefits of a project, based on data obtained from monitoring 'proxy areas' deemed to reasonably represent the conditions that the project area would experience in the baseline.

3.2. Baselines for projects reducing emissions from deforestation (RED)

As illustrated in Figure 6, there are a number of possible RED baselines and project activities affecting the carbon stocks in the different pools, the constant being that in the baseline case, the forested area, height of trees or canopy cover are reduced below the thresholds that define what a 'forest' is according to the standard under which a project is registered. RED baselines are comprised of 2 main elements: a land use and land cover (LU/LC) change component and the associated carbon stock change component. As discussed below, each standard has particular requirements to determine the eligibility of RED projects and provides specific guidance for the estimation of baselines; however, the following steps are generally applicable:

- Step 1 Definition of the project type
- Step 2 Definition of the project boundary
- Step 3 Projection of LU/LC in the baseline
- Step 4 Estimation of baseline carbon stock changes
- Step 5 Estimation of baseline GHG emissions
- Step 6 Estimation of the baseline net GHG emissions and removals

3.2.1. Baselines for RED projects under the VCS

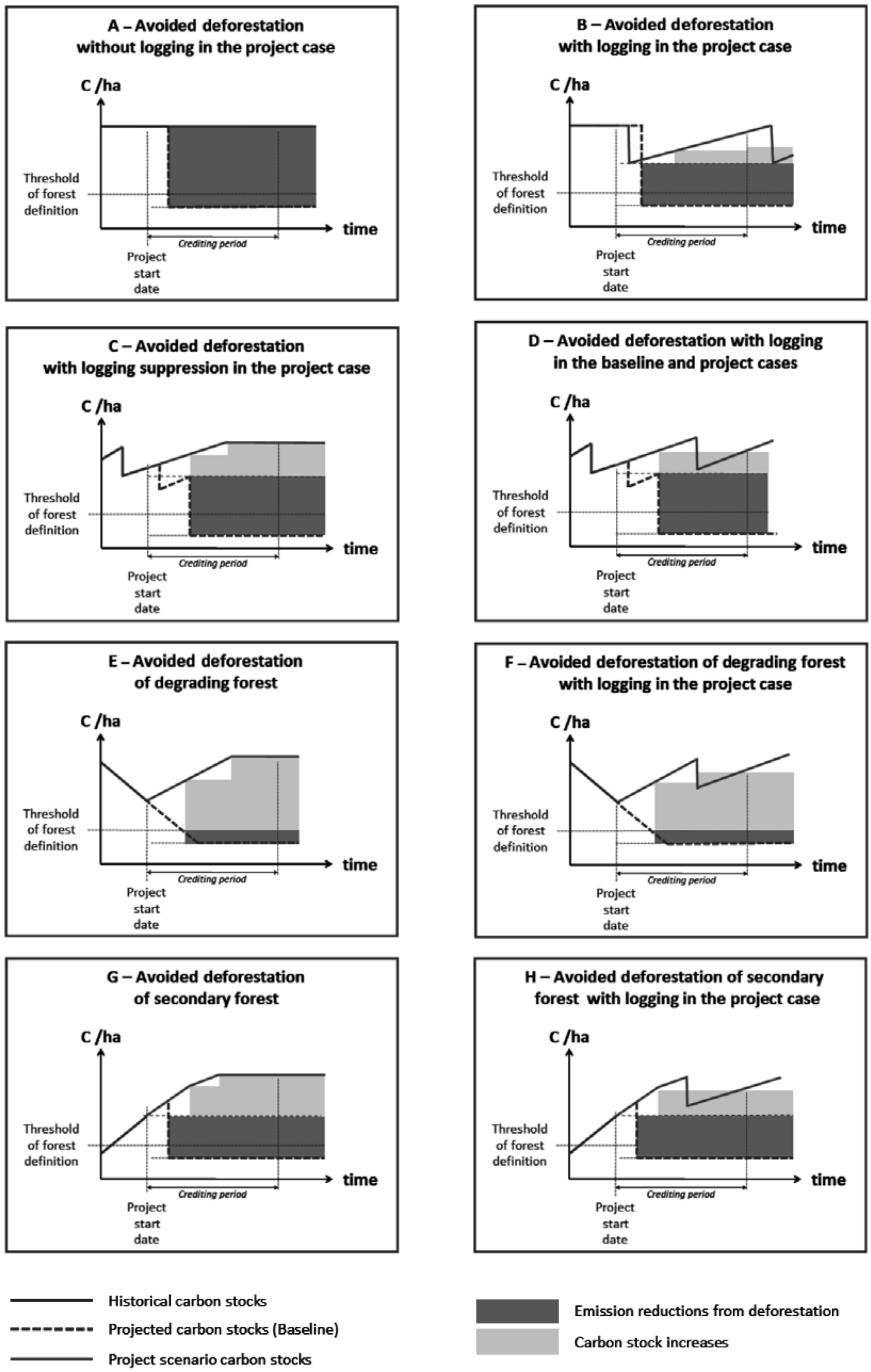
3.2.1.1. VCS Guidance

All AFOLU projects are subject to the general baseline rules as defined by Section 6.3 of the VCS 2007.1[22]. In addition, the VCS Tool for AFOLU Methodological Issues[23] and the VCS Guidance for AFOLU Projects[24] (and their relevant updates[25]) provide specific guidance for each project type, which is summarised below for RED projects and in the respective sections of this reference guide for other relevant project types under the REDD+ umbrella.

Step 1. Definition of the project type

The VCS, through its AFOLU guidance documents, offers guidance for the estimation of baselines for projects reducing the conversion of native or natural forests to non-forest land that would be deforested in the absence of the REDD project activity, which are categorised as follows.

a. **Avoiding planned deforestation (APD):** Reduces GHG emissions by stopping deforestation on forest lands that are legally authorised and documented to be converted to non-forest land. This REDD practice can occur in degraded to mature forests, either at the forest frontier or in the forest mosaic configuration. APD project proponents must provide the verifier with evidence showing that the project area was planned to be converted.
b. **Avoiding unplanned frontier deforestation and degradation (AUFDD)**: The project proponent must demonstrate that the project area is located geographically where deforestation/



Source: Adapted from Pedroni, Lucio. 'Illustration of eligible VCS activities (REDD mosaic and frontier methodologies)'. Carbon Decisions International, 2010.

Figure 6. Examples of possible RED baselines and project activities

degradation will likely happen during the project crediting period. Where the expansion of the deforestation frontier into the project area is linked to the development of infrastructure that does not yet exist, evidence must be provided to the verifier that such infrastructure would have been developed in the absence of the REDD project. Frontier configurations are defined as any landscape in which all forest areas in the project area have no current direct physical connection with areas anthropogenically deforested.

c. **Avoiding unplanned mosaic deforestation and degradation (AUMDD)**: Under this activity, a baseline projection of deforestation and degradation must be developed for the region in which the project area is located, making sure it takes into account such factors as historical deforestation and degradation rates and that the proposed regional baseline area is similar to the project area in terms of: drivers of deforestation and degradation, landscape configuration and socio-economic and cultural conditions. Mosaic configurations are defined as any landscape in which no patch of forest[26] in the project area exceeds 1000 ha and forest patches are surrounded by anthropogenically cleared land[27].

Step 2. Definition of the project boundary

In order to estimate the baseline and project scenarios and the project's leakage, the boundary of the REDD activity shall be clearly delineated and defined. For all REDD project types, the VCS Tool for AFOLU Methodological Issues establishes that only land qualifying as 'forest'[28] for a minimum of 10 years prior to the project start date can be included in the project boundary. According to the VCS AFOLU guidance documents,[29] the project boundary is defined by the following.

a. **The geographical boundary within which the project will be implemented**: Project participants need to clearly define the spatial boundaries of a project so as to facilitate accurate measuring, monitoring, accounting and verifying of the project's emission reductions/removals.
b. **The project crediting period:** This is the period of time for which the net GHG emission reductions or removals will be verified, which under the VCS is equivalent to the project lifetime. The project must have a robust operating plan covering this period. The project crediting period for REDD projects shall be between 20 and 100 years.
c. **The sources and sinks, and associated types of GHGs (i.e. CO_2, N_2O and CH_4), the project will affect**: Projects must account for any significant sources (sinks are optional) of carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4) that are reasonably attributable to project activities. Emissions of N_2O from project activities within the project area, including from application of all N-containing soil amendments (e.g. inorganic fertiliser, organic fertiliser, manure and plant residues), and N_2O emissions caused by microbial decomposition of any plant material including trees, shrubs and herbaceous vegetation that fix nitrogen, may be considered insignificant for REDD projects[30] and do not have to be accounted for. Emissions from removal or burning of herbaceous vegetation, fossil fuel combustion from transport in project activities and collection of non-renewable wood sources for fencing of the project area may be considered insignificant for REDD projects and do not have to be accounted for. Other GHG sources may be considered insignificant and do not have to be accounted for if together such omitted decreases in carbon pools and increases in GHG emissions amount to less than 5% of the total CO_2-eq benefits generated by the project[31].
d. **The carbon pools that the project will consider.** The carbon pools that shall be accounted for by the different types of REDD projects under the VCS are shown in Table 2.

Moreover, the VCS guidance allows pools to be omitted if their exclusion leads to conservative estimates of the number of carbon credits generated. For more information on inclusions and exclusions of pools by project category and type, refer to the VCS Tool for AFOLU Methodological Issues (page 5)[33] and the VCS Guidance for AFOLU Projects (page 17)[34].

Step 3. Projection of Land Use/Land Cover in the baseline

Developing the LU/LC change component of the baseline is handled differently for the 3 REDD activity types allowed under the VCS, as follows.

a. **Avoiding planned deforestation**: The project developer must provide verifiable evidence to demonstrate that, based on government- and landowner-planned land use changes, the project area was intended to be cleared. The annual

Table 2. Pools to be considered by VCS REDD project activities

Project type	Living biomass			Dead organic matter			
	Above ground trees	Above ground non-tree	Below ground	Litter	Dead wood	Soil	Wood products
Convert logged to protected forests	Y	N	O	N	Y	O	Y
Convert low-productive forests to productive forests	Y	N	O	N	O	N	O
Conventional logging to RIL: A. with no effect on total timber extracted	Y	N	O	N	Y	O	N
B. with >25% reduction in timber extracted	Y	N	O	N	Y	O	Y
Extend rotation age	Y	N	O	N	O	N	O

Notes:

Y: Pool shall be included in the baseline and monitoring plan for the project.

N: Pool need not be measured because it is not subject to significant changes or potential changes are transient in nature.

O: Pool is optional: it shall be included if its carbon stock is significantly reduced by the project[32]; and may be included if its carbon stock is significantly increased by the project.

rate of forest conversion shall be based on the common practice in the area, i.e. how much forest is typically cleared each year by similar baseline activities.

b. **Avoiding unplanned frontier deforestation and degradation**: The project proponent must demonstrate that the project area is located geographically where deforestation/degradation will likely happen during the crediting period. Where the expansion of the deforestation frontier into the project area is linked to the development of infrastructure that does not yet exist, evidence must be provided to the verifiers that such infrastructure would have been developed in the absence of the REDD project.

c. **Avoiding unplanned mosaic deforestation and degradation**: A baseline projection of deforestation and degradation under this activity must be developed for the region in which the project area is located, making sure it takes into account such factors as historical deforestation/degradation rates and that the proposed regional baseline area is similar to the project area in terms of drivers of deforestation/degradation, landscape configuration and socio-economic and cultural conditions.

The baseline methodology must outline the measurements, calculations and assumptions used to estimate the annual amount and likely general location of the expected deforestation/degradation under baseline conditions. Additionally, the VCS requires project proponents of all REDD project types to reassess the project baseline at least once every 10 years and have this reassessment validated at the same time as the next VCS verification.

Step 4. Estimation of baseline carbon stock changes

In order to estimate the carbon stock component, the VCS AFOLU documents mandate the use of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and recommend the project design document for the Noel Kempff Climate Action Project[35], which provides methods for estimating the baseline carbon stocks for forests projected to be deforested and degraded, including logging, forest regrowth and dead wood. The guidance on methods provided in the aforementioned documents for the carbon stock component of the baseline can be used for any of the eligible REDD activities under the VCS.

Step 5. Estimation of baseline GHG emissions

The VCS AFOLU documents establish that, for inclusion of emissions of non-CO_2 gases in the baseline of REDD projects, the project proponents must provide evidence that the practice that generates such emissions and for which they plan to claim credit is the common practice in the area (e.g.

demonstrate that forest clearing by fire is a common practice among baseline deforestation agents).

Step 6. Estimation of the baseline net GHG emissions and removals
This step determines the baseline for a project activity by adding the total carbon stock changes and the GHG emissions that would occur in the absence of the proposed project activity. If significant, carbon stocks in long-lived wood products must be estimated and deducted from the baseline emissions estimates. The VCS mandates project proponents to estimate the baseline net GHG emissions and removals for each year of the proposed crediting period expressed in terms of CO_2 equivalents employing global warming potentials (GWPs) of 310 for N_2O and 21 for CH_4.

*3.2.1.2 Relevant methodological elements and tools for the development of **ex-ante** REDD baselines following the VCS*

This section identifies and introduces internationally recognised, credible and transparent methodological guidance and tools that may be useful when constructing *ex-ante* baselines for RED projects, and in particular, for Steps 4 and 5 above. It also presents, where relevant, approved and proposed VCS methodologies or some of their elements, which may provide useful insights on how specific requirements of VCS REDD methodologies may be approached.

Methods to estimate baseline LU/LC and their associated effects on carbon stocks and GHG emissions are indicated for each of the REDD project types covered by the VCS. The general IPCC guidelines approach to developing GHG inventories, based on the multiplication of activity data by emission factors, is followed here; ‘activity data’ refers to the areal extent (in ha) of an LU/LC category over time (also referred to as ‘area change data’), and the emission factors represent the emissions/removals of GHG per ha of area change (i.e. deforestation), considering the estimated location of deforestation and its matching carbon stocks at the start of the project as well as those corresponding to the land uses replacing the forests.

Moreover, methods to calculate non-CO_2 emissions (i.e. methane (CH_4) and nitrous oxide (N_2O) happening as a consequence of baseline activities (e.g. forest conversion through fire) are summarised and referenced.

3.2.1.2.1 Activity data

The methodological elements detailed below serve to define the rate and future areas of planned and unplanned (and frontier and mosaic) deforestation, and should result in the quantification and location of the forest areas that would be deforested during each year of the crediting period, as well as of the LU/LC categories that would replace such forests. With this information, LU/LC change categories (e.g. from forest to cropland) are identified, located and quantified. The total size in hectares per LU/LC change category serves as the activity data for the estimation of the baseline emissions due to carbon stock changes.

Avoiding planned deforestation

In VCS-APD projects, the annual deforestation rate is determined by the common practice observed in similar operations in the context of the proposed project, e.g. the annual rate at which forests are usually converted to the planned or authorised land use in the project’s country, state, municipality, etc. by similar baseline deforestation agents. The total area to be converted in the baseline is given by the deforestation permits/plans that the baseline agents must submit to the validators.

The module ‘Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation’ (Version 1.0—April 2009)[36] developed by Avoided Deforestation Partners as part of their ‘REDD methodology modules’ (currently undergoing validation under the VCS) represents a good example of the application of the VCS AFOLU guidance on how to calculate the annual area of land deforested in planned deforestation projects. In summary, the module requires knowledge of the rate (area deforested per year) at which the planned areas will be deforested to give an area per stratum per year through the project period. Where a valid verifiable plan exists for the rate at which deforestation is projected to occur, this rate may be used. The rate can also be established by examining proxy areas that encompass parcels of land that have used land conversion practices that the baseline land manager would implement. A similar approach is used by the American Carbon Registry ‘Methodology for REDD—avoiding planned deforestation’ (Version 1.0—August 2010),[37] currently undergoing the period of public comments.

Avoiding unplanned frontier and mosaic deforestation and degradation

Since the VCS AFOLU requires the project area of AUFDD and AUMDD to be located where deforestation/degradation will likely happen during the crediting period, in order to identify the project area, project proponents need to carry out an analysis of deforestation/degradation for the region where the project is intended to be implemented, usually referred to as the 'reference region'.

Although so far no AUFDD or AUMDD methodologies have been validated under the VCS, practically all of those currently undergoing the process of validation—including the 'REDD methodology modules' of Avoided Deforestation Partners, the 'Methodology for estimating reductions of GHG emissions from frontier deforestation' developed by Amazonas Sustainable Foundation[38] and the 'Baseline and monitoring methodology for project activities that reduce emissions from deforestation on degrading land' designed by Terra Global Capital, LLC[39]—coincide on their approach to define the reference region and estimate the rate and location of deforestation within it, which was originally proposed by the 'Methodology for estimating reductions of GHG emissions from mosaic deforestation' produced by the BioCarbon Fund of the World Bank (also in the process of validation)[40]. The estimation of the rate and areas of future deforestation following this approach considers the expected changes, during the crediting period, at the level of agents, drivers and underlying causes of deforestation and the remaining forest area that is suitable for the further expansion of the deforestation frontier. In general, this is done through the following steps.

1. Analysing the historical land use in the reference region and the project area: This implies the collection and analysis of spatial data in order to identify current land use and land cover conditions and to analyse LU/LC change during a historical reference period.
2. Analysing the agents, drivers and underlying causes of deforestation to estimate the quantity and location of future deforestation.
3. Projecting the rate and location of future deforestation: This step aims at locating in space and time the baseline deforestation expected to occur during the crediting period, and is performed through the following 3 analytical sub-steps:
    a. selection of the baseline approach (e.g. historical average, linear extrapolation or modelling);
    b. analysis of constraints to the further expansion of the deforestation; and
    c. quantitative and spatial projection of future deforestation.

For a detailed description of each of these steps, the reader is invited to review the WB methodology or any of the other methodologies mentioned above (or preferably, one already validated, if available). The following methodological resources may be used for the development of new methods and for the application of those introduced above:

- Guidance on how LU/LC categories are defined can be found in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 3[41].
- Some of the LU/LC models and software packages useful to project the location of future deforestation currently available (and recommended by some of the methodologies presented above) include GEOMOD[42], Land Change Modeler[43] and Dinamica EGO[44]. A comprehensive list of models and the applicability conditions of each is contained in the Terrestrial Carbon Group Policy Update no. 2 on Tools for Setting Reference Emission Levels[45].
- General guidance that may serve to complement the methods presented above or as the basis for developing new approaches for the establishment of historical baseline deforestation rates and distribution can also be found in the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) Sourcebook[46].

3.2.1.2.2 Emission factors from carbon stock changes

In general terms, the net carbon stock changes in the baseline (i.e. the emission factors) are equal to the baseline pre-deforestation stock in all relevant pools minus the long-term carbon stock in such pools after deforestation (in tC/ha), and, where applicable, minus the baseline stock which is harvested and stored long-term in wood products.

The following guidance is useful for estimating the emission factors for all of the VCS REDD project types, the only difference being the carbon pools to be considered by each of them according to the VCS provisions mentioned in Section 3.2.1.1, Step 4, above.

Volume 4 of the IPCC 2006 GL offers guidance on how to estimate changes in carbon stocks (and the resulting emission factors) and emissions of non-CO_2 gases due to the conversion from forest to other LU/LC categories:

- Chapter 2.3 presents the fundamental equation for estimating changes in carbon stocks associated with land use conversions[47].
- Chapter 5.3 offers specific guidance on how to estimate changes in carbon stocks in forest land converted to cropland[48].
- Chapter 6.3 contains instructions for cases where forest land is converted to grassland[49].
- Chapter 8.3 provides guidance when forest land is converted to settlements[50].
- Chapter 9 contains methods for cases where forest land is converted to other land[51].

Table 3 shows the location of carbon stock estimation methods in the IPCC 2006 GL relevant to the development of RED baselines. Additionally, Chapters 2.2, 2.3 and 2.4 (particularly Section 2.4.5.2) of the GOFC-GOLD Sourcebook contain useful explanations on how to estimate carbon stocks and changes in carbon stocks due to deforestation based on the IPCC documents. Examples on how the IPCC and other relevant guidance may be applied to specific projects can be found the proposed VCS REDD methodologies mentioned in the previous section.

In general, the procedure to calculate emission factors from carbon stock changes comprises the following 2 steps.

Step 1. Estimation of the carbon stocks of the forests and each post-deforestation LU/LC category identified in the project area

Carbon stock estimates in all relevant pools may be developed based on existing information (e.g. forest inventories and scientific studies), if recent and reliable. The GOFC-GOLD Sourcebook, Section 2.2.5.2.2 (page 57), proposes criteria on how to determine if existing data may be used for such estimates. If information is incomplete or not available, field measurements need to be carried out in the project area and/or in proxy areas. Instructions on how to establish sample sites and carry out field measurements are contained in a number of publications, including:

- The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (e.g. Volume 4, Chapter 2, Section 2.5.1 'Measurement-based tier 3 inventories')[52];
- Chapter 4.3 of the IPCC Good Practice Guidance on Land Use, Land-Use Change and Forestry (GPG-LULUCF)[53];
- the Sourcebook for Land Use, Land Use Change and Forestry Projects elaborated by the BioCarbon Fund (World Bank) and Winrock International[54];
- the FAO forest inventory field manual[55];

Table 3. Location of specific carbon stock estimation methods in the IPCC 2006 GL

Land use category and relevant chapter of the GL	Land use subcategory	Sections in relevant land use category chapter of the GL
Forest land Chapter 4	Forest land remaining forest land	4.2.1 Biomass 4.2.2 Dead organic matter 4.2.3 Soil carbon
Cropland Chapter 5	Land converted to cropland	5.3.1 Biomass 5.3.2 Dead organic matter 5.3.3 Soil carbon
Grassland Chapter 6	Land converted to grassland	6.3.1 Biomass 6.3.2 Dead organic matter 6.3.3 Soil carbon
Settlements Chapter 8	Land converted to settlements	8.3.1 Biomass 8.3.2 Dead organic matter 8.3.3 Soil carbon
Other land Chapter 9	Land converted to other land	9.3.1 Biomass 9.3.2 Dead organic matter 9.3.3 Soil carbon

Source: Adapted from the GOFC-GOLD Sourcebook (2009)

- the CDM A/R Methodological Tool 'Calculation of the number of sample plots for measurements within A/R CDM project activities'[56];
- Appendix A ('Developing an inventory of forest project carbon stocks') of the Climate Action Reserve Forest Project Protocol[57]; and
- the American Carbon Registry 'Tool for estimation of stocks in carbon pools and emissions from emission sources' (Version 1.0—August 2010) (draft for public comments)[58].
- In addition, the sampling calculator developed by Winrock is a free tool that may be useful when executing this step[59].

GHG emissions and removals per hectare vary according to site factors, forest or plantation types, stages of stand development and management practices. According to the IPCC 2006 GL, it is good practice to stratify the project area into various subcategories to reduce the variation in e.g. growth rate and other forest parameters and to reduce uncertainty. The more spatially variable the carbon stocks in a project, the more sampling plots are needed to attain a given precision at the same confidence level. This may result, in principle, in cost implications to implement the measuring and monitoring plan. Consequently, stratification of the project lands into a reasonable number of relatively homogeneous units can reduce the number of plots needed for measuring, monitoring and estimating.

Stratification needs to be carried out in the total area subject to deforestation in the project area and other relevant areas (i.e. leakage belt, reference region). After stratification of the forest, each stratum shall correspond to one forest class with a constant average carbon density (stock per hectare) over time. Post-deforestation carbon stocks will depend on post-deforestation land uses. The areas expected to be deforested need to be stratified as well, and each post-deforestation stratum will be represented by one or more post-deforestation land use classes for which the long-term average carbon stock needs to be estimated.

Guidance on how to carry out an adequate stratification according to a project's needs can be found in a number of publications, including:

- the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 3[60];
- the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry[61];
- the GOFC-GOLD Sourcebook, Chapter 2.2[62];
- the REDD methodology module 'Methods for stratification of the project area' developed by Avoided Deforestation Partners[63]; and
- the Sourcebook for Land Use, Land Use Change and Forestry Projects by the BioCarbon Fund (World Bank) and Winrock International[64].

Step 2. Determination of emission factors of all LU/LC change categories expected in the project area

Using the carbon stocks calculated in the previous step, the emission factors due to the transition from forest to other LU/LC categories are estimated by obtaining the difference—expressed as the average tonnes of carbon (tC) in all relevant pools per ha by strata—between the carbon stocks in the forest and in the post-deforestation LU/LC category. For example, assuming the conversion of montane forest with an estimated total carbon stock (considering all pools) of 130 tC/ha to shifting cultivation with a total carbon stock of 37 tC/ha, the resulting emission factor would be 93 tC per hectare deforested.

This step shall be carried out taking into account the minimum requirements to be considered by project proponents when developing and selecting GHG emissions or removal factors established in Section 6.5.2 of the VCS 2007.1 ('Quantification of GHG emissions and /or removals related to the methodology'), namely that such factors shall:

- be derived from a recognised origin;
- be appropriate for the GHG source or sink concerned;
- be current at the time of quantification;
- take account of the quantification uncertainty and be calculated in a manner intended to yield accurate and reproducible results; and
- be consistent with the intended use of the VCS-PD or monitoring report as applicable.

3.2.1.2.3 Estimation of harvested wood products in the baseline

As noted in Table 2, the wood products carbon pool must be accounted for by all VCS REDD project types when estimating their baselines, i.e. the amount of carbon that ended up in long-lived wood products must be estimated and deducted from the baseline emissions estimates (subject to the significance rule[65]). To do so, project designers shall follow the VCS provisions for wood products in IFM projects, which refer to the following sources:

- the PDD of the Noel Kempff Climate Action Project[66];
- the protocol for including harvested wood products of the Climate Action Reserve Forest Project Protocol[67];
- the voluntary reporting system of the US Government, known as 1605(b) after Section 1605(b) of the Energy Policy Act of 1992, Technical Guidelines for Voluntary Reporting of Greenhouse Gas Program, Chapter 1, Emission Inventories, Part I Appendix: Forestry (Appendix C—Scenarios of Harvest and Carbon Accumulation in Harvested Wood Products, Appendix D—Summary of Data and Methods Contributing to Calculation of the Disposition of Carbon in Har vested Wood Products); and Section 3: Measurement Protocols for Forest Carbon Sequestration[68].

3.2.1.2.4 Estimation of baseline GHG emissions

There are emissions of non-GHGs from biomass burning, livestock and manure management or soils that may happen in the baseline scenario. Non-CO_2 emissions in the baseline may be conservatively omitted by project participants, and under the VCS AFOLU, for inclusion of the non-CO_2 gases, the project developer must provide evidence that the practice for which they plan to claim credit is the common practice in the area. In such cases, emissions may be estimated using the instructions found in the following chapters of Volume 4 of the IPCC 2006 GL:

- Chapter 2, Section 2.4, which describes a generic approach to estimating non-CO_2 GHG emissions from fire[69];
- Chapter 5, when fire is used to convert forest to cropland (specifically, Section 5.3.4)[70];
- Chapter 6, Section 6.2.4, in cases where fire is used to convert forest to grassland[71];
- Chapter 10, for estimation of emissions from livestock and manure management[72]; and
- Chapter 11, when N_2O emissions from managed soils and CO_2 emissions from lime and urea application are considered[73].
- Emission factors to use with the above guidance can be found in the IPCC Emission Factor Database[74], which at present contains only the IPCC default data (default data presented in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories and the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories) and data from CORINAIR94, but the latter records may be renewed in due course in accordance with the latest version of CORINAIR data set.
- Additionally, the GOFC-GOLD Sourcebook, in its Chapter 2.5, explains the IPCC guidance on the estimation of GHG emissions from biomass burning, providing examples and sources of data to facilitate their application.
- The tool 'Estimation of GHG emissions related to fossil fuel combustion in A/R CDM project activities'[75] may also be applied in RED projects.

3.2.2. Baselines for RED projects under the Plan Vivo System

3.2.2.1 Plan Vivo Guidance

Step 1. Definition of the project type

The Plan Vivo Standards 2008[76] define only one eligible RED project type, which is the conservation of forests[77] and woodlands[78] under threat from deforestation. In such projects, forests shall be deemed to be under threat from deforestation where concrete and credible evidence is provided. All activities must be limited to the use of native or naturalised species and promote the restoration or protection of native ecosystems. Additionally, projects must promote sustainable land use practices that benefit communities in rural areas. Sustainable land use is defined as the planned use of land, consistent with meeting livelihood requirements and protecting soils, watercourses and biodiversity.

Step 2. Definition of the project boundary

a. **The geographical boundary within which the project will be implemented**: The Plan Vivo Guidance Manual states that technical specifications should define the project boundary, specifying which carbon stocks/emissions are included and which are excluded from the calculations. Additionally, the Plan Vivo PDD template[79] requires a map with geographical coordinates, demonstrating the project boundary/boundaries and describing the nature of the project area (i.e. large numbers of smallholder Plan Vivo projects in a certain project area, or a single project boundary for forest conservation, for example).
b. **The project crediting period:** The Plan Vivo Standards 2008 require technical specifications to define the crediting period, which shall be appropriate to the proposed project activity and have as the lower limit 10 years and an upper limit of 100 years, with 10-year increments.

c. **The sources and sinks, and associated types of GHGs (i.e. CO_2, N_2O, CH_4), the project will affect**: The Plan Vivo Standards do not specify which GHG emissions must be considered by project participants when estimating baselines.
d. **The carbon pools that the project will consider.** The Plan Vivo Manual establishes general guidance for all project types on which carbon pools should be taken into account when developing technical specifications. These are shown in Table 4.

Step 3. Projection of LU/LC in the baseline
Under the Plan Vivo Standards, determining a baseline involves gathering information on both a carbon baseline and a socio-economic baseline, to determine the factors which influence losses or other changes to carbon stock levels. Surveying the socio-economic baseline involves gathering information on:

- income levels;
- sources and types of income-generating activities;
- land use and agricultural practices;
- levels of education;
- relevant national/regional policies, circumstances or initiatives that would influence land use in the absence of the project; and
- sources of energy used.

The method for determining the carbon baseline varies according to the type of project activity to be developed. In the case of RED projects, the Plan Vivo Guidance Manual specifies that in order to calculate the carbon benefit the technical specifications must determine the rate of forest loss in the absence of the proposed activity. To this end, it requires an objective, risk-based prediction of future carbon emissions from land use change based upon the proximity of a given area to 'risk factors', such as roads, settlements and existing agriculture, as well as data on the carbon density of existing forest vegetation and an analysis of current regional land use trends.

Step 4. Estimation of baseline carbon stock changes
The Plan Vivo Standards do not define any specific requirements to estimate carbon stock changes in the baseline.

Step 5. Estimation of baseline GHG emissions
The Plan Vivo Standards do not mention any specific considerations to be taken into account when estimating baseline GHG emissions.

Step 6. Estimation of the baseline net GHG emissions and removals
The Plan Vivo Standards do not offer particular provisions on how to estimate baseline net GHG emissions and removals, but the Plan Vivo Manual requires avoided deforestation projects to present information on annual and total emission reductions, which implies the calculation of annual and total baseline estimates.

*3.2.2.2 Relevant methodological elements and tools for the development of **ex-ante** RED baselines following the Plan Vivo Standards*

This section presents specific methods that may help project designers develop the baseline elements of technical specifications for Plan Vivo project activities. Given that the basic approach of the Plan Vivo Standards to estimating RED baselines

Table 4. Carbon pools included in and excluded from calculations

Carbon pools included	Carbon pools not included
Aboveground woody biomass	Soil (small-scale projects) where the project has a minimal effect on soil carbon and/or it is uneconomic to measure
Aboveground non-woody biomass	
Belowground biomass	
Litter	
Dead wood	
Wood products	
Soil (where project activities involve a significant reduction in the soil carbon pool, in which case that loss must be deducted from carbon credits)	

is compatible with that used by the VCS, the methodological elements and tools summarised in Section 3.2.1.2 of this chapter are also applicable to the development of Plan Vivo technical specifications. However, taking into account the small-scale and limited technical capacity and funds usually linked to Plan Vivo projects, an additional effort is required to simplify these methods without compromising the environmental integrity of projects in order to comply with the Plan Vivo principle of balancing considerations of rigour with the need for flexibility, accessibility and cost-effectiveness. In order to illustrate how such simplifications may be carried out (particularly in the estimation of activity data and emission factors) relevant methodological elements of technical specifications proposed or already approved under the Plan Vivo System are introduced and summarised.

3.2.2.2.1 Activity data

As mentioned previously, the methods used to estimate the rate and location of deforestation for REDD VCS projects—used to estimate the activity data, i.e. the annual and total number of hectares deforested during the project's crediting period (summarised in Section 3.2.1.2.1 of this chapter)—may be applied to elaborate Plan Vivo technical specifications. However, in cases where the use of remote sensing and modelling of future deforestation scenarios is not feasible or too costly, a regional analysis of the relationship between land use change and certain key socio-economic and environmental causal factors (e.g. population density, distance from roads and agriculture) may be carried out, as proposed in the technical specification 'FOR-MAN—Forest management and conservation (tropical lowland humid forest)'[80] developed by AMBIO and approved by the Plan Vivo Foundation. This analysis is used to generate a 'risk matrix' that determines the risk of deforestation over a stated period for areas with defined socio-economic/ environmental characteristics. This risk matrix is applied to the area under the Plan Vivo forest management system to calculate the expected rate and location of deforestation in the future.

A similar approach has been developed for the technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[81], in which the future deforestation rate and areas are estimated through a Participatory Threat Mapping exercise with local stakeholders. Participatory Threat Mapping is an approach to threat assessment that enables local stakeholders to determine areas likely to be deforested or degraded in the absence of project activities within a defined period of time. It is based on the idea that in areas where local stakeholders interact closely with the forest, local knowledge of current and future threats to forest cover can contribute to clear and credible estimates for future reductions in carbon stocks, from which the carbon benefits of project activities can be estimated.

The technical specification 'Conservation of miombo woodland in Mozambique'[82] has proposed a third approach that estimates future deforestation in the absence of project activities by projecting historical deforestation rates into the future. The resulting rate must be justified by explaining and comparing the historical and current conditions in relevant indicators in the reference region. The areas of future deforestation are delimited to tracts of land that are Accessible, Cultivable and/or have Extractable value, and are effectively Unprotected (ACEU). If an area does not meet the ACEU criteria, the threat of deforestation is considered relatively low, and it is not included in the project. On the other hand, if there is evidence that land has been deforested in areas of similar conditions in terms of topography and the value of land, this is considered sufficient evidence of threat to justify the inclusion of an area as part of the project.

3.2.2.2.2 Emission factors from carbon stock changes

Given that estimates of carbon stock changes included in technical specifications are usually based on local surveys, the guidance contained in Section 3.2.1.2.2, Steps 1 and 2, of this chapter may be useful to estimate emission factors from carbon stock changes for Plan Vivo RED projects. Additionally, specific methodologies developed to facilitate the measurement of baseline carbon stocks by communities in a cost-effective way, such as the 'Field guide for assessing and monitoring reduced forest degradation and carbon sequestration by local communities'[83], may be helpful. Alternatively, where applicable and justifiable, default values of average carbon stocks in the pre- and post-deforestation scenarios—such as those provided by the IPCC 2006 GL or the IPCC Emission Factors Database—may be applied to estimate the emission factors resulting from the land use change. Moreover, elements from the CDM small-scale A/R methodologies may also be useful to develop simplified forest carbon stock inventories and, in general, to obtain ideas on how methods may be simplified when designing baseline and monitoring approaches[84].

3.2.2.2.3 Estimation of harvested wood products in the baseline

Given that the Plan Vivo Standards do not establish specific provisions on how to account for changes in the wood products carbon pool, the guidance offered in Section 3.2.1.2.3 above may also be applicable to technical specifications. However, it must be noted that—possibly due to cost-effectiveness concerns—most of the existing RED technical specifications do not consider this pool in their estimations (see for instance the approved technical specification 'Forest management and conservation (tropical lowland humid forest)' developed by AMBIO or the proposed technical specification 'Avoiding Unplanned mosaic deforestation and degradation in Malawi'[85]).

3.2.2.2.4 Estimation of baseline GHG emissions

As in the case of wood products, GHG emissions in the baseline are usually not considered by Plan Vivo technical specifications. Nevertheless, if considered significant, project designers may use the guidance presented in Section 3.2.1.2.4 of this chapter to include such emissions in their technical specifications, or propose simplified approaches based on it.

3.3. Baselines for projects reducing emissions from forest degradation

The baseline scenarios for projects avoiding forest degradation are similar to those for RED projects, with the main difference that in the former, the area, canopy cover and tree height never reach levels below the minimum values that define a 'forest' under the relevant standard during the crediting period. Consequently, the steps for estimating forest degradation baselines are essentially the same as for RED projects (presented in Section 3.2 above), with the exception that degradation does not generate a land use change but a long-term decline in the density of a forest that remains a forest (and in its carbon stocks). Illustrative examples of possible projects are shown in Figure 7. The procedure to estimate the baseline of projects reducing emissions from forest degradation comprises:

Step 1 Definition of the project type
Step 2 Definition of the project boundary
Step 3 Projection of forest degradation in the baseline
Step 4 Estimation of baseline carbon stock changes
Step 5 Estimation of baseline GHG emissions
Step 6 Estimation of the baseline net GHG emissions and removals

3.3.1. Baselines for projects avoiding emissions from forest degradation under the VCS

3.3.1.1 VCS Guidance

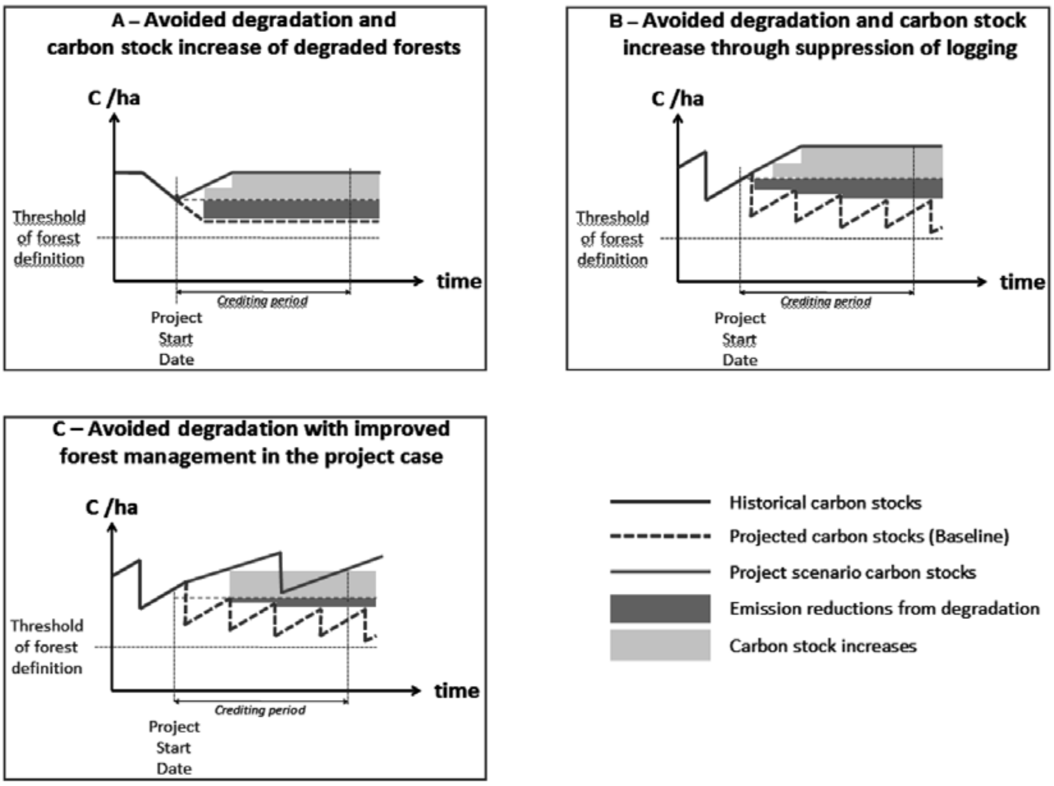
Step 1. Definition of the project type
The VCS AFOLU documents include guidance on how to develop baselines for the following 2 different types of projects reducing emissions from forest degradation.

a. **Projects reducing emissions from unplanned degradation**: Guidance for this type of projects is included as part of the provisions for projects avoiding unplanned frontier deforestation and degradation and for those avoiding unplanned mosaic deforestation and degradation, addressed in Section B of this chapter.
b. **Projects reducing emissions from planned degradation**: This type of project is eligible for crediting under the VCS as part of its improved forest management (IFM) category only where project areas have been designated, sanctioned or approved to be managed for wood products such as saw timber, pulpwood and fuelwood (e.g. as logging concessions or plantations) by the national or local regulatory bodies. In particular, the following 2 improved forest management practices creditable under the VCS deal with planned degradation.
    i. **Conversion of logged forests to protected forests (LtPF)**. This includes: (1) protecting currently logged or degraded forests and plantations from further logging and degradation; and (2) protecting unlogged forests that would be logged in the absence of carbon finance. Generally speaking, converting logged forests to protected forests reduces emissions caused by harvesting (i.e. protects carbon stocks) and increases the carbon stock as the forest regrows and/or continues to grow.
    ii. **Conversion of low-productive forests to high-productive forests (LtHP)**. Low-productive forests usually satisfy one of the

following conditions: they qualify as forest as defined by the host country, but do not contain much timber of commercial value; they are either degraded or in the process of degrading due to frequent disturbance (fire, animal grazing, fuelwood gathering, etc.); or they have a very slow growth rate or low crown cover. Project activities relevant to this section of the document include, for example, the mitigation of disturbance events.

Step 2. Definition of the project boundary
According to the VCS AFOLU guidance documents[86], the project boundary for the REDD and IFM project types reducing degradation is defined by the following.

a. **The geographical boundary within which the project will be implemented:** Project participants need to clearly define the spatial boundaries of a project so as to facilitate accurate measuring, monitoring, accounting and verifying of the project's emission reductions/removals.
b. **The project crediting period:** This is the period of time for which the net GHG emission reductions or removals will be verified, which under the VCS is equivalent to the project lifetime. The project must have a robust operating plan covering this period. The project crediting period for REDD and IFM projects shall be between 20 and 100 years.
c. **The sources and sinks, and associated types of GHGs (i.e. CO_2, N_2O, CH_4), the project will affect**: Projects must account for any significant sources (sinks are optional) of CO_2, N_2O and CH_4 that are reasonably attributable to project activities. Emissions of N_2O from project activities within the project area, including from application of all N-containing soil amendments (e.g. inorganic fertiliser, organic fertiliser, manure and plant residues), and N_2O emissions caused by microbial decomposition of any plant material including trees, shrubs and herbaceous vegetation that fix nitrogen, may be considered insignificant for IFM and REDD projects[87] and do not have to be accounted for. Emissions from removal



Source: Adapted from Pedroni, Lucio. 'Illustration of eligible VCS activities (REDD mosaic and frontier methodologies)'. Carbon Decisions International, 2010.

Figure 7. Examples of projects reducing emissions from degradation

or burning of herbaceous vegetation, fossil fuel combustion from transport in project activities and collection of non-renewable wood sources for fencing of the project area may be considered insignificant for IFM and REDD projects and do not have to be accounted for. Other GHG sources may be considered insignificant and do not have to be accounted for if together such omitted decreases in carbon pools and increases in GHG emissions amount to less than 5% of the total CO_2-eq benefits generated by the project[88].

d. **The carbon pools that the project will consider:** The carbon pools that shall be accounted for by IFM and REDD projects addressing forest degradation under the VCS are shown in Table 5.

As mentioned previously, the VCS guidance allows pools to be omitted if their exclusion leads to conservative estimates of the number of carbon credits generated. Specific inclusions and exclusions of pools according to the project category and type are given in the VCS Tool for AFOLU Methodological Issues (page 5)[90] and in the VCS Guidance for AFOLU Projects (page 17)[91].

Step 3. Projection of forest degradation in the baseline
The VCS AFOLU provisions for REDD projects covering forest degradation (i.e. AUFDD and AUMDD) are presented in Section 3.2 above and therefore are not repeated here. In the case of IFM project activities, project developers using a project-based approach (rather than a performance/ benchmark standard)[92] for establishing a baseline shall provide the following information to prove that they meet minimum acceptable standards:

a. a documented history of the operator (e.g. operator shall have 5 to 10 years of management records to show normal historical practices); common records would include data on timber cruise volumes, inventory levels, harvest levels, etc. on the property;
b. the legal requirements for forest management and land use in the area, unless verifiable evidence can be provided demonstrating that common practice in the area does not adhere to such requirements; and
c. proof that their environmental practices equal or exceed those commonly considered a minimum standard among similar landowners in the area.

The baseline for the IFM project is then the management practices projected through the life of the project, satisfying at a minimum the 3 requirements mentioned above.

Step 4. Estimation of baseline carbon stock changes
The VCS AFOLU guidance documents do not provide specific instructions on how to estimate baseline carbon stock changes in IFM projects. However, the general methodological guidance offered by the Tool for AFOLU Methodological Issues (page 4) points out that the *ex-ante* determination and quantification of the baseline and project scenario, including the leakage assessment, shall follow either relevant IPCC 2006 Guidelines for AFOLU, or approved CDM or VCS methodologies.

Step 5. Estimation of baseline GHG emissions
As mentioned in Section 3.2 above, AUFDD and AUMDD projects wanting to include emissions of non-CO_2 gases in their baselines must provide evidence that the practice for which they plan to claim credit is the common practice in the area. No additional guidance for non-CO_2 baseline emissions exists for IFM projects avoiding degradation, but if such emissions are expected to occur (for instance, when degradation is due to disturbances involving the use of fire) and project proponents wish to account them (not doing so would be conservative), the general methodological guidance offered by the Tool for AFOLU Methodological Issues, establishing that the *ex-ante* determination and quantification of the baseline shall follow either relevant IPCC 2006 Guidelines for AFOLU or approved CDM or VCS methodologies.

Step 6. Estimation of the baseline net GHG emissions and removals
As mentioned in Step 6 of Section 3.2, according to VCS guidance, project proponents must estimate the baseline net GHG emissions and removals for each year of the proposed crediting period expressed in CO_2 equivalents.

3.3.1.2 Relevant methodological elements and tools for the development of ex-ante baselines for projects reducing emissions from forest degradation following the VCS

Following the same approach introduced in Section 3.2.1.2, recognised methods and approved and proposed VCS-IFM and other relevant baseline methodologies to estimate *ex-ante* the annual areas that would be degraded in the absence of the project during the crediting period (activity data) and the changes in carbon stocks that would result from such forest degradation (emission factors) are presented below. Methods applicable to REDD AUFDD and AUMDD projects, as well as those required to calculate baseline harvested wood products and non-CO_2 emissions in RED projects, introduced in Section 3.2, are also valid for avoided unplanned degradation projects and for practical reasons are not repeated here. In addition, given that the baseline for the planned degradation project types relevant to this section (LtPF and LtHP) is similar, the following guidance applies to both of them.

3.3.1.2.1 Activity data

In general, in order to estimate the activity data required to develop the baseline emissions from carbon stock changes, it is necessary to estimate the annual rate at which degradation would occur so as to quantify the area that would be degraded annually and in total in the baseline during the crediting period.

For planned and legally authorised degradation (logging) projects LtPF and LtHP, the rate, annual and total areas (as well as the location) of baseline forest degradation are derived from the legal management permit issued by the relevant governmental authority and the ensuing management practices projected through the life of the project, considering the history of the operator, the relevant legal requirements (including their enforcement status) and the common environmental practices in the project context.

Although at present no LtPF or LtHP methodologies have been validated under the VCS, some ideas on how to project future planned degradation may be found in the PDD of the Noel Kempff project (Baseline Component A), which projects the baseline timber harvest within the host country and within the project area based on a model of the domestic and international timber markets. The potential pathway of future harvests both in the project area and in the entire country are simulated through a dynamic optimisation model implemented in GAMS™, an algebraic modelling system for mathematical programming and optimisation.

Further approaches have been elaborated in methodologies currently undergoing the process of VCS approval[94]. For example, the proposed methodology ‘Improved forest management—logged to protected forest on fee simple forested properties, V.7.0. July 28, 2010’[95], developed by 3GreenTree and ERA Inc., projects the impact of

Table 5. Pools to be considered by VCS project activities avoiding forest degradation

Project type	Living biomass			Dead organic matter			
	Above ground trees	Above ground non-tree	Below ground	Litter	Dead wood	Soil	Wood products
Planned or unplanned conversion of forest to non-forest, with final land cover of annual crop	Y	O	O	N	O	O	Y
Planned or unplanned conversion of forest to non-forest, with final land cover of pasture grasses	Y	O	O	N	O	N	Y
Planned or unplanned conversion of forest to non-forest, with final land cover of perennial crop	Y	Y	O	N	O	N	Y
Conversion of logged to protected forests	Y	N	O	N	Y	O	Y
Conversion of low-productive forests to productive forests	Y	N	O	N	O	N	O

Notes:
Y: Pool shall be included in the baseline and monitoring plan for the project.
N: Pool need not be measured because it is not subject to significant changes or potential changes are transient in nature.
O: Pool is optional: it shall be included if its carbon stock is significantly reduced by the project[89]; and may be included if its carbon stock is significantly increased by the project.

the baseline activities over time by analysis unit within the harvestable areas within the project boundary through the use of one or more modelling tools, including, for example, a stand-level forest productivity model and a landscape-level harvest schedule model.

Additionally, the Climate Action Reserve Forest Project Protocol, in its Appendix B[96] provides useful guidance on how to model future carbon stocks, and offers a list of the forest growth models (often referred to as growth and yield simulation models) approved for use with the Protocol (and the VCS[97]), which project the results of direct sampling through simulated forest management activity. Such models include:

- CACTOS: California Conifer Timber Output Simulator[98]
- CRYPTOS: Cooperative Redwood Yield and Timber Output Simulator[99]
- FVS: Forest Vegetation Simulator[100] (which includes FVS carbon reports, part of the Fire and Fuels Extension to FVS and used to estimate the amount of carbon stored in various forest stand components, such as standing live and dead trees and surface fuels, over time)
- FPS: Forest Projection System [101]
- FREIGHTS: Forest Resource Inventory, Growth, and Harvest Tracking System
- CRYPTOS Emulator
- FORESEE[102]

In countries and regions where specific forestry models do not exist or are not available, a simple spreadsheet-based model (including common simple growth models such as the Chapman–Richards model of tree growth appropriately parameterised) may be used. Spreadsheet models may also be necessary to extrapolate some growth models to include additional pools and harvest schedules.

3.3.1.2.2 Emission factors from carbon stock changes

The emission factors are equal to the difference, expressed in tC/ha, between the carbon stocks found in the project area at project start in all relevant pools and those resulting from degradation activities in the baseline. Methods to estimate such carbon stock changes are included in Volume 4, Chapter 4.2 'Forest land remaining forest land' of the IPCC 2006 GL[103]. The GOFC-GOLD Sourcebook, Chapter 2.4.6, contains a brief explanation of how such methods are applied.

The steps to estimate the emission factors for VCS-IFM projects avoiding planned forest degradation are similar to those used for RED baselines explained in Section 3.2.1.2.2 above, with the difference that, in Step 2, the emission factors are obtained by estimating the changes in carbon stocks in all relevant pools—per ha and by strata—resulting from degradation activities over time (i.e. areas within the project boundaries may go through different degradation stages implying different carbon stocks as time goes by) departing from the initial stocks in the forest and considering forest regrowth and wood products. The amount of carbon in long-lived wood products must be estimated and deducted from the baseline emissions estimates as explained in Section 3.2.1.2.3 above.

It must be noted that some of the models mentioned in the previous section automatically estimate the annual change in carbon stocks in live aboveground tree biomass, dead wood and wood products by strata through the selected period, while other models provide the annual carbon stock and require the project proponent to estimate the change in carbon stocks, which should be calculated as the difference in stocks between one year and the next. Likewise, if the output of the models is the tree volume, it may be converted to biomass and carbon using the guidance of the IPCC 2006 GL, Chapter 4.2 (e.g. Box 4.2 'Biomass conversion and expansion factors for assessing biomass and carbon in forests').

3.3.2. Baselines for projects reducing emissions from forest degradation under the Plan Vivo System

3.3.2.1 Plan Vivo Guidance

Even though neither the Plan Vivo Standards nor the Plan Vivo Manual excludes projects reducing emissions from forest degradation, this type of project is not explicitly covered by any of the eligible activities under their umbrella: the guidance for projects conserving forests and woodlands under threat from deforestation does not make reference to the reduction of emissions from degradation (see Section 3.2.2.1 above), and the Plan Vivo project type 'Restoration and reforestation of degraded or damaged ecosystems' covers activities increasing carbon stocks by assisting the recovery of forests that have already been degraded or damaged, and is therefore addressed in Section 3.4 of this chapter ('Baselines for sustainable forest management projects').

Nevertheless, there is the possibility that the Plan Vivo Association may accept the application of its guidance for RED projects to those reducing degradation, as has been done in the proposed technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[104]. If approved, this technical specification could set the precedent for the development of such projects under the Plan Vivo System. In this case, Sections 3.2.2 and, where applicable, 3.3.1 of this chapter may be followed for the development of baselines for this project type.

3.4. Baselines for sustainable forest management projects

In general, sustainable forest management activities are implemented on forest lands managed for wood products such as saw timber, pulpwood and fuelwood. Common baseline scenarios for this project type include degrading forests and forests harvested using suboptimal management practices or practices not focused on maximising carbon stocks (see illustrative examples in Figure 8). Since projects reducing emissions against a baseline of forest degradation have already been covered in Section 3.3 of this chapter, this section focuses on the development of baseline scenarios where management practices maintain or have resulted in (more or less) stable average carbon stocks over time, but have not maximised them.

The general procedure to estimate the baseline of sustainable forest management projects comprises:

- Step 1 Definition of the project type
- Step 2 Definition of the project boundary
- Step 3 Projection of forest management in the baseline
- Step 4 Estimation of baseline carbon stock changes
- Step 5 Estimation of baseline GHG emissions
- Step 6 Estimation of the baseline net GHG emissions and removals

3.4.1. Baselines for Sustainable Forest Management projects under the VCS

3.4.1.1 VCS Guidance

Step 1. Definition of the project type
The IFM category of the VCS AFOLU contains a number of eligible project types, some of which address planned degradation (or unsustainable logging)—presented in Section 3.3 of this chapter—while others reduce the emissions associated to their operations and increase carbon stocks through enhanced practices in managed forests. This section focuses on the latter type of VCS-IFM projects, namely:

a. **Conversion from conventional logging to reduced impact logging (RIL)** typically reduces carbon emissions during timber harvesting due to: reductions in damage to other trees (by implementing directional felling or vine cutting, etc.); improved selection of trees for harvesting based on inventoried knowledge concerning tree location and size; improved planning of skid trails (in peat swamp forests this could include avoiding the use of canals to extract the logs—the canals

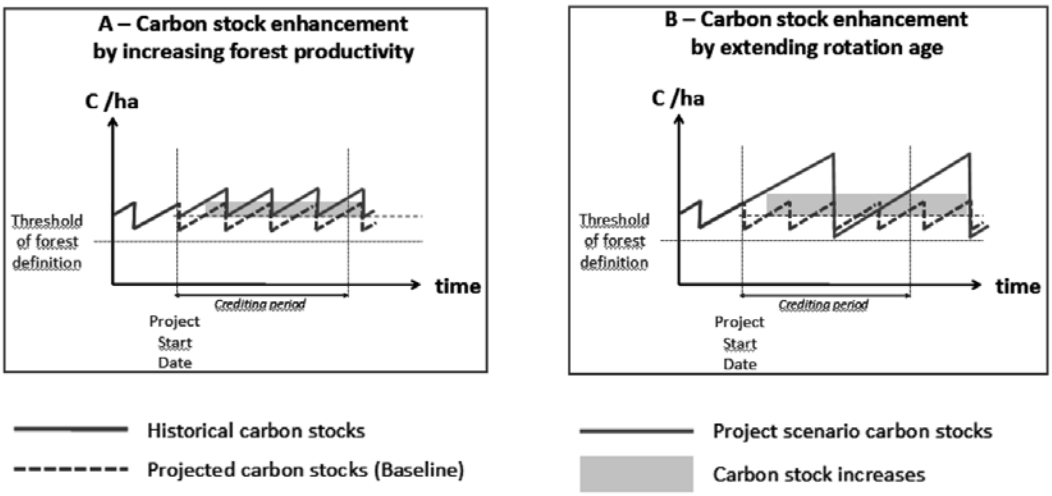


Figure 8. Examples of sustainable forest management projects

drain the peat and increase CO_2 emissions) and roads; and the reduced size of logging roads.

b. **Extending the rotation age of evenly aged managed forests (ERA)**. Trees are typically harvested at an economic or optimal rotation age; extending the age at which the trees are cut increases the average carbon stock on the land. There is no fixed period of years over which the extension should occur, but generally the longer the period (in the order of 5–20 years), the more the average carbon stock increases.

c. **Conversion of low-productive forests to high-productive forests (LtHP)**, or improving poorly stocked forests, can also increase the carbon stock. As mentioned previously, low-productive forests usually have a very slow growth rate or low crown cover. Project activities relevant to this section of the reference guide include the introduction of other tree species with higher timber value or growth rate, the adoption of enrichment planting to increase the density of trees and/or other forest management techniques (e.g. fertilisation, liming) to increase carbon stocks.

Step 2. Definition of the project boundary

According to the VCS AFOLU guidance documents the project boundary for IFM project types is defined by the following.

a. **The geographical boundary within which the project will be implemented:** Project participants need to clearly define the spatial boundaries of a project so as to facilitate accurate measuring, monitoring, accounting and verifying of the project's emission reductions/removals.

b. **The project crediting period:** This is the period of time for which the net GHG emission reductions or removals will be verified, which under the VCS is equivalent to the project lifetime. The project must have a robust operating plan covering this period. The project crediting period for IFM projects shall be between 20 and 100 years.

c. **The sources and sinks, and associated types of GHGs, the project will affect**: Projects must account for any significant sources (sinks are optional) of CO_2, N_2O and CH_4 that are reasonably attributable to project activities. Emissions of N_2O from project activities within the project area, including from application of all N-containing soil amendments (e.g. inorganic fertiliser, organic fertiliser, manure and plant residues), and N_2O emissions caused by microbial decomposition of any plant material including trees, shrubs and herbaceous vegetation that fix nitrogen, may be considered insignificant for IFM projects[105] and do not have to be accounted for. Emissions from removal or burning of herbaceous vegetation, fossil fuel combustion from transport in project activities and collection of non-renewable wood sources for fencing of the project area may be considered insignificant for IFM projects and do not have to be accounted for. Other GHG sources may be considered insignificant and do not have to be accounted for if together such omitted decreases in carbon pools and increases in GHG emissions amount to less than 5% of the total CO_2-eq benefits generated by the project[106].

d. **The carbon pools that the project will consider.** The carbon pools that shall be accounted for by IFM projects relevant to this section of the reference guide are presented in Table 6.

As noted in previous sections, the VCS guidance allows pools to be omitted if their exclusion leads to conservative estimates of the number of carbon benefits generated. The VCS Tool for AFOLU Methodological Issues (page 5)[108] and the VCS Guidance for AFOLU Projects (page 17)[109] include guidance on specific inclusions and exclusions of pools according to the project category and type.

Step 3. Projection of forest management in the baseline

As mentioned in Section 3.3, the VCS AFOLU provisions for IFM project activities request project developers using a project-based approach (rather than a performance/benchmark standard)[110] for establishing a baseline to provide the following information to prove that they meet minimum acceptable standards:

a. a documented history of the operator (e.g. operator shall have 5 to 10 years of management records to show normal historical practices); common records would include data on timber cruise volumes, inventory levels, harvest levels, etc. on the property[111];

b. the legal requirements for forest management and land use in the area, unless verifiable evidence can be provided demonstrating that common practice in the area does not adhere to such requirements; and

c. proof that their environmental practices equal or exceed those commonly considered a minimum standard among similar landowners in the area.

Consequently, the baseline for IFM projects represents the emissions and carbon stocks entailed by the management practices projected through the life of the project, satisfying at a minimum the 3 requirements mentioned above.

Step 4. Estimation of baseline carbon stock changes
As pointed out in Section 3.3 of this chapter, the VCS AFOLU guidance documents do not offer specific instructions on how to estimate baseline carbon stock changes in IFM projects, but the general methodological guidance offered by the Tool for AFOLU Methodological Issues (page 4) notes that the *ex-ante* determination and quantification of the baseline and project scenario, including the leakage assessment, shall follow either relevant IPCC 2006 Guidelines for AFOLU, or approved CDM or VCS methodologies.

Step 5. Estimation of baseline GHG emissions
No specific guidance for non-CO_2 baseline emissions exists for IFM projects, but if significant, project proponents may wish to account them using the general methodological guidance offered by the Tool for AFOLU Methodological Issues, which dictates that the *ex-ante* determination and quantification of the baseline shall follow either relevant IPCC 2006 Guidelines for AFOLU, or approved CDM or VCS methodologies. Not accounting such emissions in the baseline would be conservative.

Step 6. Estimation of the baseline net GHG emissions and removals
As mentioned in previous sections, project proponents must estimate (in CO_2 equivalents) the baseline net GHG emissions and removals for each year of the proposed crediting period.

3.4.1.2 Relevant methodological elements and tools for the development of ex-ante baselines for improved management projects following the VCS

Baselines for the VCS project types improving forest management practices covered in this section (RIL, ERA and LtHP) are similar to those for IFM projects reducing emissions from planned forest degradation (i.e. LtPF and the LtHP project types presented in Section 3.3) in that both represent a scenario where the project area contains a forest that has been legally sanctioned to be harvested. In fact, the VCS AFOLU guidance on baselines for both groups of IFM projects is practically identical, with the exception of the carbon pools that shall be considered by each project type. The same applies to the methodological elements and tools for the estimation of planned degradation baselines that were introduced in Section 3.3.1.2 above, which are not repeated here for the sake of

Table 6. Pools to be considered by VCS project activities improving forest management

Project type	Living biomass			Dead organic matter			
	Above ground trees	Above ground non-tree	Below ground	Litter	Dead wood	Soil	Wood products
Convert logged to protected forests	Y	N	O	N	Y	O	Y
Convert low-productive forests to productive forests	Y	N	O	N	O	N	O
Conventional logging to RIL: A. with no effect on total timber extracted	Y	N	O	N	Y	O	N
B. with >25% reduction in timber extracted	Y	N	O	N	Y	O	Y
Extend rotation age	Y	N	O	N	O	N	O

Notes:
Y: Pool shall be included in the baseline and monitoring plan for the project.
N: Pool need not be measured because it is not subject to significant changes or potential changes are transient in nature.
O: Pool is optional: it shall be included if its carbon stock is significantly reduced by the project[107]; and may be included if its carbon stock is significantly increased by the project.

brevity. Nevertheless, it is suggested to ERA project developers to refer, in addition to such guidance, to the approved VCS 'Methodology for improved forest management through extension of rotation age'[112] (VM0003, Version 1.0) for further examples of how management practices may be modelled to construct baselines.

3.4.2. Baselines for sustainable forest management projects under the Plan Vivo System

3.4.2.1 Plan Vivo Guidance

Step 1. Definition of the project type
Even though under the Plan Vivo System the sustainable management of forests is not *per se* a project type, the standards contain the project category 'Restoration and reforestation of degraded or damaged ecosystems', which encompasses activities increasing carbon stocks by assisting the recovery of forests that have been degraded or damaged. It must be noted that in this section only the forest restoration activities covered by this Plan Vivo project type are addressed; reforestation (by definition carried out in non-forest areas) is not considered as part of the REDD+ umbrella for the purposes of this reference guide (for more details, read the explanation offered in the introductory chapter).

Step 2. Definition of the project boundary

1. **The geographical boundary within which the project will be implemented**: As mentioned in Section 3.2.2.1, the Plan Vivo Guidance Manual establishes that technical specifications for all eligible project types should define the project boundary making specific reference to which carbon stocks/emissions are included and which are excluded from the calculations. Additionally, the Plan Vivo PDD template[113] requires a map with geographical coordinates, demonstrating the project boundary/boundaries and describing the nature of the project area (i.e. large numbers of smallholder Plan Vivo projects in a certain project area, or a single project boundary for forest conservation, for example).
2. **The project crediting period:** The Plan Vivo Standards 2008 require technical specifications to define the crediting period, which shall be appropriate to the proposed project activity and have as the lower limit 10 years, and an upper limit of 100 years, with 10-year increments.
3. **The sources and sinks, and associated types of GHGs (i.e. CO_2, N_2O, CH_4), the project will affect**: The Plan Vivo Standards do not specify which GHG emissions must be considered by projects relevant to this section.
4. **The carbon pools that the project will consider.** As stated in Section 3.2.2.1 above, the Plan Vivo Manual establishes general guidance for all project types on which carbon pools should be taken into account when developing technical specifications, which are presented in Table 3.

Step 3. Projection of Land Use/Land Cover in the baseline
According to the Plan Vivo Guidance Manual, the carbon baseline in areas where sequestration activities are planned represents carbon stocks in existing vegetation and expected changes in land use. Current carbon stocks should be estimated through biomass surveys or using data in the available literature.

Step 4. Estimation of baseline carbon stock changes
The Plan Vivo Standards do not establish any specific requirements to estimate carbon stock changes in the baseline.

Step 5. Estimation of baseline GHG emissions
The Plan Vivo Standards do not mention any particular considerations to be taken into account when estimating baseline GHG emissions.

Step 6. Estimation of the baseline net GHG emissions and removals
The Plan Vivo Standards do not define special requirements to estimate the baseline net GHG emissions and removals.

*3.4.2.2 Relevant methodological elements and tools for the development of **ex-ante** sustainable forest management baselines following the Plan Vivo Standards*

This section introduces methods that may be used for the construction of baselines according to the Plan Vivo guidance for the forest restoration projects presented above. Given that the provisions for the estimation of non-CO_2 GHG emissions in the baseline are the same for all the eligible Plan Vivo project types, the guidance offered in Section 3.2.2.2.4 above (and not repeated in this section), may also be helpful when establishing baselines for restoration projects.

3.4.2.2.1 Activity data

To date, only one technical specification focused specifically on forest restoration has been approved by the Plan Vivo Foundation: the technical specification 'FOR-REST-SUBT1—Sub-tropical forest restoration'[114].

This specification was developed by AMBIO and contains a regeneration component. It assumes that the baseline is the carbon stock in a typical open forest based on the assumption that current land use would continue unchanged and that the long-term average carbon storage would be the same as the current carbon stock. Details of the modelling approach and parameters used (initial biomass; maximum potential biomass per ha; species distribution; maximum growth; biomass allocation relative to stem; average annual mortality; wood carbon content; turnover and decomposition factors; product allocation and lifetime) are given in the publication 'Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level'[115]. Details of the productivity data are based on the article 'Community forest management and carbon sequestration: a feasibility study from Chiapas, Mexico'[116].

Moreover, taking into account that the Plan Vivo guidance for forest restoration activities is not prescriptive about how carbon stock changes should be projected in the baseline scenario, and given the similarities that may exist between some activities under this Plan Vivo project type and VCS projects converting low-productive forests to high-productive forests (or LtHP), the methods proposed for the latter in Section 3.4.1.2 may also be used, adapted and/or simplified to elaborate technical specifications for projects restoring forests.

3.4.2.2.2 Emission factors from carbon stock changes

As in the case of VCS IFM projects discussed in Section 3.4.1.2, the emission factors for forest restoration baselines represent the difference between the carbon stocks existing in the forest at project start and those resulting from the expected baseline management practices during the crediting period (expressed in tC/ha/year). Guidance for determining the initial carbon stock inventory and estimating baseline carbon stock changes can be found in the sources referenced in Section 3.3.1.2.2 above.

3.4.2.2.3 Estimation of harvested wood products in the baseline

In order to estimate harvested wood products in the baseline of Plan Vivo restoration projects, the approach used by the approved technical specification 'FOR-REST-SUBT1—Sub-tropical forest restoration' based on the publication 'Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level'[117] may be followed. In addition, the guidance offered in Section 3.2.1.2.3 could be adapted as necessary for the inclusion of this pool in new technical specifications.

4. Additionality

4.1. Basic concepts

All REDD+ projects need to demonstrate that they are additional, i.e.:

1. **for projects reducing GHG emissions:** that anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the project activity; and
2. **for project increasing carbon stocks:** that the actual net GHG removals by sinks[118] are increased above the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the project.

Baseline and monitoring methodologies must include methods to analyse the additionality of projects, and project design documents require the application of such methods to the proposed project activities. A number of methodological tools and approaches are available to demonstrate and assess the additionality of projects. This chapter introduces and briefly summarises those approved by the VCS and the Plan Vivo Standards that are applicable to REDD+ project activities.

4.2. Methods for the demonstration and assessment of additionality

4.2.1. Under the VCS

The VCS 2007.1 establishes that, in addition to using a VCS Program-approved methodology, the project proponent shall demonstrate that the project is additional using one of the following 3 tests:

1. the project test, which determines additionality based on regulatory surplus, implementation barriers and common practice;
2. the performance test, which assesses the project's regulatory surplus and performance standards; and
3. the technology test, which evaluates the project's regulatory surplus and technology additionality.

Detailed information on how each of these tests is carried out is contained on page 16 of the VCS 2007.1[119].

In addition to these tests, the VCS Association has developed the 'Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities—VT0001'[120], which has already been approved by the VCS AFOLU Steering Committee. The procedure depicted by the tool is presented in Figure 9. This tool was adapted from the 'Tool for the demonstration and assessment of additionality in A/R CDM project activities'[121], which—as with all other CDM-approved tools—may also be used by VCS projects and methodologies. Likewise, the 'Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities'[122] may be adjusted as required by project developers to be used with REDD+ project activities.

4.2.2. Under the Plan Vivo Standards

According to the Plan Vivo Standards 2008, Plan Vivo projects are highly additional, since they work only with small-scale producers and communities in developing countries that would otherwise lack the financial, technical and organisational capacity to implement sustainable land use activities that result in carbon sequestration and other ecosystem benefits.

Nevertheless, according to the Plan Vivo Manual[123] (pages 30–31) project proponents must demonstrate the following, as a minimum.

1. **The additionality of the project:** The project does not owe its existence to legislative decrees or to commercial land use initiatives likely to have been economically viable in their own right without payments for ecosystem services. Although in the first few years projects may receive financial support from research or other funding institutes, 100% of producer payments are made out of carbon finance derived from sales explicitly allocated to them. Therefore, if a sale has not been made, planting will not go ahead. This aspect of the Plan Vivo System is designed so that projects are *de facto* additional.
2. **The additionality of the activities:** In the absence of project development funding and carbon finance, financial, technical, social,

cultural, technical, ecological or institutional barriers would have prevented the project activity. Moreover, the Plan Vivo Manual recommends carrying out an analysis of what land use activities are common practice in order to strengthen the credibility of the barriers assessment.

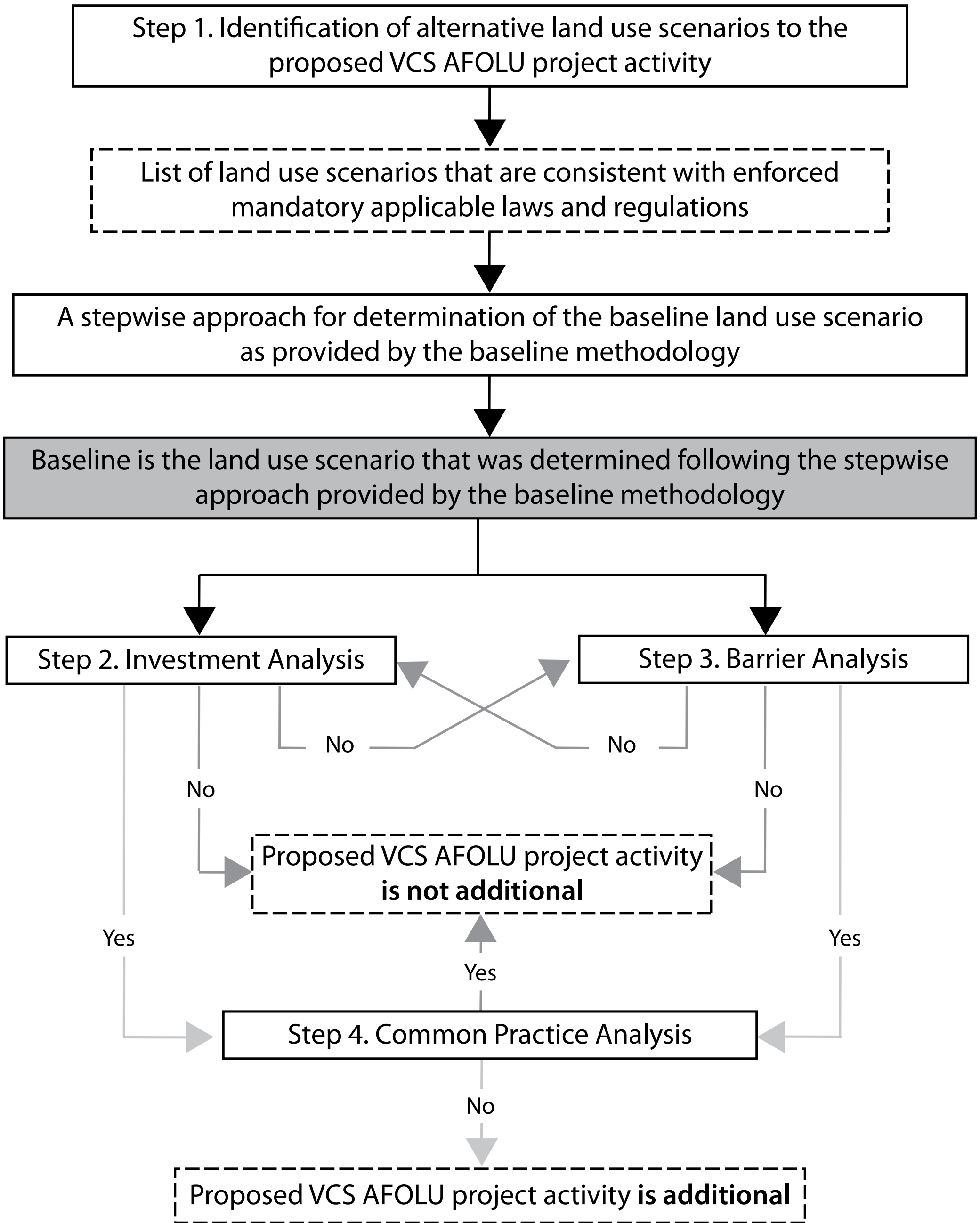


Figure 9. Indicative flowchart of the tool for the demonstration and assessment of additionality in VCS AFOLU project activities

5. Estimating project emissions

5.1. Basic concepts

The goal of this chapter is to provide guidance on how to estimate *ex-ante* and *ex-post* carbon stock changes and non-CO_2 emissions due to the implementation of REDD+ projects. *Ex-ante* estimates are carried out based on the expected effectiveness of the proposed measures to reduce emissions from deforestation and/or increase carbon stocks during the crediting period. In general, the rationale for *ex-ante* estimates is to facilitate the optimal implementation of the project activities and to provide indicative projections of the carbon benefits and associated revenues; however, *ex-ante* calculations have different functions in each of the standards covered in this reference guide.

- In the case of the VCS, the *ex-ante* project scenario serves to determine the project's carbon benefits, which are used for the identification of significant emission sources and carbon stock changes in pools using the 'CDM A/R significance tool'. Moreover, methods applied to estimate the project scenario *ex-ante* are also used to obtain *ex-post* estimates, but employing as input the data monitored by project participants, and, in its case, omitting insignificant emissions and pools.
- Under the Plan Vivo Standards, project carbon stock changes and carbon benefits are only estimated *ex-ante* and included in the technical specifications of specific projects. *Ex-post* project benefits are assumed to equal such estimates if the monitored performance indicators (e.g. forest cover in the project area, establishment of fire breaks, etc.) show that the targets for the implementation of project activities established in the technical specifications are met as scheduled.

Given that neither of the standards prescribes specific steps on how to calculate project emissions—other than their general rules regarding conservativeness, project boundaries and consistency between baseline and project scenarios, introduced in previous chapters of this reference guide—the approaches offered in this section as illustrative examples have been extracted from proposed and approved methodologies and technical specifications. As in Chapter 3 ('Estimating baselines for REDD+ project activities'), methods and tools are presented distinguishing those that serve to estimate/identify activity data and those useful to estimate/identify emission factors.

5.2. Estimating *ex-ante* and *ex-post* project emissions for RED projects

5.2.1. Under the VCS

5.2.1.1 Relevant methodological elements and tools for ex-ante estimation of RED project emissions and changes in carbon stocks

5.2.1.1.1 Activity data

Avoiding planned deforestation

The approved VCS 'Methodology for conservation projects that avoid planned land use conversion in peat swamp forests' (VM0004, Version 1.0)[124] estimates the area and location of degradation (logging) and deforestation by detecting (through monitoring) the number of logging gaps and areas deforested present within the project boundary in a given year; these areas are then multiplied by degradation and deforestation emission factors developed by the methodology. For *ex-ante* estimates, this methodology assumes that project activities that prevent land use changes within the project boundary would be 100% successful and thus emissions from land use changes should be assumed to be zero. Nevertheless, the methodology may be useful when estimating *ex-ante* project scenarios where the reduction of emissions may be expected to be lower than 100% (e.g. due to illegal logging) and methods are available or designed to adequately reflect the effectiveness of the proposed measures (see for instance the approach proposed by the BioCarbon Fund below). The American Carbon Registry 'Methodology for REDD—avoiding planned deforestation' (Version 1.0—August 2010)[125], currently undergoing the phase of public comments, estimates activity data based on remote sensing data, and follows a similar approach to calculate *ex-ante* project emissions.

Avoiding unplanned frontier and mosaic deforestation and degradation

Both the 'Methodology for estimating reductions of GHG emissions from mosaic deforestation' (RED-NM-001 / Version 01—15 December 2008)[126] elaborated by the BioCarbon Fund of the World Bank and the 'Methodology for estimating reductions of GHG emissions from frontier deforestation' (RED-NM-002 / Version 01—28 November 2008)[127] proposed by the Amazonas Sustainable Foundation (both undergoing validation), estimate the LU/LC in the project scenario in 2 separate steps by projecting: (1) the extent and location of actual deforestation and (2) the adjustment of the mosaic of forest areas and their carbon densities.

The quantification and location of deforestation is based on the expected results of the management regime proposed by the project proponent and in most cases does not require spatial modelling; instead, a land use planning exercise consistent with any existing management plan is suggested. Project proponents shall define the projected quantity and location of actual *deforestation* and justify it by briefly describing the planned management. Maps of actual deforestation for each future year showing the expected locations of actual deforestation and the timing where different forest polygons are expected to be deforested under the project scenario shall then be produced, and, where no deforestation is expected under the project scenario, project proponents need to briefly explain why this is likely to happen.

The adjustment of the mosaic of forest polygons and classes (based on carbon densities) is required given that under the project conditions it is possible that different discrete areas of forest will change their carbon density over time in a rather different way from that under the baseline scenario. Consequently, the areas where reductions and enhancements in carbon stocks are expected to happen must be located and such changes must be estimated (although enhancements might conservatively be omitted). Finally, derived from this information an adjusted sequence of maps showing the LU/LC situation under the project case for each future project year must be elaborated.

A different approach to estimate *ex-ante* project emissions has been included in the 'Baseline and monitoring methodology for project activities that reduce emissions from deforestation on degrading land' (Version 2.0)[128] developed by Terra Global Capital. In this methodology, the *ex-ante* estimation of the deforestation and forest degradation rates are based on a breakdown of the effectiveness of every project activity in decreasing any deforestation driver relative to that driver's contribution to deforestation and degradation. For example, assuming that the collection of fuelwood leads to degradation releasing 200 tC/year, and the introduction by the project of fuel-efficient woodstoves decreases emissions by 50 tC/year, the effectiveness of such stoves to decrease degradation is 25%. Effectiveness values are estimated for every combination of project activities and drivers. The methodology outlines the procedure to quantify the maximal effectiveness of a number of potential project activities and each of the targeted drivers.

5.2.1.1.2 Emission factors from carbon stock changes

For both planned and unplanned deforestation project types, the baseline emission factors from carbon stock changes developed following the guidance and methods presented in Chapter3, Section 3.2.1.2.2 (baseline emission factors for RED projects), shall also be used to estimate project emissions. In cases where an LU/LC change category that was not projected to occur in the baseline is expected to appear in the project scenario, the same guidance shall be used to calculate the respective emission factors. Likewise, the methods in Chapter 3, Section 3.3 1.2 (baseline emission factors for projects reducing emissions from forest degradation), may be used to develop emission factors for areas where forest carbon densities are assumed to change in the project scenario. It must be noted that increases in carbon stocks in the project scenario may conservatively be omitted from the calculations.

Additionally, the Forest Project Protocol[129] (Version 3.0, September 2009) of the Climate Action Reserve offers useful steps for updating the project area's forest carbon inventory for Avoided Conversion Projects[130]. It is also recommended to review the methodologies mentioned in 1.1.1 above to understand how this guidance was integrated in the context of each of them.

5.2.1.1.3 Estimation of harvested wood products in the project scenario

In cases where the proposed project activities generate harvested wood products, the guidance introduced in Chapter 3, Section 3.2.1.2.3, may be used. Additionally, the methods included in Section 6.2.5

of the Forest Project Protocol of the Climate Action Reserve to determine actual carbon in harvested wood products may be helpful. However, it must be kept in mind that not accounting for this pool in the project case is conservative.

5.2.1.1.4 Estimation of GHG emissions in the project scenario

In order to estimate non-CO_2 emissions in the project scenario, the methods explained in Chapter 3, Section 3.2.1.2.4, for calculating such emissions in the baseline may be used.

5.2.2. Under the Plan Vivo Standards

5.2.2.1 Relevant methodological elements and tools for the ex-ante estimation of RED project emissions and changes in carbon stocks under the Plan Vivo Standards

5.2.2.1.1 Activity data

The technical specification 'FOR-MAN—Forest management and conservation (tropical lowland humid forest)'[131], developed by AMBIO for forest management and conservation projects and approved by Plan Vivo in 2007, assumes that project emissions will be zero if the forest management and sustainable land use practices it proposes to reduce pressures on the forests are carried out according to the targets and schedules it establishes. Consequently, project benefits are assumed to be equal to baseline emissions.

A similar (although more elaborated) approach is used by the technical specification 'Conservation of miombo woodland in Mozambique'[132] (developed by Envirotrade and currently under review) but in this case the calculated emission reductions are based on a 75% reduction in deforestation relative to the baseline scenario (i.e. the project activities have an effectiveness of 75%). In both technical specifications, the carbon stocks used to estimate emissions were based on local surveys.

On the other hand, the proposed technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[133] (submitted by the Malawi Environmental Endowment Trust in 2009 and currently under review by Plan Vivo) calculates the prevented loss of carbon stocks from avoided deforestation and degradation over the project period by multiplying the loss of carbon stocks under the baseline scenario by the effectiveness of project activities in preventing that loss. This is done by determining the impact that expected annual achievements for project activities identified in the activity plan would be expected to have on the main threats of deforestation and degradation in the project area. In contrast to the technical specifications introduced above, in this case the expected achievements are not quantified by the specification. Instead, the threat reduction as a result of project activities must be estimated case by case by local stakeholders and technical experts by identifying threats to forest cover in the project area, ranking the threats by area and intensity of impact, and estimating the likely impacts of project activities on those threats over the project period. The technical specification contains methods to identify and rank threats, as well as to estimate the impacts of project activities on them.

5.2.2.1.2 Emission factors from carbon stock changes

Given that under the existing RED Plan Vivo technical specifications project emissions are estimated as a percentage of baseline emissions, the emission factors from land use change in the project case are by definition those used to build the baseline scenario, which may be developed using the guidance provided in Chapter 3, Section 3.2.2.2.2, of this reference guide.

5.2.2.1.3 Estimation of harvested wood products in the baseline

Harvested wood products are usually not considered when estimating the baseline or project scenarios under the Plan Vivo Standards for RED projects. However, the guidance presented in Chapter 3, Section 3.2.1.2.3, may be used by project proponents to incorporate such pools into the estimation of the project's carbon benefits.

5.2.2.1.4 Estimation of project GHG emissions

GHG project emissions are normally not considered by Plan Vivo technical specifications. However, the proposed technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[134] accounts for such emissions when significant (based on the application of the CDM tool for determining the significance of GHG emissions). Furthermore, this technical specification identifies potential significant sources of emissions and offers a tool for the calculation of GHG emissions from transport during the design and implementation of project activities. The estimated GHG emissions are subtracted from the carbon benefits of the project. Additionally, project designers may use the guidance presented in Chapter 3, Section 3.2.1.2.4, to include GHG project emissions in their technical specifications, or propose simplified approaches based on it.

5.3. Estimating *ex-ante* and *ex-post* emissions for projects reducing emissions from forest degradation

5.3.1. Under the VCS

5.3.1.1 Relevant methodological elements and tools for the ex-ante estimation of emissions and changes in carbon stocks for projects reducing emissions from forest degradation under the VCS

5.3.1.1.1 Activity data

Projects reducing emissions from unplanned degradation

Guidance to facilitate the estimation of project emissions for this type of project is the same as that provided in the previous section for projects avoiding unplanned frontier and mosaic deforestation and degradation, and is therefore not repeated here.

Conversion of logged forests to protected forests

Given that currently no LtPF methodologies have been approved by the VCS, there are few examples on how to estimate the area undergoing different carbon stock changes within the project boundary. One of them can be found in the PDD of the Noel Kempff project[135]. In addition, the methods referenced in Section 5.2 above for the estimation of carbon stock changes the project scenario in projects avoiding planned deforestation above may also be useful to carry out this task.

Conversion of low-productive forests to high-productive forests

As in the previous case, there are no LtHP methodologies approved so far under the VCS that may be used to illustrate how a project scenario for such project type may be constructed. Taking into account that the LtHP project type covered in this section avoids further degradation in the project area by mitigating disturbance events, thus increasing the productivity of the logged forest, the methods used to identify the areas degraded after project implementation by projects reducing planned deforestation (presented in Section 5.2.1.1.1 of this chapter) might be applicable in this case.

5.3.1.1.2 Emission factors from carbon stock changes

Projects reducing emissions from unplanned degradation

Refer to the guidance provided in Section 5.2.1.1.2 of this chapter for the estimation of emission factors for unplanned deforestation projects, which is also applicable to projects reducing unplanned degradation.

Conversion of logged forests to protected forests and Conversion of low-productive forests to high-productive forests

For both project types, the baseline emission factors from carbon stock changes developed following the methods presented in Chapter 3, Section 3.3.1.2.2 (baseline emission factors for projects reducing emissions from degradation), shall also be used to estimate project emissions. The same methods shall be used to develop emission factors for areas where changes in forest carbon densities are not present in the baseline scenario. It must be noted that increases in carbon stocks in the project scenario may conservatively be omitted from the calculations.

5.3.1.1.3 Estimation of harvested wood products in the project scenario

For all project types under this section, the guidance applied to estimate harvested wood products in the baseline case (Chapter 3, Section 3.2.1.2.3) may also be used for the project scenario.

5.3.1.1.4 Estimation of GHG emissions in the project scenario

In order to estimate non-CO_2 emissions in the project scenario, the methods explained in Chapter 3, Section 3.2.1.2.4, may be used by all project types addressed in this section.

5.3.2. Under the Plan Vivo Standards

As mentioned in Chapter 3, Section 3.3, projects reducing emissions from forest degradation are not currently covered explicitly by any of the eligible activities under the Plan Vivo Standards. Hence, no guidance is suggested in this section of the reference guide.

5.4. Estimating ex-ante and ex-post emissions for sustainable forest management projects

5.4.1. Under the VCS

5.4.1.1 Relevant methodological elements and tools for the ex-ante estimation of emissions and changes in carbon stocks for sustainable forest management projects under the VCS

5.4.1.1.1 Activity data

Conversion from conventional logging to reduced impact logging

At the time of writing, no methodologies have been approved or proposed for RIL project activities under the VCS. However, considering the nature of possible project interventions (e.g. directional felling or vine cutting, improved selection of trees for harvesting, improved planning of skid trails and roads, reduced size of logging roads), approaches might be developed based on modelling (for *ex-ante* estimations) and localised sampling to quantify the actual areas where carbon stocks have increased due to project measures.

Extending the rotation age of evenly aged managed forests

The approved VCS 'Methodology for improved forest management through extension of rotation age' (VM0003, Version 1.0)[136] (currently the only ERA methodology approved or proposed under the VCS) suggests the use of models and methods such as those mentioned in Chapter 3 Section 3.3.1.2.1, of this reference guide to estimate *ex-ante* the areas with changes in carbon stocks produced by project activities during the crediting period, while actual changes are monitored through sampled field measurements.

Conversion of low-productive forests to high-productive forests

To date, no approved VCS methodologies for LtHP projects increasing the productivity of forest through e.g. the introduction of other tree species with higher timber value or growth rate, the adoption of enrichment planting to increase the density of trees and/or other forest management techniques (e.g. fertilisation, liming) are available that might serve to illustrate how to estimate areas with changing carbon stocks in the project scenario. Nevertheless, methods similar to those included in the approved ERA summarised in the previous paragraph might also be useful for detecting and quantifying areas with carbon stock changes in the project scenario during the crediting period.

5.4.1.1.2 Emission factors from carbon stock changes

The methods suggested in Section 5.2.1.1.2 of this chapter to estimate carbon stock changes in projects for LtPF and LtHP can also be applied to all the IFM project types included in this section.

5.4.1.1.3 Estimation of harvested wood products in the project scenario

For all project types covered in this section, the guidance suggested to estimate harvested wood products in the baseline case (Chapter 3, Section 3.2.1.2.3) may also be used for the project scenario.

5.4.1.1.4 Estimation of GHG emissions in the project scenario

For all project types in this section, non-CO_2 emissions in the project scenario may be estimated by applying the methods introduced in Chapter 3, Section 3.2.1.2.4.

5.4.2. Under the Plan Vivo Standards

5.4.2.1.1 Activity data

Project activities considered in the technical specification 'FOR-REST-SUBT1—Sub-tropical forest restoration'[137] aim at restoring forests degraded through harvesting, fire and grazing, and either involve enrichment planting, where open areas are planted with pine and cypress, or are conducted through encouraging natural regeneration by fencing off the area to prevent grazing. The carbon sequestration potential of such project activities is estimated over 150 years, assuming a crop rotation of 40 years on an average quality site with optimal climatic conditions, resulting in 44.7 tonnes of carbon per ha above an initial soil and vegetation carbon baseline of 210 tC/ha. This calculation includes above- and belowground biomass, soil carbon and carbon in products. As pointed out in Chapter 3 Section 3.4.2.2.1, the details of the modelling approach and parameters used (initial biomass, maximum potential biomass per ha; species distribution; maximum growth; biomass allocation relative to stem; average annual mortality; wood carbon content; turnover and decomposition factors; product allocation and lifetime) are given in the publication 'Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level'[138]. Details of the productivity data are based on the article 'Community forest management and carbon sequestration: a feasibility study from Chiapas, Mexico'.[139]

Moreover, the models and approaches that have been proposed for IFM projects under the VCS might be also used, adapted or simplified as required, to estimate and quantify the effects of restoration project activities in future technical specifications.

5.4.2.1.2 Emission factors from carbon stock changes

Carbon stock changes arising from project activities may be estimated by using models such as those applied by the technical specification 'FOR-REST-SUBT1—Sub-tropical forest restoration'. Alternatively, the guidance for VCS IFM projects in Section 5.2.1.1.2 might be used or adapted for estimating carbon stock changes when designing new technical specifications.

5.4.2.1.3 Estimation of harvested wood products in the project scenario

The guidance introduced in Chapter 3, Section 3.4.2.2.3, for estimating harvested wood products in the baseline of Plan Vivo restoration projects may also be applied to project estimates; in fact, the same approach shall be used for both scenarios in order to ensure consistency in estimates.

5.4.2.1.4 Estimation of GHG emissions in the project scenario

GHG emissions in the project case may be estimated through the methods summarised in Chapter 3, Section 3.2.2.2.4, which were also recommended for baseline emissions. Consistent methods should be used when building both scenarios.

6. Leakage

6.1. Basic concepts

Leakage is defined as the net increase of anthropogenic emissions of GHGs which occurs outside the project boundary, and which can be measured and is directly attributable to project activities. Leakage emissions must be deducted from the emission reductions generated by the project in order to determine its net carbon benefits, based on which carbon credits (VCUs, Plan Vivo Certificates or another type of VER or CER) are issued.

The following sections of this chapter describe how leakage is approached by the VCS for specific REDD+ project types—the Plan Vivo Standards contain only general guidance for all project types, summarised in the previous paragraph—and gives some examples on how the provisions specified in their guidance documents have been integrated into proposed and approved methodologies and technical specifications.

6.2. Assessing and managing leakage in RED projects

6.2.1. Under the VCS

6.2.1.1 VCS Guidance

In the context of VCS AFOLU projects, leakage is limited to increases in GHG emissions occurring outside a project's boundary but within the same country, when significant (as stated in other sections of this reference guide, the significance of off-site climate impacts shall be assessed by project proponents by using the CDM significance tool).

The VCS AFOLU documents define a couple of general provisions for all REDD project types for addressing and managing leakage, which are complemented by the specific guidance by project type explained below. These general rules stipulate, in summary, that if leakage-prevention measures for any eligible REDD activity include tree planting, agricultural intensification, fertilisation, fodder production and/or other measures to enhance cropland and grazing land areas, then any significant increase in GHG emissions associated with these activities shall be estimated and subtracted from the project's net emission reductions.

Moreover, they stipulate that any carbon credits generated from stopping illegal logging activities (to the extent they supply regional/global timber markets) shall also be subject to market leakage discounts; however, such leakage need not be considered if the project proponent chooses not to claim carbon credits from stopping such activities (i.e. illegal logging is not considered in the baseline or project scenario). The VCS Tool for AFOLU Methodological Issues offers project proponents the option of estimating the project's market leakage effects across the entire country and/or using analysis(es) from other similar projects to justify a different market leakage value instead of applying the default market leakage discounts it provides[140].

Avoiding planned deforestation

In this project type, the displacement of baseline activities is expected to be controlled and measured directly by monitoring the activities of the project landowners (i.e. individuals, communities, private companies or local/national governments) that were originally planning to deforest the project area (i.e. the baseline deforestation agents). In order to avoid that these landowners make up for the generation of goods and/or services lost through implementation of the carbon project, the VCS AFOLU documents require landowners to demonstrate to the VCS verifier that the management plans and/or land use designations of other owned lands have not materially changed as a result of the REDD project (e.g. designating new lands as timber concessions, increasing harvest rates in lands already managed for timber, clearing intact forests for agricultural production or increasing fertiliser use to enhance agricultural yields) because such changes could lead to reductions in carbon stocks or increases in GHG emissions.

Avoiding unplanned frontier and mosaic deforestation and degradation

For these types of projects, project proponents are required to identify leakage potential and address the socio-economic factors that drive deforestation/

degradation. Developers of AUFDD and AUMDD projects shall design and implement activities to minimise leakage, and monitor and account for leakage using approved methodologies. Activities that sustainably reduce deforestation/degradation may include the establishment of: agricultural intensification practices; lengthened fallow periods; agroforestry and fast-growing woodlots on degraded land; understorey farming; ecotourism and other sustainable livelihood activities; and/or sustainable production of non-timber forest products.

6.2.1.2 Examples of how the VCS guidance on leakage has been applied in RED methodologies

Avoiding planned deforestation

The module 'LK-ASP Estimation of emissions from activity shifting for avoided planned deforestation v1.0'[141], part of the Avoided Deforestation Partners' 'REDD methodology modules' currently undergoing validation, provides 2 methods to estimate leakage; these are applied depending on the deforestation agent, which could be an identified individual, organisation or corporation or the government of the host country.

The approach in the first case is to calculate the total rate at which deforestation is forecast to occur across the land managed by the baseline agent of deforestation (including the baseline projected deforestation within the project boundaries). The predicted deforestation within the project boundary is then subtracted from the total rate. This subtraction gives the expectable rate if no leakage occurred. The area of leaked deforestation results from subtracting this rate from the total area of deforestation by the focal agent each year after project implementation. This approach is also proposed by the American Carbon Registry 'Methodology for REDD—avoiding planned deforestation, version 1.0—August 2010'[142]—currently undergoing the period of public comments—with some minor differences.

Where the agent is the government of the host country, or a yet to be determined agent that will receive government sanction to deforest, it is assumed that there will be no activity shifting. However, it is critical for this assumption to hold true that all projects under this category fulfil the module's applicability condition that allocated area is not increased solely for the purpose of eliciting REDD projects.

All of the above-mentioned methodologies contain more or less similar methods to estimate market leakage, which needs to be considered in cases where the project leads to a decrease in the production of timber. For instance, the methodology modules (and in particular the module 'LK-ME Estimation of emissions from market effects v1.0'[143]) calculate the leakage due to market effects as the emissions from logging that is displaced outside the project area multiplied by a leakage factor (based on the values established in the VCS guidance documents), which is determined by considering where in the country logging might be increased as a result of the decreased supply of the timber caused by the project. If the areas liable to be logged have a higher carbon stock than the project area it is likely that the proportional leakage is higher and vice versa.

Avoiding unplanned frontier and mosaic deforestation and degradation

In order to monitor and quantify leakage, the 'Methodology for estimating reductions of GHG emissions from mosaic deforestation' proposed by the BioCarbon Fund defines a leakage belt, which is the land surrounding or adjacent to the project area to which baseline activities are likely to be displaced from inside the project area. To define the boundary of the leakage belt, the methodology asks project proponents to analyse the potential mobility of the main identified deforestation agents. If the RED project activity causes a displacement of baseline activities into the leakage belt, and more deforestation is detected in this area compared with its baseline, it is considered as leakage, and the decrease in carbon stocks is subtracted from the project's emission reductions. Moreover, if leakage prevention measures include tree planting, agricultural intensification, fertilisation, fodder production and/or other measures to enhance cropland and grazing land areas, then the increase in GHG emissions associated with these activities is estimated and subtracted from the project's net emission reductions.

The 'leakage belt' approach has also been used in a number of proposed VCS methodologies, including the 'Methodology for estimating reductions of GHG emissions from frontier deforestation' developed by Amazonas Sustainable Foundation[144] and the 'Baseline and monitoring methodology for project activities that reduce emissions from deforestation on degrading land' designed by Terra Global Capital, LLC.[145]

The module 'LK-ASU Estimation of emissions from activity shifting for avoided unplanned deforestation v1.0'[146], part of the 'REDD methodology modules' of Avoided Deforestation Partners, makes a distinction between local and immigrant deforestation agents, and offers different approaches to manage and estimate the leakage that each of these types of agents could generate during the crediting period. Two methods are provided to estimate leakage due to the displacement of baseline activities of local deforestation agents: 1) leakage belt (previously explained) and 2) activity monitoring. Activity monitoring estimates leakage by assessing and monitoring the displacement of grazing and agricultural activities, as well as of the use of non-sustainable biomass. It also offers 3 options to estimate leakage from immigrant agents: 1) time discount approach; 2) leakage accounting through another programme; and 3) buffer of credits. The time discount approach addresses all forms of leakage due to displacement of unplanned deforestation, and may therefore be used instead of the methods described above to estimate leakage from local agents.

Under the time discount approach, leakage is assumed to be the difference between actual net emission reductions and their net present value for climate change mitigation. The net present value is calculated based on the assumption that the REDD project activity will cause a 100% displacement of the baseline deforestation. Using a 100-year time horizon, a discount rate of 1% and the atmospheric carbon decay curve from the version of the Bern model used in the IPCC's Third Assessment Report, the net present value of avoiding the emission of one tonne of CO_2 has been calculated as being 0.6 tCO_2-eq. Thus, under this option, leakage due to displacement of unplanned baseline activities is assumed to be 40% of the project's net anthropogenic GHG emission reductions.

Under the option of leakage accounting through another programme, leakage due to shifting of unplanned baseline deforestation due to immigrant agents is included in the accounting of a broader REDD programme (e.g. a state- or nationwide REDD programme recognised by the UNFCCC or VCS) instead of being measured and deducted from the project's net emission reductions.

Using the option of establishing a buffer of credits, the net anthropogenic GHG emission reductions are calculated without taking into account the displacement of unplanned baseline activities of immigrant groups. Instead, under certain conditions, 10% of credits issued for the emission reductions will be earmarked. Earmarked credits will have to be held in a credit account that is not under the control of the project participants and such earmarked credits will not be available for trade.

CDM tools applied by REDD methodologies to estimate emissions from leakage

A number of methodological tools developed under the CDM have been used by some of the methodologies mentioned above that may be useful for the quantification of emissions from leakage in new REDD+ methodologies, namely:

1. Tool for estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity[147]
2. Tool for calculation of GHG emissions due to leakage from increased use of non-renewable woody biomass attributable to an A/R CDM project activity[148]
3. Tool for estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity[149]

6.2.2. Under the Plan Vivo Standards

6.2.2.1 Plan Vivo Guidance

Under the Plan Vivo Standards, technical specifications are required to contain an analysis of leakage and other risks that may jeopardise the achievement of the carbon benefit and mechanisms for controlling them. Although accounting for positive leakage is not practised, the Plan Vivo documents underline that there is a strong likelihood of it happening in Plan Vivo projects, as the technology and knowledge transfer resulting from the project should attract farmers in the area to more sustainable land use systems over time as they see benefits realised on their own and other people's land.

6.2.2.2 Examples of how the Plan Vivo guidance on leakage has been applied in RED methodologies

In order to estimate the effects of leakage on a project's carbon benefits, the technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[150] requests project participants to identify the potential sources of leakage and the mitigation measures proposed by the project, and, with this information, assess the risk of leakage for each of the main threats identified. The carbon benefits of the project are then reduced by an amount that reflects the likely impacts of the project activities on carbon stocks outside the project area. The risk of leakage for each of the main threats to forest cover is estimated by local stakeholders, with the support of the project coordinator and technical service providers. A simple rating system is used to estimate the percentage reduction in project effectiveness that leakage is likely to cause.

Other technical specifications approved and proposed (i.e. 'Forest management and conservation (tropical lowland humid forest)'and 'Conservation of miombo woodland in Mozambique', respectively) address leakage by implementing activities to reduce the pressures on forests, and assume that leakage will be zero or require its monitoring.

6.3. Assessing and managing leakage in projects reducing emissions from forest degradation

The VCS project types covered in this section on avoiding planned degradation (i.e. conversion of logged forests to protected forests (LtPF) and conversion of low-productive forests to high-productive forests (LtHP)) are bound to the leakage rules of VCS IFM projects, which basically limit the assessment of leakage to market effects, along the lines of the rules explained in Section 6.1 introducing this chapter. Approaches on how to identify and quantify such leakage for projects reducing emissions from planned deforestation, reviewed in Section 6.2.1.2 above, may therefore be used also for LtPF and LtHP projects. Likewise, given that the VCS methodologies analysed in the previous section (6.2.1.2) are the same that may be applied to projects reducing emissions from unplanned degradation, project developers may consider the methods contained in them for the elaboration of their methodologies and projects.

Moreover, as mentioned in previous chapters, given that no eligible Plan Vivo activities qualify as 'projects reducing emissions from degradation', no guidance or examples of approaches to estimate leakage under such standards are given in this section.

6.4. Assessing and managing leakage in sustainable forest management projects

All of the sustainable forest management project types included in this project category (i.e. conversion from conventional logging to reduced impact logging, extension of the rotation age of evenly aged managed forests and conversion of low-productive forests to high-productive forests) fall within the IFM category of the VCS AFOLU, for which guidance and approaches to estimate emissions from market leakage have been presented in Section 6.2 above.

7. Monitoring

7.1. Basic concepts

Monitoring in the context of REDD+ projects refers primarily to the collection and archiving of all relevant data necessary for estimating and measuring the net anthropogenic GHG emissions and removals by sinks of a project activity during the crediting period. It also relates to monitoring the overall performance of the project site to demonstrate that the project has accomplished what was originally proposed (e.g. that the project has achieved the targeted forest protection).

This chapter summarises the carbon stock monitoring provisions set out in the VCS and Plan Vivo Standards and points out sources of methods and tools that may be useful in the design of VCS monitoring methodologies and Plan Vivo technical specifications.

7.2. Monitoring requirements for REDD+ projects

7.2.1. Under the VCS

7.2.1.1 VCS Guidance

According to the VCS 2007.1, the project proponent shall establish and maintain criteria and procedures for obtaining, recording, compiling and analysing data and information important for quantifying and reporting GHG emissions and/or removals relevant for the project and baseline scenario (i.e. GHG information system). Monitoring procedures should include the following:

- purpose of monitoring;
- types of data and information to be reported, including units of measurement;
- origin of the data;
- monitoring methodologies, including estimation, modelling, measurement or calculation approaches;
- monitoring times and periods, considering the needs of intended users;
- monitoring roles and responsibilities; and
- GHG information management systems, including the location and retention of stored data.

Where measurement and monitoring equipment is used, the project proponent shall ensure the equipment is calibrated according to current good practice. Moreover, the VCS requires project proponents to apply GHG monitoring criteria and procedures on a regular basis during project implementation. Monitoring reports shall include all the monitoring data, calculations, estimations, conversion factors and other standard factors as defined in the monitoring clause of the applied VCS methodology and set out in the VCS-PD.

Additionally, the VCS AFOLU documents establish that, in order to be eligible under the VCS, AFOLU projects must have robust and credible monitoring protocols as defined in the approved methodologies. Monitoring and *ex-post* quantification of the project scenario (including leakage) must follow the applicable guidance available in approved A/R CDM methodologies and/or IPCC documents.

7.2.1.2 Relevant methodological elements and tools for monitoring REDD+ baselines following the VCS

A number of sources are available that provide guidance applicable to monitoring REDD+ projects:

- the GOFC-GOLD Sourcebook (particularly, Chapter 2.1 presents the state of the art for data and approaches to be used for monitoring changes in forest areas (i.e. deforestation and forestation) and for monitoring changes within forest land (i.e. forest remaining forest land, e.g. degradation); it also includes general recommendations and detailed recommended steps for monitoring changes of forest areas or in forest areas);
- the IPCC 2006 GL (e.g. Volume 4, Chapter 2, Section 2.5.1 'Measurement-based tier 3 inventories')[151];
- the IPCC GPG-LULUCF[152];
- the Sourcebook for Land Use, Land-Use Change and Forestry Projects elaborated by the BioCarbon Fund (World Bank) and Winrock International[153];

- the Climate Action Reserve Forest Project Protocol[154];
- the monitoring sections of the methodologies presented in this reference guide, e.g.:
  - o the approved VCS 'Methodology for conservation projects that avoid planned land use conversion in peat swamp forests' (VM0004, version 1.0)[155];
  - o the approved VCS 'Methodology for improved forest management through extension of rotation age'[156] (VM0003, Version 1.0);
  - o the proposed 'Methodology for estimating reductions of GHG emissions from mosaic deforestation' produced by the BioCarbon Fund of the World Bank (also in process of validation)[157]
  - o the proposed 'REDD methodology modules' of Avoided Deforestation Partners, particularly module 'M-FCC Methods for monitoring forest cover changes in REDD project activities v 1.0'[158];
  - o the proposed American Carbon Registry 'Methodology for REDD—avoiding planned deforestation' (Version 1.0—August 2010)[159];
  - o the proposed 'Methodology for estimating reductions of GHG emissions from frontier deforestation' developed by Amazonas Sustainable Foundation[160].

7.2.2. Under the Plan Vivo Standards

7.2.2.1 Plan Vivo Guidance

The Plan Vivo Manual establishes that technical specifications must detail how the activity should be monitored. They should prescribe easy-to-measure monitoring indicators which allow rapid and cost-effective monitoring by the technical team and community technicians and prescribe the following (with justifications).

1. An appropriate monitoring schedule
- How often the activity should be monitored and over what period (e.g. 'monitoring should take place in years 0, 1, 3, 5 and 10');
- What targets should be reached by each stage (e.g. '50% of the plot should be established in year 0')

2. Appropriate monitoring indicators
Technical specifications should recommend easy-to-measure monitoring indicators that can be used by local technicians to determine whether the target has been met. Cost and time-effectiveness should be paramount considerations as local technicians generally work with minimum resources and travel between plots may be difficult.

7.2.2.2 Relevant methodological elements and tools for monitoring REDD+ baselines following the Plan Vivo Standards

Examples of how monitoring schedules and indicators for REDD+ Plan Vivo projects have been established in practice may be found in the available technical specifications:

- the approved technical specification 'FOR-MAN—Forest management and conservation (tropical lowland humid forest)'[161];
- the approved technical specification 'FOR-REST-SUBT1—Sub-tropical forest restoration'[162];
- the proposed technical specification 'Conservation of miombo woodland in Mozambique'[163]; and
- the proposed technical specification 'Avoiding unplanned mosaic deforestation and degradation in Malawi'[164].

Moreover, the IPCC GPG-LULUCF in its Chapter 4 (4.3.3.8.1[165]) provides guidance and points out good practices for monitoring projects involving multiple small-scale landholders that can be used to develop monitoring plans in Plan Vivo technical specifications.

8. Addressing non-permanence

8.1. Basic concepts

Non-permanence refers to the temporary nature of the emission reductions and increases in carbon stocks achieved by projects in the AFOLU sector, given that carbon contained in the biomass of trees and vegetation is at a continuous risk of being emitted into the atmosphere. In order to provide certainty to carbon buyers and credibility to the carbon markets, various approaches have been put forward to address this issue. In this chapter, the approaches to deal with non-permanence adopted by the VCS and the Plan Vivo Standards are summarised.

8.2. Approaches to address non-permanence in REDD+ projects

8.2.1. Under the VCS

For AFOLU projects to be eligible for VCS crediting, the risk of non-permanence (i.e. the potential reversibility of sequestered/protected carbon) must be addressed. As the VCS does not include mandatory future verification of the carbon benefits previously claimed by verified projects (i.e. 're-verification'), the VCS approach for addressing non-permanence requires that projects maintain adequate buffer reserves of non-tradable carbon credits to cover unforeseen losses in carbon stocks. The buffer credits from all projects are held in a single AFOLU Pooled Buffer Account.

The number of buffer credits that a given project must deposit into the AFOLU Pooled Buffer Account is based on an assessment of the project's potential for future carbon loss. Project proponents are charged with:

1. undertaking the initial risk assessment, which must consider both transient and permanent potential losses in carbon stocks; and
2. determining the appropriate buffer reserve based on guidance provided in the Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination[166].

This self risk assessment must be clearly documented and substantiated where possible. During verification, the VCS verifier evaluates the project's risk assessment and adjusts it as appropriate before determining the project's required buffer reserve.

Future verification of AFOLU projects that have generated VCUs in the past is optional, but it is in the interests of project proponents to verify periodically in order to claim a greater percentage of the carbon benefits held in the buffer. The buffer can be drawn upon over time as a project demonstrates its longevity, sustainability and ability to mitigate risks.

Guidance on determining the appropriate overall risk level of a given project, based on major risk factors associated with specific project activities, is provided in table form in the Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination. The approach for conducting the non-permanence risk analysis to determine the number of buffer credits that a given AFOLU project shall deposit into the AFOLU Pooled Buffer Account includes the following steps.

Step 1: Conduct a risk assessment.

a. Evaluate the project against the risk factors applicable to all AFOLU project types.
b. Evaluate the project against the risk factors associated with the specific project type.
c. Based on the above assessments, determine the overall risk classification for the project.

Step 2: Based on the project's overall risk classification, deposit the appropriate amount of credits into the AFOLU Pooled Buffer Account.

Step 3: Repeat Steps 1 and 2 every time the project seeks VCS verification and adjust the project's buffer withholding as necessary.

In addition to using the tabular guidance, the 'risk likelihood × significance' risk assessment methodology outlined in Appendix A of the Risk Tool may be optionally used.

8.2.2. Under the Plan Vivo Standards

The Plan Vivo System also uses a buffer approach as an additional risk management mechanism to ensure permanence. In the context of the Plan Vivo System, a carbon buffer is defined as a stock of unsold and non-saleable carbon held by each project, which is generated by deducting a specified percentage from each producer's carbon sequestration potential according to the risk level determined to apply to the project as a whole. Therefore, when calculating the carbon benefit using the technical specifications, this represents the total carbon benefit of the Plan Vivo project. The total saleable carbon is then determined by subtracting the percentage carbon buffer.

Currently, all Plan Vivo projects have a minimum 10% risk buffer. The level of risk buffer may vary, however, and is reviewed annually by the Plan Vivo Foundation for each project based on information provided in annual reports. The appropriate risk buffer size is then prescribed for the project as a whole, based on evidence from projects, technical specifications and advice from the external reviewers.

9. Estimating net carbon benefits

9.1. Basic concepts

In general, the net carbon benefits of a project activity over a verification period are equal to the project minus baseline carbon stocks and GHG emissions, adjusted for leakage and discounting any permanence buffers. However, given that each standard contains particular provision on how to carry out this calculation, this chapter introduces the guidance to be taken into account and the procedures to be followed when estimating the net carbon benefits of REDD+ project activities and determining the corresponding amount of carbon credits to be issued under the VCS and the Plan Vivo programmes.

9.2. Estimating net carbon benefits in REDD+ projects

9.2.1. Under the VCS

The VCS 2007.1 establishes that the project GHG emission reductions or removal enhancements shall be quantified as the difference between the GHG emissions and/or removals from GHG sources, sinks and reservoirs relevant for the project and those relevant for the baseline scenario. To this end, the project proponent shall quantify, as appropriate, GHG emission reduction and removal enhancements separately for each relevant GHG and its corresponding GHG sources, sinks and/or reservoirs for the project and the baseline scenario. Moreover, the VCS AFOLU documents instruct project proponents to use full GHG accounting, providing annual estimates of overall project GHG impacts expressed in terms of CO_2 equivalents employing global warming potentials (GWPs) of 310 for N_2O and 21 for CH_4 when estimating net emission reductions and GHG removals.

In the case of IFM rotation forestry projects, the maximum number of carbon credits to be assigned to the project shall not exceed the project's net carbon stock benefits (i.e. project minus baseline carbon stocks, including long-lived wood products) averaged across the current harvesting/rotation cycle[167], adjusted for project emissions of CO_2, N_2O and CH_4, and leakage. This is to prevent proponents from unrealistically inflating the project's carbon benefits, and number of credits issued, by timing verification events to coincide with peak carbon stocks and not accounting for subsequent carbon losses from harvesting.

When calculating the number of carbon credits that should be issued to a given project, the tradable credits (VCUs) are estimated by subtracting out the leakage from the total estimated 'credits' and then subtracting out the non-permanence buffer. It must be noted that the buffer calculation is based on only the part of the carbon benefits of the project corresponding to carbon stock changes within the project boundary (i.e. emissions reduced from 'permanent' sources do not suffer the buffer discount).

9.2.2. Under the Plan Vivo Standards

As mentioned in Chapter 5, under Plan Vivo the carbon benefits of projects are estimated *ex-ante* as carbon mitigation potentials included in technical specifications. The total carbon benefit is determined by subtracting from such potential any leakage and the carbon buffer determined according to the risk assessment of the project as a whole.

10. Dealing with uncertainty

10.1. Basic concepts

Estimated carbon emissions and removals arising from AFOLU activities have uncertainties associated with the measures/estimates of: area or other activity data, carbon stocks, biomass growth rates, expansion factors and other coefficients.

10.2. Dealing with uncertainty in REDD+ projects

10.2.1. Under the VCS

10.2.1.1 VCS Guidance

The VCS AFOLU documents limit their guidance on this issue to establish that IPCC 2006 GL shall be used in terms of quality assurance/control and uncertainty analysis in all AFOLU project types. Additionally, examples on how such guidance has been applied are given in the approved and proposed methodologies mentioned in the following section.

10.2.1.2. Relevant methodological elements and tools for uncertainty analysis in REDD+ VCS projects

Specific guidance on assessing uncertainty is given in the chapters on specific land use categories of the 2006 IPCC GL, Volume 4:

- Chapter 4 addresses uncertainties relevant to inventory estimates made for forest land remaining forest land[168];
- Chapter 5 offers specific guidance on how to assess uncertainties in inventory estimates related to forest land converted to cropland[169];
- Chapter 6 contains instructions for cases where forest land is converted to grassland[170];
- Chapter 8 provides guidance to assess uncertainties in estimations when forest land is converted to settlements[171];
- Chapter 9 contains uncertainty assessment methods for cases where forest land is converted to other land[172].

Additionally, examples on how the VCS and IPCC guidance have been used to estimate baseline, project and carbon benefit uncertainties can be found in a number of methodologies, including the following: the approved VCS 'Methodology for improved forest management through extension of rotation age, VM0003—v1.0'[173];

- the approved VCS 'Methodology for conservation projects that avoid planned land use conversion in peat swamp forests, VM0004—v1.0'[174]; and
- the module 'X-UNC Uncertainty analysis v1.0' contained in the 'REDD methodology modules'[175].

10.2.2. Under the Plan Vivo Standards

10.2.2.1. Plan Vivo Guidance

The Plan Vivo Standards do not dictate detailed guidance on how to assess uncertainty when developing carbon benefit estimates contained in technical specifications. Nevertheless, the standards mandate the use of the most conservative scenarios in such calculations, and technical specifications need to be reviewed by an external expert to ensure the credibility of all assumptions used and calculations made.

Moreover, some of the approved technical specifications carry out discounts from estimated carbon benefits to account for uncertainty in the calculations (for instance, technical specification 'FOR-MAN—Forest management and conservation (tropical lowland humid forest)'[176]).

11. Co-benefits and adaptation

11.1. Basic concepts

This chapter offers an overview of the Climate, Community and Biodiversity (CCB) Standards[177], which identify land-based projects that are designed to deliver robust and credible GHG reductions while also delivering net positive benefits to local communities and biodiversity. The standards can be applied to any land-based carbon projects including both projects that reduce GHG emissions through avoided deforestation and forest degradation and projects that remove carbon dioxide by sequestering carbon.

Given that the CCB guidance can be combined very effectively with carbon accounting standards, and that 2 such standards have been explored in detail throughout this reference guide, the chapter focuses on the CCB criteria devoted to community and biodiversity benefits. However, it must be noted that to earn CCBA approval, projects must satisfy all required criteria in their project documents, including climate benefits, and may optionally also try to satisfy the Gold Level criteria[178].

11.2. CCB criteria on community and biodiversity benefits

Following is a summary of the CCB criteria related to community and biodiversity benefits, including Gold Level criteria. The reader is invited to review the indicators of each individual criterion, as well as the comprehensive list of resources referenced in Appendix A of the CCB Standards in order to better address such criteria when designing project activities.

11.2.1. Community criteria

11.2.1.1. Net Positive Community Impacts

The project must generate net positive impacts on the social and economic well-being of communities and ensure that costs and benefits are equitably shared among community members and constituent groups during the project lifetime. Projects must maintain or enhance the High Conservation Values (identified in the standards) in the project zone that are of particular importance to the communities' well-being.

11.2.1.2. Offsite Stakeholder Impacts

The project proponents must evaluate and mitigate any possible social and economic impacts that could result in the decreased social and economic well-being of the main stakeholders living outside the project zone resulting from project activities. Project activities should at least 'do no harm' to the well-being of offsite stakeholders.

11.2.1.3. Community Impact Monitoring

The project proponents must have an initial monitoring plan to quantify and document changes in social and economic well-being resulting from the project activities (for communities and other stakeholders). The monitoring plan must indicate which communities and other stakeholders will be monitored, and identify the types of measurements, the sampling method and the frequency of measurement. Since developing a full community monitoring plan can be costly, it is accepted that some of the plan details may not be fully defined at the design stage, when projects are being validated against the standards. This is acceptable as long as there is an explicit commitment to develop and implement a monitoring plan.

11.2.2. Biodiversity criteria

11.2.2.1. Net Positive Biodiversity Impacts

The project must generate net positive impacts on biodiversity within the project zone and within the project lifetime, measured against the baseline conditions. The project should maintain or enhance any High Conservation Values present in the project zone that are of importance in conserving globally, regionally or nationally significant biodiversity. Invasive species populations must not increase as a result of the project, either through direct use or indirectly as a result of project activities. Projects may not use genetically modified organisms (GMOs) to generate GHG emission reductions or removals. GMOs raise unresolved ethical, scientific and socio-economic issues. For example, some GMO attributes may result in invasive genes or species.

11.2.2.2. Offsite Biodiversity Impacts

The project proponents must evaluate and mitigate likely negative impacts on biodiversity outside the project zone resulting from project activities.

11.2.2.3. Biodiversity Impact Monitoring

The project proponents must have an initial monitoring plan to quantify and document the changes in biodiversity resulting from the project activities (within and outside the project boundaries). The monitoring plan must identify the types of measurements, the sampling method and the frequency of measurement. Since developing a full biodiversity monitoring plan can be costly, it is accepted that some of the plan details may not be fully defined at the design stage, when projects are being validated against the standards. This is acceptable as long as there is an explicit commitment to develop and implement a monitoring plan.

11.2.3. Gold Level criteria

11.2.3.1. Climate Change Adaptation Benefits

The Gold Level Climate Change Adaptation Benefits criterion identifies projects that will provide significant support to assist communities and/or biodiversity in adapting to the impacts of climate change. Anticipated local climate change and climate variability within the project zone could potentially affect communities and biodiversity during the life of the project and beyond. Communities and biodiversity in some areas of the world will be more vulnerable to the negative impacts of these changes due to:

- vulnerability of key crops or production systems to climatic changes;
- lack of diversity of livelihood resources and inadequate resources, institutions and capacity to develop new livelihood strategies; and
- high levels of threat to species survival from habitat fragmentation.

Land-based carbon projects have the potential to help local communities and biodiversity adapt to climate change by: diversifying revenues and livelihood strategies; maintaining valuable ecosystem services such as hydrological regulation, pollination, pest control and soil fertility; and increasing habitat connectivity across a range of habitat and climate types.

11.2.3.2. Exceptional Community Benefits

The Gold Level Exceptional Community Benefits criterion recognises project approaches that are explicitly pro-poor in terms of targeting benefits to globally poorer communities and the poorer, more vulnerable households and individuals within them. In so doing, land-based carbon projects can make a significant contribution to reducing the poverty and enhancing the sustainable livelihoods of these groups. Given that poorer people typically have less access to land and other natural assets, this optional criterion requires innovative approaches that enable poorer households to participate effectively in land-based carbon activities. Furthermore, this criterion requires that the project will 'do no harm' to poorer and more vulnerable members of the communities, by establishing that no members of a poorer or more vulnerable social group will experience a net negative impact on their well-being or rights.

11.2.3.3. Exceptional Community Benefits

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Endnotes

1 As defined according to decision 2/CP.13 of the Conference of the Parties to the United Nations Framework Convention on Climate Change. Available at http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=8.

2 See Section B of the note by the UNFCCC Secretariat 'Methodological issues relating to the role and contribution of conservation, sustainable management of forests, changes in forest cover and associated carbon stocks and greenhouse gas emissions and the enhancement of forest carbon stocks to enhance action on mitigation of climate change and to the consideration of reference levels' (FCCC/SBSTA/2009/2), available at http://unfccc.int/resource/docs/2009/sbsta/eng/02.pdf.

3 Available at http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/SFCM_2009_smaller.pdf.

4 The report was developed by Paulo Lopes of the Centre for Environmental Policy of the Imperial College of London (http://reducecarbon.wordpress.com/summary-of-the-results/).

5 Available at http://moderncms.ecosystemmarketplace.com/repository/moderncms_documents/SFCM_2009_smaller.pdf.

6 http://www.americancarbonregistry.org.

7 http://www.carbonfix.info.

8 http://www.climateactionreserve.org.

9 http://www.iso.org/iso/catalogue_detail.htm?csnumber=43277.

10 http://www.socialcarbon.org.

11 Available at http://www.v-c-s.org/docs/

12 The VCS Double Approval Process Submission Form, which is used for submitting a methodology element to the VCS Association, available at http://www.v-c-s.org/docs/VCS Double Approval Process Submission Form.doc.

13 For more details, refer to the VCS Program normative document on the double-approval process: http://www.v-c-s.org/docs/VCS-Program-Normative-Document_Double-Approval-Process_v1.1.pdf.

14 Available at http://www.v-c-s.org/docs/Voluntary Carbon Standard 2007_1.pdf.

15 Available at http://planvivo.org.34spreview.com/wp-content/uploads/2009_PINtemplate_PlanVivo1.pdf.

16 Available at http://planvivo.org.34spreview.com/wp-content/uploads/PlanVivo_PDDTemplate.pdf.

17 For more information on the Plan Vivo Foundation, the Technical Advisory Panel and the general governance structure of the program, see: http://planvivo.org.34spreview.com/?page_id=34.

18 Available at http://planvivo.org.34spreview.com/wp-content/uploads/Guidance-manual_Plan-Vivo.pdf.

19 As agreed by the Conference of the Parties to the UNFCCC through its decision 4/CP.15 (http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=11).

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

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

22 Available at http://www.v-c-s.org/docs/Voluntary.

23 http://www.v-c-s.org/docs/Tool for AFOLU Methodological Issues.pdf.

24 http://www.v-c-s.org/docs/Guidance for AFOLU Projects.pdf.

25 Including the VCS AFOLU Program Update of 21 May 2010 http://www.v-c-s.org/docs/VCS-AFOLU_Program_Update_21May10.pdf.

26 Forest patches are defined as any forest area surrounded by anthropogenically deforested areas.

27 Any landscape that does not meet the definition of mosaic or frontier shall follow the baseline guidelines for mosaic in full where it can be shown that 25% or more of the project boundary is within 50 m of land that has been anthropogenically deforested within the 10 years prior to the project start date. If this criterion is not met, the frontier baseline guidelines shall be followed in full.

28 Using internationally accepted definitions of what constitutes a forest, e.g. based on UNFCCC host country thresholds or FAO definitions.

29 Including the VCS AFOLU Program Update of 21 May 2010 http://www.v-c-s.org/docs/VCS-AFOLU_Program_Update_21May10.pdf.

30 See EB 42: http://cdm.unfccc.int/EB/042/eb42rep.pdf and EB 44: http://cdm.unfccc.int/EB/044/eb44rep.pdf.

31 The following EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

32 The sum of decreases in carbon pools and increases in GHG emissions that may be neglected (i.e. considered 'insignificant') shall be less than 5% of the total CO_2-eq benefits generated by the project. The following CDM EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

33 http://www.v-c-s.org/docs/Tool for AFOLU Methodological Issues.pdf.

34 http://www.v-c-s.org/docs/Guidance for AFOLU Projects.pdf.

35 Available at http://conserveonline.org/workspaces/climate.change/ClimateActionProjects/NoelKempff/NKPDD.

36 Version 1.0 (April 2009) is available at http://www.netinform.net/KE/files/pdf/8_BL-PL Baseline planned deforestation v1.0.pdf.

37 Available at http://www.americancarbonregistry.org/carbon-accounting/ACR Methodology for REDD - Avoiding Planned Deforestation PUBLIC COMMENT DRAFT.pdf.

38 Available at http://www.v-c-s.org/docs/RED Frontier Methodology 28nov08.pdf.

39 Available at http://www.netinform.de/KE/files/pdf/VCS REDD methodology Terra Global Capital - revised v2 clean.pdf.

40 Available at http://www.v-c-s.org/docs/REDD_mosaic_methodology_15_Dec_2008.pdf or http://wbcarbonfinance.org/docs/BioCF_RED_Mosaic_Methodology.pdf.

41 Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf.

42 An introduction to the use of GEOMOD for forest carbon projects can be found at http://www.winrock.org/ecosystems/files/SpatialModelingOfBaselinesForLULUCFCarbonProjects-TheGEOMODModelingAapproach2003.pdf.

43 An overview of the Land Change Modeler, and links to buy the software are available at http://www.clarklabs.org/products/Land-Change-Modeler-Overview.cfm.

44 Dinamica EGO is freeware that may be downloaded from the Dinamica Project site: http://www.csr.ufmg.br/dinamica/index.html.

45 http://www.terrestrialcarbon.org/site/DefaultSite/filesystem/documents/TCG%20Policy%20Brief%202%20REL%20Tool%20Review%20090601.pdf.

46 Available at http://www.gofc-gold.uni-jena.de/

47 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.

48 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_05_Ch5_Cropland.pdf.

49 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf.

50 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_08_Ch8_Settlements.pdf.

51 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_09_Ch9_Other_Land.pdf.

52 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.

53 http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp4/Chp4_3_Projects.pdf.

54 Available at http://www.winrock.org/ecosystems/files/winrock-biocarbon_fund_sourcebook-compressed.pdf.

55 Available at ftp://ftp.fao.org/docrep/fao/008/ae578e/ae578e00.pdf.

56 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.pdf.

57 Version 3.0 (September 2009) is available at http://www.climateactionreserve.org/wp-content/uploads/2009/03/Forest_Project_Protocol_Version3.0.pdf.

58 http://www.americancarbonregistry.org/carbon-accounting/ACR Tool - Carbon Pools - Emission Sources v1.0.pdf.

59 Available at http://www.winrock.org/ecosystems/tools.asp?BU=9086.

60 Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf.

61 http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_contents.html.

62 Available at http://www.gofc-gold.uni-jena.de/redd/

63 Version 1.0 (April 2009) is available at http://www.netinform.net/KE/files/pdf/20_X-STR Stratification v1.0.pdf.

64 Available at http://www.winrock.org/ecosystems/files/winrock-biocarbon_fund_sourcebook-compressed.pdf.

65 Significance may be assessed by applying the Tool for testing significance of GHG emissions in A/R CDM project activities: http://cdm.unfccc.int/

methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf.

66 Available at http://conserveonline.org/workspaces/climate.change/ClimateActionProjects/NoelKempff/NKPDD.

67 Available at http://www.climateactionreserve.org/how/protocols/adopted/forest/development/

68 http://www.eia.doe.gov/oiaf/1605/Forestryappendix[1].pdf.

69 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.

70 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_05_Ch5_Cropland.pdf.

71 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf.

72 Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf.

73 Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf.

74 Available at http://www.ipcc-nggip.iges.or.jp/EFDB/main.php.

75 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-05-v1.pdf.

76 Available at http://planvivo.org.34spreview.com/documents/standards.pdf.

77 As defined by the Plan Vivo Standards, a 'forest' is 'A land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land-use. In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 2m in situ' (Plan Vivo Standards 2008, page 7).

78 As defined in the Plan Vivo, a 'woodland' is 'An open, park-like vegetation type with scattered trees at least 8m tall' (Plan Vivo Standards 2008, page 10).

79 http://planvivo.org.34spreview.com/wp-content/uploads/PlanVivo_PDDTemplate.pdf.

80 http://planvivo.org.34spreview.com/wp-content/uploads/forest_management1.pdf.

81 Still under review by the Plan Vivo Foundation and available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

82 Under review by the Plan Vivo Foundation. Available at http://planvivo.org.34spreview.com/wp-content/uploads/MOZavoided-deforestation-technical-specification.pdf.

83 Elaborated as part of the research project 'Kyoto: Think Global, Act Local' by the University of Twente, and available at http://www.planvivo.org/wp-content/uploads/Online-Fieldguide_community-carbon.pdf.

84 CDM small-scale A/R methodologies may be found at http://cdm.unfccc.int/methodologies/SSCmethodologies/SSCAR/approved.html.

85 Still under review by the Plan Vivo Foundation and available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

86 Including the VCS AFOLU Program Update of 21 May 2010 http://www.v-c-s.org/docs/VCS-AFOLU_Program_Update_21May10.pdf.

87 See EB 42: http://cdm.unfccc.int/EB/042/eb42rep.pdf and EB 44: http://cdm.unfccc.int/EB/044/eb44rep.pdf.

88 The following EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

89 The sum of decreases in carbon pools and increases in GHG emissions that may be neglected (i.e. considered 'insignificant') shall be less than 5% of the total CO_2-eq benefits generated by the project. The following CDM EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

90 http://www.v-c-s.org/docs/Tool for AFOLU Methodological Issues.pdf.

91 http://www.v-c-s.org/docs/Guidance for AFOLU Projects.pdf.

92 The additionality section of VCS 2007.1 describes how a Performance Test versus Project Test may be applied under the VCS. Both options are summarised in Chapter 4 of this reference guide.

93 For new management entities with no history of logging practices in the project region, the baseline should reflect just the common practices and legal requirements. However, if the common practice is unsustainable, and unsustainable practices contravene the mission of the implementing entity, then a sustainable baseline is the minimum that can be adopted. For projects focused on stopping logging or reducing the impact of logging, where the implementing entity takes over ownership of a property specifically as a carbon project to reduce forest management emissions, then the project baseline may be based on the management plans of the previous property owners (i.e. the baseline must represent what would have most likely occurred in the absence of the carbon project).

94 Such methodologies may be found at http://www.v-c-s.org/public_comment.html.

95 Available at http://www.v-c-s.org/docs/IFM-LtPF on Fee Simple Forest Properties - v7 0 Final.pdf.

96 Version 3.0 (September 2009) is available at http://www.climateactionreserve.org/wp-content/uploads/2009/03/Forest_Project_Protocol_Version3.0.pdf.

97 Methodological elements adopted by the Climate Action Reserve are automatically approved for use under the VCS.

98 Software and user guides are available at http://www.cnr.berkeley.edu/~wensel/cactos/cactoss.htm.

99 Software and guides are available at http://www.cnr.berkeley.edu/~wensel/cryptos/cryptoss.htm.

100 Software and user guides are available at http://www.fs.fed.us/fmsc/fvs/description/index.shtml.

101 This software may be ordered at http://www.forestbiometrics.com/FORM_Orders/orders.html.

102 Available at http://www.pik-potsdam.de/~lasch/web_4c/about/about.htm.

103 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf.

104 Submitted for review in 2009 and available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

105 See EB 42: http://cdm.unfccc.int/EB/042/eb42rep.pdf and EB 44: http://cdm.unfccc.int/EB/044/eb44rep.pdf.

106 The following EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

107 The sum of decreases in carbon pools and increases in GHG emissions that may be neglected (i.e. considered 'insignificant') shall be less than 5% of the total CO_2-eq benefits generated by the project. The following CDM EB tool can be used to test the significance of emissions sources: http://cdm.unfccc.int/EB/031/eb31_repan16.pdf.

108 http://www.v-c-s.org/docs/Tool for AFOLU Methodological Issues.pdf.

109 http://www.v-c-s.org/docs/Guidance for AFOLU Projects.pdf.

110 The additionality section of VCS 2007.1 describes how a Performance Test versus Project Test may be applied under the VCS. Both options are summarised in Chapter 4 of this reference guide.

111 For new management entities with no history of logging practices in the project region, the baseline should reflect just the common practices and legal requirements. However, if the common practice is unsustainable, and unsustainable practices contravene the mission of the implementing entity, then a sustainable baseline is the minimum that can be adopted. For projects focused on stopping logging or reducing the impact of logging, where the implementing entity takes over ownership of a property specifically as a carbon project to reduce forest management emissions, then the project baseline may be based on the management plans of the previous property owners (i.e. the baseline must represent what would have most likely occurred in the absence of the carbon project).

112 Available at http://www.v-c-s.org/docs/VM0003 Methodology for Improved Forest Management through Extension of Rotation Age C2010.pdf.

113 http://planvivo.org.34spreview.com/wp-content/uploads/PlanVivo_PDDTemplate.pdf.

114 Available at http://planvivo.org.34spreview.com/wp-content/uploads/subtropical_forest_restoration1.pdf.

115 de Jong B., Ochoa-Gaona S., Soto-Pinto, L., Castillo-Santiago M., Montoya-Gomez G., March-Mifsut I. and Tipper R. 1998 Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level. In: Nabuurs G., Nuutinen T., Bartelik H. and Korhonen, M. (eds) Forest scenario modelling for ecosystem management at landscape level, 221–238. EFI Proceedings No. 19.

116 de Jong B., Montoya-Gomez G., Nelson K., Soto-Pinto L., Taylor J. and Tipper R. (1995) Community forest management and carbon sequestration: a feasibility study from Chiapas, Mexico. Interciencia 20(6): 409–416.

117 de Jong B., Ochoa-Gaona S., Soto-Pinto, L., Castillo-Santiago M., Montoya-Gomez G., March-Mifsut I. and Tipper R. 1998 Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level. In: Nabuurs G., Nuutinen T., Bartelik H. and Korhonen, M. (eds) Forest scenario modelling for ecosystem management at landscape level, 221–238. EFI Proceedings No. 19.

118 The 'actual net greenhouse gas removals by sinks' is the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in emissions of the greenhouse gases by the sources that are increased as a result of the implementation of the project activity, while avoiding double counting, within the project boundary, attributable to the project activity.

119 Available at http://www.v-c-s.org/docs/Voluntary Carbon Standard 2007_1.pdf.

120 Available at http://www.v-c-s.org/docs/VCS-Tool-VT0001_Tool-for-Demonstration-and-Assessment-of-Additionality-in-AFOLU-Project-Acitivities.pdf.

121 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v2.pdf.

122 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-02-v1.pdf.

123 Available at http://planvivo.org.34spreview.com/wp-content/uploads/Guidance-manual_Plan-Vivo.pdf

124 Available at http://www.v-c-s.org/docs/VM0004 Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1-0.pdf.

125 Available at http://www.americancarbonregistry.org/carbon-accounting/ACR Methodology for REDD - Avoiding Planned Deforestation PUBLIC COMMENT DRAFT.pdf.

126 Available at http://www.v-c-s.org/docs/REDD_mosaic_methodology_15_Dec_2008.pdf or http://wbcarbonfinance.org/docs/BioCF_RED_Mosaic_Methodology.pdf.

127 http://www.v-c-s.org/docs/RED Frontier Methodology 28nov08.pdf.

128 Available at http://www.v-c-s.org/docs/Terra VCS Mosiac REDD Methodology - final after 1st validation.pdf.

129 Available at http://www.climateactionreserve.org/wp-content/uploads/2009/03/Forest_Project_Protocol_Version3.0.pdf.

130 In the context of the Climate Action Reserve's Forest Project Protocol, an Avoided Conversion Project involves preventing the conversion of forest land to a non-forest land use by dedicating the land to continuous forest cover through a conservation easement or transfer to public ownership.

131 http://planvivo.org.34spreview.com/wp-content/uploads/forest_management1.pdf.

132 http://planvivo.org.34spreview.com/wp-content/uploads/MOZavoided-deforestation-technical-specification.pdf.

133 Available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

134 Available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

135 Available at http://conserveonline.org/workspaces/climate.change/ClimateActionProjects/NoelKempff/NKPDD.

136 http://www.v-c-s.org/docs/VM0003 Methodology for Improved Forest Management through Extension of Rotation Age C2010.pdf.

137 Available at http://planvivo.org.34spreview.com/wp-content/uploads/subtropical_forest_restoration1.pdf.

138 de Jong B., Ochoa-Gaona S., Soto-Pinto, L., Castillo-Santiago M., Montoya-Gomez G., March-Mifsut I. and Tipper R. 1998 Modelling forestry and agroforestry opportunities for carbon mitigation at the landscape level. In: Nabuurs G., Nuutinen T., Bartelik H. and Korhonen, M. (eds) Forest scenario modelling for ecosystem management at landscape level, 221–238. EFI Proceedings No. 19.

139 de Jong B., Montoya-Gomez G., Nelson K., Soto-Pinto L., Taylor J. and Tipper R. (1995) Community forest management and carbon sequestration: a feasibility study from Chiapas, Mexico. Interciencia 20(6): 409–416.

140 Updated discounts are contained in the VCS AFOLU Program Update of 21 May 2010 available at http://www.v-c-s.org/docs/VCS-AFOLU_Program_Update_21May10.pdf.

141 Available at http://www.netinform.net/KE/files/pdf/13_LK-ASP Leakage activity shifting planned deforestation v1.0.pdf.

142 Available at http://www.americancarbonregistry.org/carbon-accounting/ACR Methodology for REDD - Avoiding Planned Deforestation PUBLIC COMMENT DRAFT.pdf.

143 http://www.netinform.net/KE/files/pdf/15_LK-ME Leakage market effects v1.0.pdf.

144 Available at http://www.v-c-s.org/docs/RED Frontier Methodology 28nov08.pdf.

145 Available at http://www.netinform.de/KE/files/pdf/VCS REDD methodology Terra Global Capital - revised v2 clean.pdf.

146 http://www.netinform.net/KE/files/pdf/14_LK-ASU Leakage activity shifting unplanned deforestation v1.0.pdf.

147 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-09-v2.pdf Note: Effective 04 June 2011, this tool will be superseded by the A/R tool 'Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity' (see EB 51, para 40).

148 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-11-v1.pdf.

149 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v1.pdf.

150 Still under review by the Plan Vivo Foundation and available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

151 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.

152 http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_contents.html.

153 Available at http://www.winrock.org/ecosystems/files/winrock-biocarbon_fund_sourcebook-compressed.pdf.

154 Version 3.0 (September 2009) is available at http://www.climateactionreserve.org/wp-content/uploads/2009/03/Forest_Project_Protocol_Version3.0.pdf.

155 Available at http://www.v-c-s.org/docs/VM0004 Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1-0.pdf.

156 Available at http://www.v-c-s.org/docs/VM0003 Methodology for Improved Forest Management through Extension of Rotation Age C2010.pdf.

157 Available at http://www.v-c-s.org/docs/REDD_mosaic_methodology_15_Dec_2008.pdf or http://wbcarbonfinance.org/docs/BioCF_RED_Mosaic_Methodology.pdf.

158 http://www.netinform.net/KE/files/pdf/19_M-FCC Monitoring forest cover changes v 1.0.pdf.

159 Available at http://www.americancarbonregistry.org/carbon-accounting/ACR Methodology for REDD - Avoiding Planned Deforestation PUBLIC COMMENT DRAFT.pdf.

160 Available at http://www.v-c-s.org/docs/RED Frontier Methodology 28nov08.pdf.

161 http://planvivo.org.34spreview.com/wp-content/uploads/forest_management1.pdf.

162 Available at http://planvivo.org.34spreview.com/wp-content/uploads/subtropical_forest_restoration1.pdf.

163 Under review by the Plan Vivo Foundation. Available at http://planvivo.org.34spreview.com/wp-content/uploads/MOZavoided-deforestation-technical-specification.pdf.

164 Still under review by the Plan Vivo Foundation. Available at http://planvivo.org.34spreview.com/wp-content/uploads/TS-MAL-AUMDD-V1.0.pdf.

165 http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp4/Chp4_3_Projects.pdf

166 http://www.v-c-s.org/docs/Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination.pdf.

167 This average is calculated from actual carbon measurements and/or estimates/projections based on the project's harvest plan/schedule.

168 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf.

169 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_05_Ch5_Cropland.pdf.

170 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf.

171 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_08_Ch8_Settlements.pdf.

172 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_09_Ch9_Other_Land.pdf.

173 http://www.v-c-s.org/docs/VM0003 Methodology for Improved Forest Management through Extension of Rotation Age C2010.pdf.

174 http://www.v-c-s.org/docs/VM0004 Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1-0.pdf.

175 Available at http://www.netinform.net/KE/Wegweiser/Guide2.aspx?ID=6141&Ebene1_ID=49&Ebene2_ID=1978&mode=4.

176 http://planvivo.org.34spreview.com/wp-content/uploads/forest_management1.pdf.

177 Available at http://www.climate-standards.org/standards/pdf/ccb_standards_second_edition_december_2008.pdf.

178 Projects that provide exceptional benefits in terms of explicit design for adaptation to climate change, targeting of benefits to globally poorer communities or conservation of biodiversity at sites of global conservation significance may achieve a Gold Level status by satisfying one of the optional Gold Level criteria.

Annex 1. Summary of existing REDD+ methodologies

1. Methodologies for projects reducing emissions from deforestation

Planned deforestation

Approved

VM0004 Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1.0

The methodology was developed for (and is applicable to) preventing planned land use change on undrained tropical peat swamp forests in Southeast Asia. The baseline methodology outlines methods to estimate the avoided net GHG emissions resulting from project activities implemented to stop planned land use conversion on tropical peat forest.

Unplanned deforestation

Approved

Technical specification—Forest management and conservation (tropical lowland humid forest)

Conservation and sustainable management of existing forests and implementation of activities that reduce pressure on these areas. The potential to offset carbon is equal to the predicted rate of carbon loss based on a regional baseline matrix parameterised with local data.

Proposed

Methodology for Estimating Reductions of GHG Emissions from Mosaic Deforestation

The methodology is aimed to estimate and monitor GHG emissions of project activities that reduce mosaic deforestation. Carbon stock enhancement of degraded and secondary forests that would be deforested in the absence of the RED project activity is also included in this methodology. The underlying conceptual approach of this methodology is based on drafts of the AFOLU guidance document of the Voluntary Carbon Standard. This methodology is based on the project activity 'Ankeniheny-Zahamena Biological Corridor' in Madagascar, whose baseline study, monitoring and project design documents are being prepared by the Ministry of the Environment, Water, Forests and Tourism of Madagascar with assistance of Conservation International and the International Bank for Reconstruction and Development as Trustee of the BioCarbon Fund.

Methodology for Estimating Reductions of GHG Emissions from Frontier Deforestation

The methodology is for estimating and monitoring GHG emissions of project activities that reduce frontier deforestation. It includes methods to estimate carbon stock enhancement of degraded and secondary forests that would be deforested in the absence of the RED project activity. However, accounting for carbon stock enhancement is optional in this methodology.

REDD Methodology Modules

This REDD Methodology Framework provides guidance for constructing methodologies for REDD project activities compliant with the validation and verification requirements of the VCS. By using this document, a REDD methodology can be constructed based on a set of predefined VCS-approved modules. The resulting methodology will be VCS-approved without the requirement of a methodology validation.

Modules and tools are presented that can be used to generate methodologies for activities to reduce emissions from planned and unplanned deforestation and for activities to reduce emissions from forest degradation caused by extraction of wood for fuel. No modules are included for activities to reduce emissions from forest degradation caused by illegal harvesting of trees for timber; such a module may be included in the future.

Baseline and Monitoring Methodology for Project Activities that Reduce Emissions from Deforestation on Degrading Land

This methodology sets out the project conditions and carbon accounting procedures for activities aimed at reducing unplanned anthropogenic deforestation and forest degradation. The deforestation typology covered by this methodology is of the mosaic type, as defined in the VCS guidance. This methodology explicitly lists the information that is required in a PD so that a third-party verifier can validate all *ex-ante* calculations. In addition, it stipulates which information must be included in monitoring reports so that a VCS-accredited verifier can verify these and actual VCUs can be issued.

Technical specification—Avoiding Unplanned Mosaic Deforestation and Degradation in Malawi
This technical specification was developed for use by Plan Vivo projects in Malawi. Through the Plan Vivo System, communities may be able to access payments for carbon benefits to assist with the protection and restoration of national parks and forest reserves.

This technical specification suggests activities that may help reduce threats to forest cover, and ensure that risks of leakage and non-permanence of carbon benefits are minimised. Methods that should be used to estimate the carbon benefits from project activities and the requirements for management plans are described, and approaches that can be used for monitoring the success of the project are suggested.

Many of the approaches described in this technical specification involve the close participation of local stakeholders. Direct experience of resource extraction from forests, and the impacts this brings, gives communities that interact closely with forests a valuable insight into the likely future of the forests they use.

Technical specification—Conservation of Miombo Woodland in Mozambique
This Plan Vivo technical specification provides a methodology for determining carbon benefits of conservation of miombo woodland in Sofala Province, central Mozambique. It contains:

- a method for quantifying carbon stocks in conservation areas;
- an analysis of the local deforestation rate and areas at risk of deforestation in the absence of project activities;
- a description of the interventions required to reduce the rate of deforestation through the creation of community conservation and sustainable management areas;
- a proposal for a monitoring plan for success of project activities;
- a crediting and payment scheme for emission reductions;
- an additionality test;
- a description of the likely environmental and social benefits; and
- a framework to address leakage.

The conceptual approach, methodological framework and guidelines will assist project administrators and local communities to develop appropriate project activities and collect the information necessary to produce verifiable carbon benefits.

2. Methodologies for projects reducing emissions from forest degradation

Planned degradation

Proposed
Improved Forest Management—Logged to protected forests on fee simple forested properties
This methodology is for calculating and monitoring GHG emission changes from IFM—logged to protected forest projects on fee simple properties forested with primarily native species on upland sites, where planned timber harvesting is being converted to a protected forest or managed conservation forest.

The methodology is designed for properties undergoing an ownership change or significant change in management practice, where there is a minimum risk of significant unplanned or illegal biomass removal activities.

Estimating GHG Emission Reductions from Planned Degradation (Improved Forest Management)
The methodology has been written to conform to improved forest management—logged to protected forest (IFM-LtPF) activities which prevent forest degradation through the cessation of selective logging as the baseline activity.

The methodology ‘in terms of accounting’ addresses a scenario that is accommodated in the VCS guidance for IFM projects. The methodology also applies to baseline scenario activity whereby although the actual baseline entity has not been identified the baseline activity can be clearly demonstrated and substantiated to be selective timber harvesting/production. The key components of the methodology are:

1. selection of the baseline scenario;
2. definition of project boundaries (‘project area’);

3. prediction of historical rates of degradation in the project area and reference areas (under the baseline scenario);
4. calculation of carbon flows from avoided logging;
5. monitoring.

The application of the methodology is intended to trigger a long-term sustainable shift in the economics of the covered region, creating revenues for indigenous peoples that replace and exceed revenues to be derived from the removal of their forests

3. Methodologies for sustainable forest management projects

Approved

VM0003 Methodology for Improved Forest Management through Extension of Rotation Age, v1.0

This methodology is applicable to Improved Forest Management VCS project activities that involve an extension in rotation age. The conditions under which the methodology is applicable are as follows.

- Forest management in both baseline and project cases involves clear-cut or patch-cut practices (with or without seed trees).
- Forests must be certified by the Forest Stewardship Council (FSC) or become FSC-certified within one year of the project start date.
- The project does not encompass managed peat forests.
- The total percentage of wetlands in the project area is not expected to change as part of project activities.
- Project participants must have a projection of management practices both with and without project scenarios.
- If fire is used as part of forest management, then fire control measures such as installation of fire breaks or back-burning shall be taken to ensure fire does not spread outside the project boundary; that is, no biomass burning shall be permitted to occur beyond the project boundary due to forest management activities.
- There may be no leakage through activity shifting to other lands owned or managed by project participants outside the bounds of the VCS carbon project.

Technical specification—Sub-tropical forest restoration

This system involves the restoration of open pine forest that has been degraded in the past through harvesting, fire and grazing in order to increase the stocking of commercial species. Restoration can either involve enrichment planting, where open areas are planted with pine (*Pinus oocarpa*) and cypress (*Juniperus lusitanica*), or be through encouraging natural regeneration by fencing off the area to prevent grazing.

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