Project Developer's Guidebook to VCS REDD Methodologies

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PREFACE

Since the 2007 UNFCCC Climate Change Conference in Bali, the international community has been trying to reach agreement on a practical and equitable mechanism to tackle greenhouse gas emissions from forests. Known as Reducing Emissions from Deforestation and forest Degradation (REDD), the initiative brought forest conservation to the forefront of global climate change mitigation efforts.

Despite progress made at the UN climate talks in Cancun on the inclusion of a REDD+[1] mechanism within a post-2012 climate change framework, it remains undecided how such a mechanism might be implemented and importantly – how it will be financed. While the modalities of REDD+ at the global level continue to be discussed, forest loss continues unabated. Fortunately, significant policy and technical advancements, and the mobilization of resources are already taking place outside the formal negotiations through the work of the voluntary carbon markets and multilateral REDD programs.

Creating an enabling environment for REDD+ at a national level should be the ultimate goal of countries' readiness efforts, yet this will take many countries years to achieve. In the meantime, projects, with their ability to generate immediate action at the site level, provide a critical means to channel investment, technical support, and act as important models for the development of evolving national systems. Demonstration projects are critical to the success of national level REDD+ programs because they provide near-term incentives and are a critical means of testing strategies to reduce deforestation, monitor progress, and develop robust carbon accounting systems. In short, they are investments in R&D, which the world desperately needs if we are to reduce –and eventually reverse- global forest loss.

Within the voluntary markets, the architecture to capitalize on emission reductions from reducing deforestation and forest degradation is being put into practice, building up expertise and serving as the testing ground for the implementation of innovative project frameworks. The recent standard and methodological developments in the voluntary market outlined in this guide are an important step in that direction. For the first time, REDD project developers – be they private sector, government, or community based – have a clear roadmap to monetize the emissions reductions they achieve through their efforts to reduce deforestation. The immediate future of the voluntary REDD market is bright, with investor confidence increasing and project development ramping up. In fact, the market share of REDD activities within the voluntary carbon market has grown from 1 to 30 percent in just the past three years.

Of course there is still work to be done - REDD methodologies are still complex and transaction costs high - yet forest carbon as an asset class has undeniably arrived. The onus now is on civil society, project developers, and government authorities to work together across emerging REDD initiatives in order to develop robust yet workable models for success. This will be critical if we are to leverage the full global support that is needed to conserve the world's remaining forests and avoid the worst impacts of global climate change.

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[1] Under the 2010 Cancun Agreements, the scope of REDD was expanded to include activities which reduce emissions from: deforestation; forest degradation; conservation of forest carbon stocks; sustainable management of forests; and the enhancement of forest carbon stocks, thereby becoming REDD+.

INTRODUCTION AND HOW TO USE THIS GUIDEBOOK

It has been estimated that deforestation and forest degradation contribute 17 percent of annual global greenhouse gas (GHG) emissions (IPCC, 2007), more than every plane, train, and automobile in the world. Reducing Emissions from Deforestation and Forest Degradation (REDD) has therefore become a primary focus of policy makers and organizations seeking to reduce GHG emissions and to mitigate climate change. An approach to provide economic incentives to preserve standing forests is currently operating through the voluntary carbon market whereby GHG credits are issued to projects that successfully reduce emissions from deforestation and forest degradation.

The Verified Carbon Standard (VCS) Association operates one of the leading GHG crediting programs in the voluntary carbon market, which recognizes a number of GHG mitigation activities including REDD. The VCS issues credits to project developers[2] based on the GHG benefits of eligible project activities that are quantified using a methodology that has been approved under the VCS. As of the date of this writing, the VCS has approved five (5) methodologies that can be used to account for the GHG benefits of REDD projects.

The purpose of this guidebook is to assist project developers in evaluating and selecting those VCS approved methodology(ies) that are best suited to account for the GHG benefits of their proposed REDD project activities. It contains a summary of VCS requirements applicable to all REDD projects and a detailed review of those REDD methodologies approved under the VCS at the time of writing. It also provides a number of tools for developers to compare the applicability conditions, accounting approaches, and resource requirements associated with each methodology, and suggestions for applying these methodologies in practice.

The guidebook was developed to help project developers and other relevant stakeholders understand the general operation of the VCS Standard and methodologies. The guidebook is not intended as a detailed "how to" or technical manual, or as a substitute for the assistance of technical experts. Rather, it is intended to help project developers gain an understanding of the key elements of currently available REDD methodologies so that they can make informed choices in selecting and applying these methodologies to their REDD project activities. This guidebook is also not meant to grade or rank the methodologies. All those that are approved under the VCS are equally valid and can be used by project developers to account for the GHG benefits of REDD projects provided the applicability conditions of the methodology are met.

This guidebook is intended to be a living document that will be updated periodically to include new methodologies that are approved by the VCS. All references to VCS documentation in this guidebook refer to version 3(v3) documentation released in March 2011[3]. Readers should remain alert for periodic updates to the VCS standard and tools and always confirm that they are using the most recent versions of the VCS documentation.

[2] Herein, project developers refer to entities with overall responsibility for the implementation and registration of projects (referred to as "project proponents" in the VCS documentation).

[3] Note that the previous version of VCS Program Documents, VCS 2007.1, may be used by projects only up to 8 September 2011; all projects validated after 8 September 2011 must use the current version of VCS Program Documents.

This guidebook is organized as follows:

Section 1 provides an overview of the types of eligible REDD activities and concludes with a series of potential project scenarios, illustrating the process of defining them in the VCS context.

Section 2 contains an overview of the general VCS requirements that are relevant to REDD projects.

Section 3 outlines the basic elements common to all REDD methodologies.

Section 4 provides a review of each REDD methodology, highlighting unique aspects and critical applicability conditions, and explaining its approach to accounting for project GHG benefits.

Section 5 presents a summary of the key applicability conditions for REDD methodologies and contains a decision tree to assist project developers in identifying methodologies applicable to their particular project circumstances.

Section 6 presents detailed comparison tables of accounting approaches and data and task requirements to assist project developers in assessing comparative resource needs and required level of effort among methodologies.

Section 7 provides general guidance to project developers for planning the development and registration of REDD projects under the VCS, and includes an illustrative work plan for applying a methodology to a REDD project.

Section 8 contains a list of useful references and resources for project developers who are considering the registration of a REDD project with the VCS program.

Section 9 contains a glossary of REDD terminology.

1.0

REDD PROJECT ACTIVITIES

This section provides an overview of the types of eligible VCS REDD activities. It is intended to help project developers distinguish between deforestation and degradation, as well as between planned and unplanned REDD activities. These distinctions are important to understand as they drive the GHG accounting considerations, and therefore the methodologies that can be used to account for the proposed REDD activities.

1.1 BACKGROUND ON PROJECT ACTIVITIES

Only human intervention can generate climate benefits creditable by the VCS. Hence, it is *activities*, not forests alone, that generate reductions in emissions from deforestation and forest degradation (REDD).

Every project activity is of course unique, but to establish a consistent framework within which Agriculture, Forestry, and Other Land Use (AFOLU) projects are evaluated, the VCS has formally recognized a series of eligible AFOLU project categories, including REDD, which are elaborated in the VCS AFOLU Requirements document[4]. It is important to remember that the specific range of activities that can be implemented within these categories (e.g., providing alternative, less land intensive incomes; clarifying land tenure; enforcing borders; improving agricultural productivity on existing lands) are not limited by the VCS and instead are left up to the ingenuity of the project developer.

The requirements for REDD project activities differ based on the type of activity, or specifically the type of baseline scenario that is avoided, which is the impact of the activity. The baseline scenario represents what would happen in the absence of the project. Hence, the first question to be answered in considering the development of a project is: what land use outcome does the activity avoid?

1.2 DEFORESTATION VERSUS DEGRADATION

Eligible REDD activities under the VCS are those activities that reduce net GHG emissions by stopping or reducing deforestation and/or degradation of forests. The VCS defines deforestation as "the direct, human induced conversion of forest to non-forest land" (AFOLU Requirements: VCS Version 3, section 4.2.5). For example, deforestation occurs when forests are converted to agricultural or to developed lands.

By contrast, degradation is defined by the VCS as "the persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuel-wood extraction, timber removal or other such activities, *but which does not result in the conversion of forest to non-forest land* (which would be classified as deforestation), and qualifies as *forests remaining as forests*, such as set out under the

[4] In addition to REDD, eligible AFOLU Project Categories include: Afforestation, Reforestation and Revegetation (ARR), Agricultural Land Management (ALM), Improved Forest Management (IFM), Peatland Rewetting and Conservation (PRC) and Avoided Conversion of Grasslands and Shrublands (ACoGS).

IPCC 2003 Good Practice Guidance."(AFOLU Requirements: VCS Version 3, section 4.2.5, italics added for emphasis). For example, degradation occurs when trees are selectively cut and used for fuel-wood, but the area where the trees were removed still meets the definition of forest.

The reason for differentiating between deforestation and degradation derives from the conceptual approach the IPCC takes in accounting terrestrial greenhouse gas emissions, first looking at changes in area among broad land-use classes ("activity data") and then ascribing emissions per unit area associated with these changes ("emission factors") (IPCC GPG 2003, IPCC 2006GL). It is this first accounting step that drives the distinction between deforestation and degradation. Deforestation involves the conversion of forest to another land-use, while degradation involves reductions in forest carbon stocks without a change in land-use.

There is clearly a continuum between degradation and deforestation (both involve loss of forest carbon stocks, and degradation often precedes deforestation), and they could potentially be accounted in the same way without distinguishing between them. However, the IPCC and VCS distinction allows for deforestation to be measured and monitored in part on the basis of observed land cover change that can be readily distinguished from remote sensing data. The same cannot be done (currently) for degradation, and hence the distinction made by the VCS permits different, and more practical, approaches for deforestation to be monitored and quantified, in particular through approaches that allow monitoring across large areas with a reasonable cost and level of effort.

The definition of forest is therefore critical in distinguishing deforestation and degradation. Project developers are required to use internationally accepted forest definitions, namely the UNFCCC host country forest definitions or the FAO forest definitions. The UNFCCC and FAO define forest lands as those that meet minimum land area, tree crown cover, and tree height criteria, which are explained in more detail in the text boxes 1.1 and 1.2 below. Forest lands may include mature forests, secondary forests, and degraded forests as well as forests occurring on wetlands or peatlands.

Text Box 1.1. **UNFCCC FOREST DEFINITIONS**

Under the Clean Development Mechanism (CDM), host countries must select and submit their official forest definition to the UNFCCC to host CDM afforestation/reforestation projects. Definitions must specify minimum levels for each of the following parameters:

Minimum Land Area:	0.05 – 1.00 hectare
Minimum Tree Crown Cover:	10-30%
Minimum Tree Height:	2-5 meters

UNFCCC host country forest definitions can be found at http://cdm.unfccc.int/DNA/index.html.

Text Box 1.2. **FAO FOREST DEFINITION**

The FAO definition is useful to project developers in those cases where the host country has not submitted an official forest definition to the UNFCCC. FAO specifies its definition when collecting forest data (e.g., as part of the Forest Resource Assessment) from countries. According to FAO, forests are defined as meeting all of the following criteria *in situ*:

Land Area:	> 0.50 hectare
Tree Crown Cover:	> 10 percent
Tree Height:	> 5 meters

FAO also specifies that forests do not include land that is predominantly under agricultural or urban land use. Therefore, using the FAO definition, lands used for agro-forestry that otherwise meet the above definitions are not considered forests.

The FAO forest definition is included in the FRA 2010 Report and can be found at http://www.fao.org/docrep/013/i1757e/i1757e.pdf.

With respect to the tree crown cover and height criteria under both UNFCCC and FAO definitions, forestlands are those lands which are expected to meet these criteria at maturity *in situ* (that is, if left alone). Therefore, it is possible that forest lands may include newly planted lands which are expected to meet these criteria in the future, or lands that are temporarily unstocked but which are expected to revert to a state in the future *in situ* that meets these criteria.

Project developers should be aware that some agroforestry, for example oil palm plantations or shade coffee, may meet a country's definition of forest, in which case conversion of existing forestland to these land uses would not be considered deforestation; rather, projects that avoid these conversions would be considered by the VCS as reducing degradation (if unauthorized) or improved forest management (if authorized).

1.3 REDD VERSUS IFM

Under the VCS, forest conservation projects are classified as either REDD or Improved Forest Management (IFM) depending on the baseline scenario. Activities that reduce GHG emissions by protecting forests that would otherwise have been logged (or by protecting currently logged or degraded forests from further logging) are considered IFM Logged to Protected Forest (LtPF) projects rather than REDD projects. To qualify under IFM, the baseline logging activities must have been sanctioned by a national or local regulatory body (e.g. as a timber concession or plantation). Activities that stop unsanctioned and/or illegal degradation (e.g. through the removal of fuel-wood or timber) are considered REDD activities.

This guidebook focuses on REDD activities. Future versions may also assess IFM LtPF methodologies.

Text Box 1.3. **VCS APPROVED IFM LTPF METHODOLOGIES**

VM0010: Methodology for Improved Forest Management: Conversion from Logged to Protected Forest
Quantifies the GHG removals generated from preventing logging of an unlogged tropical forest. The baseline scenario the forest management regime includes selected timber harvest practices. The quantification of GHG emission removals is determined based on a change in land use practice and an increase in carbon sequestration. This methodology is applicable to unlogged tropical forests.

VM0011: Methodology for Calculating GHG Benefits from Preventing Planned Degradation
Quantifies the GHG emission reductions generated from improving forest management and preventing the planned degradation of a forest by stopping selective logging. This methodology accounts for a reduction in GHG emissions by stopping logging as well as an increase in carbon stock growth. This methodology is applicable to previously logged or intact tropical forests where selective logging would have occurred in the absence of carbon finance.

VM0012: Improved Forest Management on Privately Owned Properties in Temperate and Boreal Forests
Quantifies the GHG emission reductions generated with improving forest management and preventing stopping logging. This methodology accounts for a reduction in GHG emissions from activities that protect currently logged or degraded forests from further logging or protect unlogged forests from logging. This methodology is applicable for privately owned (fee simple) forest properties in temperate and boreal regions.

1.4 PLANNED VERSUS UNPLANNED ACTIVITIES

The VCS distinguishes between (and requires different criteria to be addressed in methodologies covering) activities that are designed to stop or reduce "planned (designated and sanctioned) deforestation" and those that are designed to stop or reduce "unplanned (unsanctioned) deforestation and/or degradation" (VCS AFOLU Requirements document section 4.2.7).

The distinction is made between these two types of activities because the nature of evidence supporting the baseline land use scenario (the land use in the absence of the project, see section 3.3 for further discussion) is different for each, and hence different methodologies are required. The baseline land use scenario for planned deforestation, where those responsible for deforestation and/or degradation ("baseline agents") can be specifically identified, can ideally be based on direct evidence, for example, verifiable plans that clearly demonstrate authorization and intent to convert forest to a non-forest use in a determined timeframe. By comparison, the baseline scenario for unplanned deforestation, and planned deforestation where the specific baseline agent cannot be identified, are usually based on indirect evidence, for example, on the basis of inference from historical trends, like average number of hectares deforested per year in the area over the past 10 years. When assessing baselines, these two types of activities must be analyzed separately (i.e. a baseline for unplanned deforestation cannot include planned deforestation) and most methodologies only address one or the other.

1.4.1 Avoiding Planned Deforestation (APD)

Activities to avoid planned deforestation (APD) are those activities that reduce GHG emissions by stopping or reducing deforestation on forest land that is both legally authorized (by relevant government authorities) and documented to be converted to non-forest land. For example, decisions by landowners to stop planned and authorized conversion of forest lands to agricultural lands or to an urban or infrastructure development use is considered an APD activity.

Because the baseline agent and project proponent are often (but not necessarily) the same in APD projects, the VCS requires that APD projects demonstrate that the baseline agent has permission as well as *intent* to deforest the project area to ensure that APD baselines are credible and not spuriously set to be self-serving.

It is important to note that activities that avoid "planned degradation", or a loss of carbon stocks due to a sanctioned timber harvest, are not considered APD activities, but rather, as Improved Forest Management (IFM) activities and should be accounted for using applicable, approved VCS IFM methodologies.

1.4.2 Avoiding Unplanned Deforestation and Degradation (AUDD)

Activities to avoid unplanned deforestation and degradation (AUDD) are those activities that reduce deforestation and/or degradation on forest land that is either not legally authorized or is not documented for conversion to non-forest land. Unplanned deforestation and degradation typically occurs due to poor law enforcement or lack of property rights that result in piecemeal conversion of forest land to non-forest land. Examples of AUDD activities include stopping illegal logging or reducing expansion of shifting agriculture.

The VCS further classifies AUDD projects on the basis of the spatial configuration of deforestation/degradation that takes place in the baseline (business as usual, BAU) scenario. The "mosaic" configuration refers to deforestation/degradation that occurs in a patchwork-type pattern, where forest areas are more or less equally accessible across the landscape, and often deforestation/degradation are caused by local agents living in the immediate vicinity (Figure 1.1).

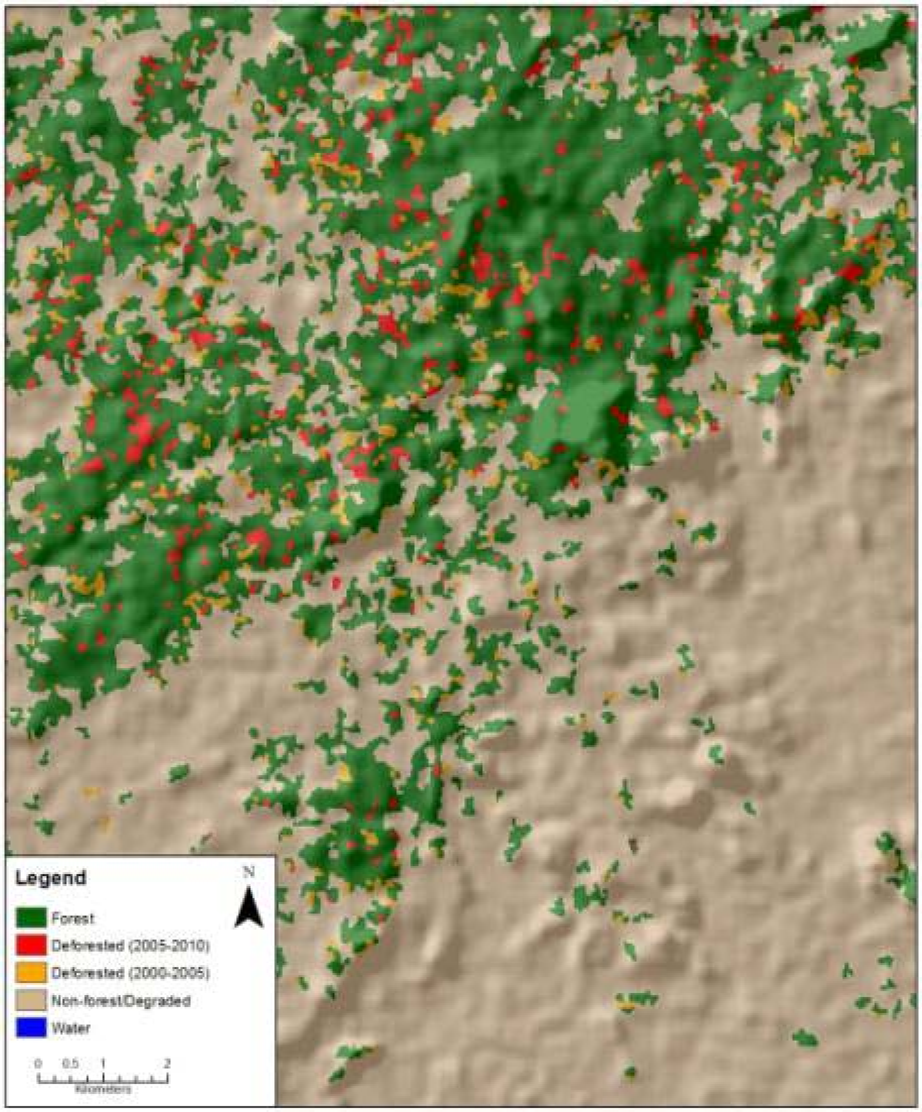

Figure 1.1. Example of the mosaic configuration of deforestation. Note the patchy distribution of recently deforested areas (in red).

The "frontier" configuration, by comparison, occurs generally as discrete "fronts" that progress steadily across a large area of intact forest, usually following a pattern dictated by access routes (e.g. roads and rivers) that channel prospective settlers from existing population centers (Figure 1.2). Consequently, frontier deforestation/degradation is often caused by immigrant agents, and frontier baselines often involve infrastructure or policies that open up access to formerly remote areas. The verbatim VCS definitions for mosaic and frontier are provided in the Glossary (Section 10).

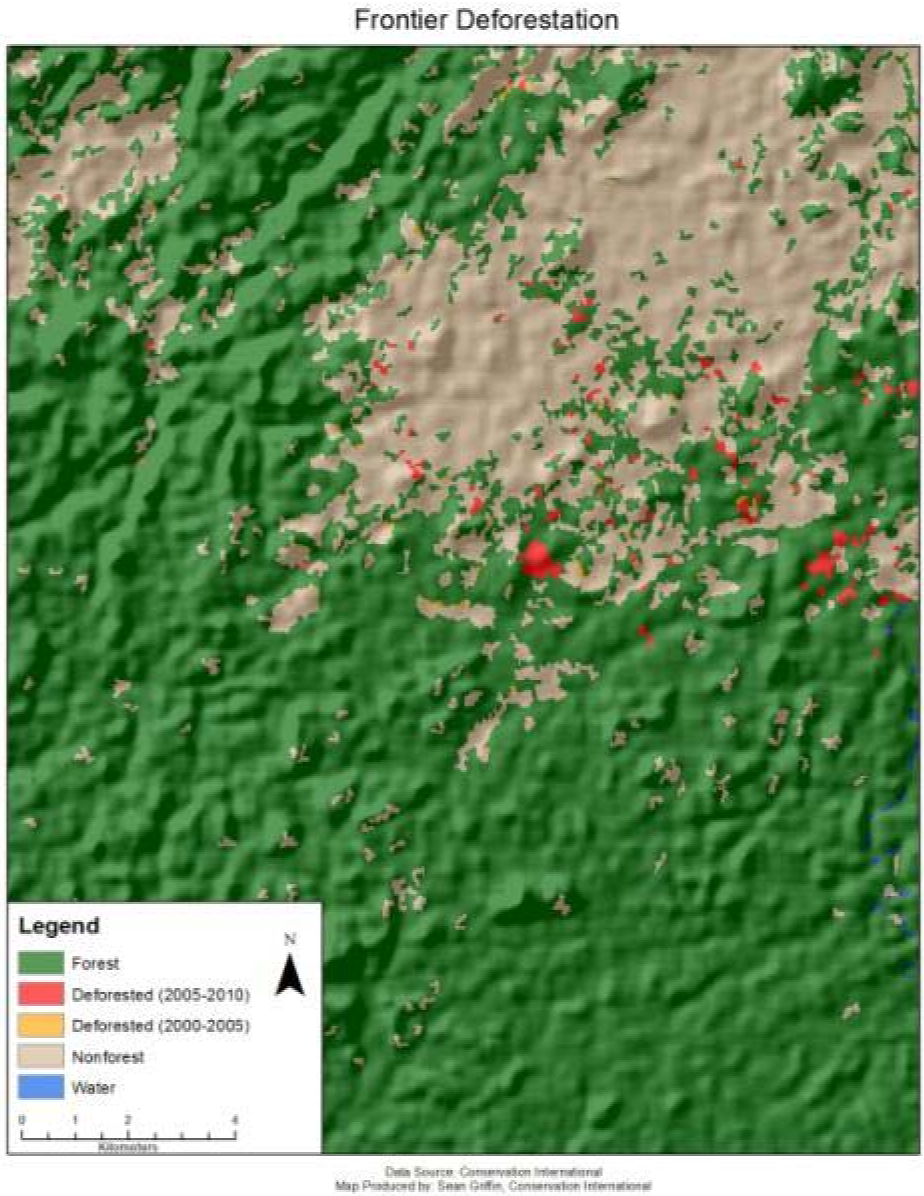

Figure 1.2. Example of the frontier configuration of deforestation. Note that the distribution of recently deforested areas (in red) is concentrated along a deforestation "front" advancing from the upper right corner of the image.

Frontier and mosaic configurations are distinguished in part so that baseline projections reflect the spatial trends of deforestation on the landscape, either advancing in a determined fashion or roughly randomly, respectively. This is important because forest carbon varies across the landscape, and where deforestation takes place determines the amount of forest carbon emitted. Thus, for all frontier deforestation configurations and some mosaic (see criteria below), the VCS requires spatial modeling to pinpoint where on the landscape deforestation occurs, and thus what specific forest carbon stocks are emitted; likewise, spatial modeling also serves to determine the allocation of deforestation among the reference region, project area and leakage belt. In light of this, and the fact that modeling baseline rates of deforestation is more challenging in frontier circumstances where no observed historical trends of deforestation/degradation can be referenced in the immediate area, some AUDD methodologies have been developed to be applicable only to either mosaic or frontier configurations.

Clearly, the distinction between mosaic and frontier depends on scale (e.g. at a very fine scale, mosaic looks like frontier). The VCS AFOLU Requirements document (Section 4.4.8) addresses this through specifying criteria under which a subset of mosaic projects are not required to develop spatial projections predicting where deforestation will occur in the baseline:

"Where, in the mosaic configuration, no patch of forest in project areas exceeds 1000 ha and the forest patches are surrounded by anthropogenically cleared land, or where it can be demonstrated that 25 percent or more of the perimeter of the project area is within 120 meters of land that has been anthropogenically deforested within the 10 years prior to the project start date, spatial projections to determine where in the project area deforestation is likely to occur are not required."

The criteria above allows project developers to forego spatial modeling if the project area does not contain any significant tracts of forest that are remotely located from recently-deforested edges (i.e. that the project area is more or less equally accessible throughout). Notwithstanding the allowance above provided by the VCS, methodologies may still require spatial modeling even where the criteria above are met.

1.5 COMBINING MULTIPLE PROJECT ACTIVITIES AND METHODOLOGIES

Project developers may implement multiple activities across a landscape in connection with a REDD project, for example, carrying out forest protection in one area with complementary improved agricultural management activities in another. Many of these activities may be of an indirect nature in protecting forests, by addressing threats and reducing pressure on forests through fostering alternative livelihoods or improving productivity of existing ones. Rural development activities, for example, can both serve to reduce deforestation/degradation in a project area by decreasing reliance on the forest or land base there, and make up for the loss of resources that protection entails, and thereby reduce the displacement of activities outside the project area (i.e. leakage mitigation activities). These kind of REDD strategies are often agriculture- and/or forestry-related, and often multiple strategies are carried out in combination. Where this is the case, project developers may either:

1. Develop the project as a stand-alone REDD activity, being sure to account for any increases in emissions resulting from activities implemented outside the project area, unless deemed de minimis, or
2. Combine multiple activities under a single VCS Project Description (PD), including with the REDD project any rural development activities implemented outside the REDD project area, each delineated as a separate VCS project activity such as ALM, ARR, or IFM. In other words, these activities could be accounted independently, and then summed for the combined project. Alternatively, each activity could be developed as a stand-alone project with a separate VCS PD, and likewise accounted independently.

When combining multiple activities under a single VCS project, different activities must be segregated spatially (i.e. no overlap) to facilitate accounting by activity type using an activity-specific methodology, or a methodology that covers multiple activities (currently none exists). Peatland Rewetting and Conservation (PRC) projects, another VCS-eligible AFOLU project category, however, may take place "on top of" (i.e. in the same area as) a REDD project, where, for example, a REDD project is implemented on a forested wetland growing on peat. In fact, REDD on peatlands must also follow PRC project requirements, and apply a PRC methodology, where (peat) soil carbon emissions exceed the de minimis threshold in the with-project case.[5]

When developing multiple AFOLU project activities, project developers may prepare and submit separate or combined Project Descriptions (PD) to be validated. Because different methodologies must still be applied for each discrete activity, combining multiple activities into a single PD is not likely to generate significant cost savings in the preparation or validation of the project. Combining projects into a single PD also potentially reduces flexibility for the project developer by requiring all project activities to successfully complete validation before the combined project can be registered.

1.6 ILLUSTRATIVE EXAMPLES OF DEFINING REDD PROJECTS WITHIN THE VCS FRAMEWORK

The following is a series of examples of potential project scenarios. Each includes a demonstration of the process of defining a project by evaluating baseline circumstances and potential project interventions, and classifying them in terms of VCS-eligible project categories. This is not intended to be an exhaustive list of potential project scenarios, but instead is illustrative.

Text Box 1.4. **SCENARIO 1 – ILLEGAL DEFORESTATION OF A FOREST AUTHORIZED FOR CONVERSION**

Scenario: A large intact forest area is under threat of deforestation from illegal land invasion and clearing by migrant colonists for short-term subsistence agriculture (annual crops with extended fallow period). The landowner of the forest area holds permission to convert the forest to another land use, but has no plans or intent to do so, and instead seeks to protect the area by enforcing the property boundary.

Suggested VCS project presentation: Avoiding unplanned deforestation (AUDD). Verifiable threats are from unauthorized agents (the colonists) only. Avoiding planned deforestation (APD) would require evidence of intent to convert to another land use.

[5] Eligible combined category projects, including REDD + Rewetting of Drained Peatland (RDP) and REDD + Conservation of Undrained or Partially Drained Peatland (CUPP) are elaborated in the VCS AFOLU Requirements document (Section 4.2.11).

Text Box 1.5. **SCENARIO 2 – NEW HIGHWAY CONSTRUCTION THROUGH A REMOTE FORESTED AREA**

Scenario: A new highway is planned that will traverse a large expanse of previously inaccessible forest. Authorization and plans for construction of the highway exist. The highway is expected to facilitate new settlement and clearing of the surrounding area by immigrants. A local conservation organization successfully lobbies for the highway construction to be stopped.

Suggested VCS project presentation: Avoiding unplanned deforestation (AUDD), likely frontier. Although there is a planned deforestation component (the highway), the planned deforestation is restricted to the immediate right-of-way of the highway and the relative direct impact of road construction is small. By comparison, a much larger area of unplanned deforestation is expected to result from the influx of population facilitated by the road. It could also be possible to develop this project as a combined avoiding planned and unplanned deforestation activity, however each would require independent accounting.

If the highway were *not* expected to facilitate new settlement or immigration, the project would only avoid planned deforestation.

Text Box 1.6. **SCENARIO 3 – FOREST CONSERVATION WITH THE INTRODUCTION OF SUSTAINABLE FOREST MANAGEMENT**

Scenario: A forest area is under threat of deforestation by local communities who are clearing land for shifting agriculture. The project developer engages the communities in authorized sustainable forest management for commercial timber production in the forest area as an alternative livelihood activity compatible with forest conservation, which together with other project activities reduces the need for agricultural expansion by the communities.

Suggested VCS project presentation: Avoiding unplanned deforestation (AUDD). The project is fundamentally a forest conservation project, which introduces sustainable forest management as a conservation strategy. The activity would not be an IFM project (forests remaining as forests), as the baseline land use scenario is not forest.

Text Box 1.7. **SCENARIO 4 – SELECTIVE ILLEGAL LOGGING ON AN AUTHORIZED LOGGING CONCESSION**

Scenario: A logging concession to a forest area is granted to a concession holder who does not exercise its right to log. Illegal logging focused on scattered high value species is taking place in the area, and the concession holder seeks to improve enforcement of the concession boundaries to prevent the entry of illegal loggers.

Suggested VCS project presentation: Avoiding unplanned degradation (AUDD). Selective logging typically results in degradation, not deforestation. Despite the fact that the concession is authorized, the logging taking place in the concession is *not* authorized, and therefore the project activity is defined as avoiding unplanned degradation.

Text Box 1.8. **SCENARIO 5 – LEGAL DEFORESTATION FOLLOWED BY PLANTATION FORESTRY**

Scenario: A conservation organization acquires and protects an area of native forest that had been permitted for conversion to Eucalyptus plantations, thereby preventing the cutting of native forest. The Eucalyptus plantations would meet the applicable country definition of forest.

Suggested VCS project presentation: Improved Forest Management (IFM, Logged to Protected Forest, LtPF). Despite the fact that conversion of native forest is being prevented, the project does not qualify as a REDD activity because the baseline land use is also forest, albeit one with significantly less conservation value. The baseline scenario is thus considered "forests remaining as forests", and hence deforestation, in the VCS sense of the word, is not taking place. Where the conversion of forest in the baseline is sanctioned, as it is in this case and most others involving commercial plantations, the project activity is considered IFM by the VCS. If conversion of forest in the baseline was unsanctioned, the project activity would be considered AUDD, avoiding unplanned degradation.

Text Box 1.9. **SCENARIO 6 – DEGRADATION PRECEDING DEFORESTATION**

Scenario: A forest area is subject to progressive degradation over time from illegal logging and fuel-wood collection, and fires encroaching from adjoining pasture lands that are periodically burned. Degradation eventually leads to total loss of forest cover and conversion to pasture, where continuous grazing pressure prevents natural reestablishment of forest. Forest protection measures are implemented and extension activities are initiated (improved pasture management and fast-growing fuel-wood plantations) to reduce pressures from surrounding communities.

Suggested VCS project presentation: Avoiding unplanned deforestation and/or degradation (AUDD). As is often the case, deforestation is preceded by degradation. The project could either be developed as an avoiding unplanned deforestation and degradation (AUDD) activity, or alternatively, degradation could be ignored in the baseline and the project developed as simply an avoiding unplanned deforestation (AUDD) activity if, for example, quantifying degradation was found to be infeasible.

Text Box 1.10. **SCENARIO 7 – FOREST CONSERVATION IN WELL-PROTECTED AREA**

Scenario: A conservation organization wishes to use carbon finance to maintain the conservation of a protected area of critical importance to several threatened species. The conservation organization has done of good job over the years of keeping a near zero rate of deforestation in the area, both because of the remote location of the forest area and their successful work with neighboring communities. The project proponent would essentially like to receive compensation for maintaining the carbon stock of the standing forest.

Suggested VCS project presentation: Unless a clear, credible argument can be made about an imminent threat to the forest area, the project would not be a likely to receive VCUs as currently no VCS categories or REDD methodologies exist to cover conservation projects. Rather, the project would fall into the REDD-"plus" category as defined by the UNFCCC. While the REDD-plus text agreed upon in COP 16 includes five recognized activities – reducing emissions from deforestation and forest degradation, conservation and enhancement of forest carbon stocks, sustainable management of forests – most of these activities have yet to be defined by the UNFCCC. Without a clear definition of these activities in place, including "conservation" it is not currently possible to measure progress or pay for the performance of such projects.

2.0

GENERAL VCS REDD REQUIREMENTS

This section contains a summary of the general VCS requirements that apply to all REDD projects, including requirements related to: project area; project start date; project crediting period; additionality; compliance with laws; environmental and social impacts; and non-permanence risk. While not always addressed in REDD methodologies, these requirements must all be addressed in the REDD Project Description (PD) that is submitted for validation.

2.1 ELIGIBLE PROJECT AREA

For REDD projects, the project area is the area of forestland under the control of the project developer that will be protected by the REDD project activities, and where the generation of GHG emission reductions or removals may take place. The project area need not be a single contiguous area, but can be composed of a collection of dispersed tracts. To be eligible under the VCS, the project area must be 100 percent forested at the project start date and for the period at least 10 years prior to the start date (i.e. forest is at least 10 years old). See section 1.2 for further discussion of forest definitions.

In APD projects, the project area is the forestland that is under the control of the project developer and which is planned for conversion. In AUDD projects, the project area is the forestland that is under the control of the project developer and which is subject to potential deforestation and/or degradation in the future; this is not to say that the entire project area is deforested in the baseline land use scenario, but only that it could be (see section 3.2 for further discussion of baselines).

It should also be noted that the project area for AUDD projects is not always the same area as where the project activities to protect the project area will take place. For example, project activities could include developing alternative livelihood activities that are directed to strategic areas outside the project area (e.g. access points or communities in the surrounding area), but which result in avoided deforestation in the forestland that is delineated as the project area.

Project developers can typically demonstrate control of the project area through proof of title over a right of use which is legally recognized in the host country of the project (VCS Standard, section 3.12). Proof of title or right of use can take various forms in each country. In some cases, control may arise through law or regulation. In other cases, control may arise through contractual agreement with the owner of the right of use. In many cases, there may be conflicting evidence, and project developers will want to consult legal counsel to receive appropriate advice on resolving any inconsistencies and clearly demonstrating proof of title.

In general, the VCS requires that the project area is under control of the project developer at the time of validation, or by the time of the first verification. The exception to this rule exists only for grouped projects, which are allowed to expand their project area after validation, however the boundary of the area in which grouped project instances may occur must be set out at validation. The VCS requirements with respect to "grouped projects"are outlined in the VCS Standard (Section 3.4), and in the VCS AFOLU Requirements document (Section 3.7). Although some methodologies contain detailed guidance for grouped projects, project developers may apply any VCS-approved REDD methodology to a grouped REDD project.

2.2 PROJECT START DATE

Under the VCS, the project start date for an AFOLU project is "the date on which activities that lead to the generation of GHG emission reductions or removals are implemented" (VCS AFOLU Requirements 3.2.1). Therefore, for REDD projects, the project start date is the date when the REDD activities are implemented; in practice, this may coincide with the date that the management plan or protection plans were put into place.

The project start date is significant because it determines the beginning of the baseline period and the project crediting period, which are both fixed and limited in duration. With this in mind, the crediting potential of a project over the first baseline period and first project crediting period will be maximized if the project developer fully implements the REDD activities across the entire project area as soon as practicable after the project start date.

The project start date is also significant because it determines the date by which projects must be registered under the VCS. According to Version 3 of the VCS Standard, the following validation deadlines apply to all AFOLU projects:

Table 2.1. PROJECT START DATES AND VALIDATION DEADLINES.

Project start date	Validation completed (final validation report issued) by
Before 1 January 2002	Validation (*and* verification) within one year of the approval of the methodology and no later than 1 October 2012[6]
On or after 1 January 2002, and before 8 March 2008	7 March 2013
On or after 8 March 2008	Within 5 years of project start date

[6] These early start projects must also demonstrate that they were initially intended as GHG projects, and that they engaged independent carbon experts and quantified the baseline and GHG reduction using an externally reviewed methodology. These projects must also complete the first verification by 1 October 2012.

2.3 PROJECT CREDITING PERIOD

The VCS allows project developers to select a project crediting period of between 20 and 100 years for most AFOLU projects, including all REDD projects. Crediting periods may be renewed up to four (4) times, however, the total crediting period cannot exceed 100 years. For most projects, the start of the project crediting period will commence with the project start date. [7]

The project crediting period is significant because it establishes the minimum time period over which the project developer must monitor and report baseline and project GHG emissions, and therefore the period over which the project developer must incur associated monitoring and verification costs. Other factors to consider when selecting the initial project crediting period of the REDD project may include the length of the planned activities as well as the length of the key agreements underlying the project (for example, management agreements or community/landowner agreements establishing rights to the emission reductions in the project area).

It is important to note that the choice of project crediting period does not impact the time frame for assessing the non-permanence risk of the project (see section 2.8), which should generally be evaluated over a period of 100 years from the start of the current monitoring period (VCS AFOLU Non-Permanence Risk Tool, section 2.1.1). The choice of project crediting period also does not impact the time frame for re-assessing the baseline, which must be reassessed every 10 years for REDD projects (see section 3.2 of this document).

A project's crediting period can be different from the length of time over which the project activity will be carried out, which is instead referred to as "project longevity" in the VCS AFOLU Non-Permanence Risk Tool (see section 2.7). A project with longevity shorter than 30 years will fail the Risk Tool[8]. Thus, to be eligible, a REDD project activity must be implemented for at least 30 years, monitored and reported for at least 20 years, and consider risks over at least a 100 year period.

2.4 ADDITIONALITY

All VCS projects, including REDD projects, must demonstrate that they are additional to what would have occurred under a business as usual scenario. That is to say that the REDD project activity would not have occurred in the absence of carbon finance. All approved VCS REDD methodologies can address additionality using the most recent VCS "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities" (VCS Additionality Tool). The VCS Additionality Tool follows a step-wise process involving (1) identification of alternative land use scenarios, (2) investment or barriers analysis, and (3) common practice analysis. A summary of these steps is provided below.

Step 1: Identify alternative land use scenarios - The baseline scenario is the most likely land use in the project area in the future in the absence of the project activity (see section 3.2 for further discussion). The baseline scenario is the most likely scenario amongst the alternatives that have been identified, and is selected based on the approach contained in the applicable REDD methodology. The VCS Additionality Tool requires that the scenarios should be "credible" and "feasible for the project area taking into account

[7] The only exceptions to this rule is when the project started before 1 January 2002, in which case, the start of the crediting period is 1 January 2002.

[8] Unless covered by a legal agreement, e.g. government decree of a protected area, in effect for 100 or more years

relevant national and/or sectoral policies and circumstances, such as historical land uses, practices and economic trends," and must be consistent with "enforced laws and regulations". A key word here is "enforced". In some cases, it can be demonstrated with evidence that laws are not enforced, for example in the case of "paper parks" that receive no real protection and are consequently under threat of deforestation despite their official status. Thus, initiating protection measures in an already declared, but unfunded national park, could be demonstrated to be additional.

Step 2 and 3: Perform investment or barrier analysis - After identifying the baseline land use scenario, project developers need to identify obstacles that would prevent the project activity from taking place by performing either an investment or barrier analysis. An investment analysis can be used to demonstrate that the project scenario, in the absence of carbon revenues, is less financially attractive than one of the other land use scenarios. Alternatively, barrier analysis can be used to demonstrate that there are barriers (e.g., technological, institutional, social, ecological, etc.) that prevent the project from occurring, and that can be overcome by intervention financed through the sale of GHG emission reductions.

Step 4: Analyze common practice - The final step of the VCS Additionality Tool is demonstrating that the project activities are not common practice in the project region. Where activities similar to those of the proposed REDD project are also present in the project region, it is necessary to identify the essential differences between these activities and the proposed project activity (e.g. a nearby protected area is financed through philanthropic funds not available to the project).

2.5 COMPLIANCE WITH APPLICABLE LAWS

AFOLU projects, including REDD projects, are not eligible under the VCS if implementation of the project activities violates any laws, regardless of whether or not the laws are enforced. Therefore, it is important that project developers understand the laws that apply to their projects, to ensure that the project activities themselves do not violate any such laws. As jurisdictional and/or national REDD programs emerge, project developers should stay abreast of applicable rules and requirements that may apply to their REDD projects.

2.6 ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

The VCS requires project developers to identify potential negative environmental and socio-economic impacts of their projects, and takes steps to mitigate these impacts. In the case of REDD, it is unlikely that forest protection measures will generate net negative environmental impacts (on the contrary, it will typically generate net positive environmental impacts). However, it is possible that forest protection measures could impact livelihoods of those people who depend on the forest for food, fuel, or income. In these cases, it will be important to mitigate these negative socio-economic impacts, through for example, activities supporting the development of alternative livelihoods. Project developers that want to demonstrate positive environmental and socio-economic impacts of their REDD project activities may consider using and demonstrating conformance with additional standards such the Climate, Community, and Biodiversity (CCB) Standards or the SOCIALCARBON Standard.

2.7 NON-PERMANENCE RISK

The VCS requires all AFOLU projects, including all REDD projects, to contribute a portion of their GHG emission reductions to a risk buffer to protect against the risk of non-permanence. Non-permanence refers to the risk of reversal after a project has been credited, or in the case of REDD projects, the risk that

GHG emissions in the project area will exceed the baseline rate of GHG emissions in future periods after credits have already been issued for earlier periods.

The VCS requires each project to assess its risk of non-permanence using the AFOLU Non-Permanence Risk Tool[9]. This tool contains specific procedures for project developers and validation/verification bodies to follow when conducting a non-permanence risk analysis for a project, and essentially involves assessing three broad categories of non-permanence risk: internal risk, external risk, and natural risk.

Table 2.2. VCS NON-PERMANENCE RISK CATEGORIES.

Internal Risk	External Risk	Natural Risk
Project Management Financial Viability Opportunity Cost Project Longevity	Land tenure Community engagement Political risk	Fire Pest and disease outbreaks Extreme weather Geological risks Other natural risks

The tool provides detailed guidance on assigning a score for each of the above risks, which are then summed to arrive at an overall score for each category of risk. The overall score for a project determines the project's overall risk rating and therefore the number of credits that the project developer must contribute to the VCS pooled buffer. Non-permanence risk withholdings will range from 10 to 60 percent of the net change in carbon stocks, i.e. before leakage is deducted (a risk rating greater than 60 represents a failure and ineligibility). Project developers should consult the VCS document *Registration and Issuance Process* for the rules and requirements for the release and cancellation of buffer credits.

[9] VCS. 2011. AFOLU Non-Permanence Risk Tool. Verified Carbon Standard, Washington, D.C.

3.0

ANATOMY OF A REDD METHODOLOGY

This section is intended to introduce the reader to the general elements common to all REDD methodologies. Specific requirements for each methodology are elaborated in section 4.0.

Methodologies establish detailed GHG measurement and accounting rules for specific project types and circumstances, and must be consistent with the VCS AFOLU Requirements summarized in Sections 1 and 2. The VCS relegation of detailed accounting rules to methodologies acknowledges that the one size fits all approach is not appropriate given the diversity of projects, and acknowledges that there is no one "correct" way to conduct measurement and accounting. Together, the VCS Standard and methodologies ensure consistency in accounting and measurement across projects, providing for a "level playing field." Methodologies, however, may be stricter or more conservative than VCS requirements. For example, a methodology that requires inclusion of a carbon pool deemed optional in the VCS AFOLU Requirements, or stricter uncertainty thresholds, is not out of compliance.

The key components shared by all methodologies include the following, here organized to align with the general elements included in most methodologies:

- Applicability Conditions
- Project Boundaries
- Baseline
- Leakage
- Monitoring
- Uncertainty
- Quantification of GHG Emission Reductions

3.1 APPLICABILITY CONDITIONS

Methodologies generally begin by setting out the criteria, or applicability conditions, which must be met for the methodology to be used for a specific project. Applicability conditions serve to identify the scope of a particular methodology, and by extension the circumstances beyond which it cannot (and was not designed to) be applied. For example, some methodologies are specific to either planned or unplanned deforestation, or cover either mosaic or frontier deforestation. Applicability conditions often restrict a methodology to certain baseline (post forest conversion) land uses. The list of applicability conditions is the first thing a project developer should consult when evaluating methodology options, and a key is provided in section 5.2 to assist in identifying applicable VCS approved REDD methodologies.

3.2 PROJECT BOUNDARIES

Methodologies specify the relevant project boundaries for the proposed project activity. For REDD projects, project boundaries include geographic boundaries as well as included carbon pools and GHG emission sources. The term "project boundary" sometimes causes confusion because it also refers to GHG accounting boundaries defined as pools, sinks and sources.

3.2.1 Geographic Boundaries

The project area is the area of forest land under control of the project developer that will be protected by the REDD project activities. Any non-forest land existing within an area of interest at the project start date must be delineated and excluded from the project area. Requirements for documenting the project area are detailed in the VCS AFOLU Requirements document section 3.4.1.

AUDD projects also require the geographic delineation of the reference area and leakage area. The reference area is an area where the agents and drivers of deforestation are similar to those found in the project area. It is in this area that past and present deforestation and degradation are assessed using remote sensing in order to determine historic rates of deforestation. The period over which the historic rate of deforestation is determined is referred to as the reference period. This information is then used to model the rate or amount of future deforestation in the baseline.

The leakage area is one or more geographical area(s) outside the project area where GHG emissions due to the project activity occur. The increase in GHG emissions in the leakage area relative to its baseline (see section 3.3 below) is attributed to displacement of activities from within the project area and is quantified and deducted in the calculation of project GHG emission reductions. Leakage is discussed further in section 3.4 below.

3.2.2 Carbon Pools and GHG Emission Sources

VCS AFOLU Requirements and REDD methodologies define the carbon pools and GHG emission sources that will be included within the project accounting boundary. Carbon pools (i.e. discrete, measurable compartments in the forest ecosystem containing sequestered carbon) may include:

- Aboveground tree biomass
- Aboveground non-tree woody biomass (e.g. shrubs)
- Belowground tree biomass (coarse roots)
- Litter (forest floor)
- Dead wood (standing and lying dead wood)
- Soil (including peat)
- Wood products

Pools which must always be considered by REDD project methodologies are: aboveground tree biomass; aboveground non-tree biomass in cases where the baseline (post conversion) land use includes perennial tree crops; and wood products in cases where there is a significant reduction in the wood products pool caused by the project, e.g. through stopping commercial timber harvest (see below for further discussion of determining significance).

Pools which methodologies may include or exclude are: belowground tree biomass (generally coarse roots $\geq$ 2 mm diameter), aboveground non-tree biomass, litter, dead wood and soil carbon. In many cases, methodologies may leave these pools as optional, but generally require their inclusion if the anticipated increase in emissions from these pools resulting from the project is significant (see below for further discussion). Where a REDD project takes place on peat soils and project emissions from the soil pool are significant, the project is also subject to PRC project requirements and thus the soil pool must be included in the project boundary.

In addition to considering changes in the carbon pools above, methodologies may also include other GHG emission sources related to the project activities that occur inside or outside the project area. Some emission sources may be included when they occur in the baseline and are reduced in the project, for example nitrous oxide (N2O) emissions where nitrogen fertilizer is applied in agriculture, and methane (CH4) emissions where fire is used in land clearance or where land use in the baseline involves rice or livestock management. Project activities that result in significant (see below) emissions *outside* the project area must be monitored and accounted for as leakage (for example where increased emissions result from leakage mitigation activities like agricultural intensification).

Determining Significance – de minimis

Pools and emission sources may be excluded if the combined increase in project emissions that they represent is less than 5 percent of the total GHG emission reductions from the project. For example, a project developer may ignore (and not account for) the potential increase in GHG emissions due to leakage mitigation activities, if it is determined (on the basis of credible representative data or research findings) that such emissions would represent less than 5 percent of expected total GHG emission reductions from the project.

This evaluation process is described in VCS AFOLU Requirements: Version 3 (section 4.3.3) and in the procedures outlined in the referenced CDM "Tool for testing significance of GHG emissions in A/R CDM project activities.[10]" The analysis is generally applied in advance (ex ante), and identifies emission sources that in combination are insignificant and may be excluded from the project boundary. The analysis compares estimates of expected emissions by source, referenced from scientific literature or IPCC default values (see Section 9 Resources), with conservative estimates of anticipated project performance.

[10] http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf

In addition to the *de minimis* criteria, project developers may also utilize the principle of "conservative exclusion", whereby a pool or source can be ignored if its exclusion results in conservative accounting of GHG emission reductions (see VCS AFOLU Requirements document 4.3.4). As an example, non-CO2 emissions from the burning of woody biomass in the baseline land use scenario could be conservatively excluded where they do not occur, or are reduced, in the project. Similarly, soil carbon emissions resulting from deforestation in the baseline can be conservatively excluded. These exclusions reduce GHG emission reductions credited to the project activity, hence they are conservative, but serve to greatly simplify accounting and measurement effort, the cost of which can in some cases exceed the value of foregone GHG emission reductions.

In addition to the *de minimis* and conservative exclusion principles described above, the VCS further simplifies accounting by allowing (but not requiring) the universal exclusion of the following emission sources from REDD project methodologies:

- nitrous oxide (N2O) emissions, e.g. from fertilizer application or decomposition of biomass from nitrogen-fixing plants
- GHG emissions from removal or burning of herbaceous biomass
- GHG emissions from collection of wood for rural fencing
- GHG emissions from transportation and machinery use

3.3 BASELINE EMISSIONS

Procedures for quantifying the baseline emissions of the REDD project activity are another key component of each approved REDD methodology. Baseline emissions refer to the emissions in the baseline (or business as usual, BAU) scenario which are expected to occur in the absence of the project activity. Consequently, the projection of baseline emissions is made in advance (or ex ante) of the baseline or project crediting period, and is never monitored after the fact (or ex post), unlike project emissions (Section 3.4). Baselines must be re-assessed and revalidated every 10 years (VCS AFOLU Requirements 3.1.9). The baseline scenario for REDD projects is comprised of a land-use and land-cover (LU/LC) change component ("activity data", *sensu* IPCC, explained in Section 1.2) and a carbon stock change component ("emission factor", *sensu* IPCC).

3.3.1 Land Use/Land Cover Change (Activity Data)

The first step in determining the projected change in land use/land cover is to identify the baseline scenario, or the most likely land use, in the project area in the absence of the project activities. Project developers may develop such baseline projections for the entire crediting period of the project, for example to inform project financial planning; however, VCS requires a reassessment of the baseline every 10 years as it does not consider projections beyond this timeframe to be realistic.

For APD project methodologies, the rate and amount of land use/land cover change in the baseline scenario is based on existing land conversion plans or, if the specific agent of deforestation cannot be identified, based on the common practice of the identified class of agents in the region. Verifiable evidence is required and examples of acceptable evidence to substantiate APD baselines are provided in the VCS AFOLU Requirements document (section 4.4.8). Projects must provide further evidence that planned deforestation in the baseline was authorized and intended (i.e. that intent to exercise land conversion rights can be demonstrated).

For AUDD project methodologies, the land use/land cover change in the baseline scenario is based on historical trends observed over the previous (usually) 10-12 years (VCS requires at least the previous 10 years) that are used to make future projections of deforestation. Most REDD methodologies include separate procedures for modeling the rate (or amount) and the location of land use/land cover change; however, modeling the location (spatial modeling) may not be required if the AUDD is a mosaic configuration that meets the criteria explained in Section 1.2.2.

3.3.2 Carbon Stock Change (Emission factors)

The second step in determining baseline emissions is to assess the emissions resulting from projected land use changes, calculated as the difference in carbon stocks between the current land use (forest) and the baseline land use scenario (e.g., agriculture, grazing, degraded forest). Methodologies require that forest carbon stocks be estimated from direct inventory of the project area, or from measurements from forests representative of the project area, while some may also allow the use of conservative estimates from the literature or IPCC defaults. For baseline (post forest conversion) land uses, all approved REDD methodologies permit the use of default carbon stock values from local studies or literature, or, where not available, from direct sampling of proxy sites. The use of data from the literature or IPCC defaults will usually have different implications for uncertainty, thus some methodologies require the lower and upper ranges of the values to be used for forest and non-forest classes respectively (see also section 3.6 Uncertainty). Where spatial modeling is not conducted as part of baseline modeling, and thus emission factors are not matched to specific pixels on a map, methodologies generally employ an area-weighted average emission factor from a stratified sample or assume the strata with the lowest average carbon stocks are deforested first.

3.4 LEAKAGE

Procedures for determining the emissions caused by leakage are a critical element of all REDD methodologies. Leakage refers to the increase in GHG emissions outside the project boundary (but within the same country; i.e. international leakage is not accounted for) which is measurable and attributable to the project activity. The types of leakage relevant to REDD projects are activity shifting leakage and market leakage[11].

Decreases in emissions outside the project area attributable to the project activity, also referred to as "positive leakage", are not credited by the VCS.

3.4.1 Activity Shifting (Non-market) Leakage

[11] These are referred to as non-market (activity shifting) and market leakage, respectively, in a draft revision to AFOLU Requirements released in June 2011 by the VCS for public comment. As such, the VCS treatment of leakage from REDD projects as described below is subject to change and readers are urged to consult the most current versions of the VCS documents when using this guidebook.

Activity shifting leakage occurs where agents shift their deforestation/ degradation activities outside the project area. Activity shifting is relevant to both APD and AUDD projects. For APD projects, activity shifting is tracked by monitoring other lands under the control of the deforestation agent for any changes to management plans and/or land-use designations (if the agents of deforestation are identifiable), or estimating deforestation caused by shifts in domestic commodity production, for example, where the exact agent cannot be identified. For AUDD Projects, activity shifting leakage due to local agents is monitored in a leakage area or "belt" including accessible forest areas surrounding the project, where any increases in deforestation/degradation above the baseline projection are attributed to displacement of activities from the project area.

Activity shifting leakage due to future *immigrant* agents, where it is expected that immigrants will be redirected and will shift their future activities away from the project area and leakage area to other parts of the country, is also addressed by some methodologies. In those methodologies where immigrant leakage is addressed, the methodologies prescribe procedures for estimating (rather than observing, as in a leakage belt) the emissions from immigrant actors, in effect estimating activity shifting leakage as if the entire country were a leakage belt[12].

3.4.2 Market Leakage

Market leakage occurs when the project activity reduces the production of a commodity that results in an increase in production elsewhere to meet continuing market demand. Under the VCS, market leakage assessed to projects is restricted to market leakage occurring within national boundaries. Market leakage may be relevant to both APD and AUDD projects. In cases where project activities reduce the amount of timber or other commodities that is supplied to regional, national and/or global markets, some methodologies establish procedures and factors that project developers should use to determine market leakage, usually referencing guidance and default factors provided in the VCS AFOLU Requirements document.[13]

3.5 MONITORING

For the purpose of this guidebook, and in conformance with the terminology of most methodologies, monitoring refers to the process of measuring the emissions in the project area and in the leakage area after the project activity has been implemented, usually immediately prior to verification. Measured emissions in the project and leakage areas after the project starts are then compared to the baseline emissions previously projected to determine the project's GHG emission reductions. The monitoring component of REDD methodologies therefore specifies the items which should be measured, typically forest cover, carbon pools, and GHG emission sources, the procedures involved in measurements, and procedures for managing quality assurance/quality control.

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[12] The proposed VCS revisions mentioned above, and yet to be approved as of release of this guidebook, instead treat non-market (activity shifting) leakage from unidentified agents, like redirected immigrants, as untraceable and to be conservatively assessed as 100 percent of baseline emissions due to these agents, unless it can be convincingly demonstrated otherwise.

[13] A new VCS Tool for the Estimation of Market Leakage is slated for release in 2011, and as before, readers are urged to consult the most current VCS documents to confirm the VCS procedures.

Where specified in methodologies, the minimum frequency of monitoring ranges from annually to every 5-10 years. In practice, project developers should compare the estimated costs of monitoring and verification to the expected value of the credits that will be generated during the same monitoring interval. Shorter monitoring intervals require increasingly accurate and precise data from each event to detect change, increasing monitoring costs (related to the cost of obtaining both carbon stock (inventory) and forest cover (satellite imagery) data). Given monitoring costs, projects with lower levels of absolute baseline emissions may monitor less frequently than those with higher levels of absolute baseline emissions. It should be noted that monitoring forest cover change on a less than annual basis is seldom possible because of the need to mosaic imagery from throughout the year to achieve sufficient cloud-free coverage of the entire monitoring area.

3.6 UNCERTAINTY

The measurement of forest cover, carbon pools and GHG emission sources in both the baseline and project scenarios are generally based on sampling approaches and other statistical methods that are subject to potential error and uncertainty. The VCS requires that methodologies quantify and account for uncertainty in these items. In conformance with the VCS Standard version 3.1 (Section 4.1) all methodologies must impose confidence deductions when the uncertainty exceeds +/-15 percent of the mean at the 95 percent confidence level or +/-10 percent of the mean at the 90 percent confidence level. Please note this guidebook expresses uncertainty as the half width of the confidence interval (i.e. +/-15 percent as opposed to 30 percent). In practice, these deductions reduce estimates by the amount of uncertainty exceeding this threshold, and thus there is an incentive to improving the precision and accuracy of project measurement and accounting.

3.7 QUANTIFICATION OF GHG EMISSION REDUCTIONS

In all VCS REDD methodologies, GHG emission reductions, creditable as Verified Carbon Units (VCUs), are calculated with the following basic formula (also well-illustrated in the VCS AFOLU Requirements document 4.7.2, Table 4):

> GHG emission reduction credits issued (VCUs) =
>
> Baseline emissions (projected ex ante) *minus*
>
> Project emissions (monitored ex post) *minus*
>
> Leakage (monitored ex post) *minus*
>
> Non-permanence Risk Buffer withholding (assessed ex post; note that the non-permanence buffer withholding is calculated as a percent of net change in carbon stocks, i.e. prior to deduction of leakage)

Although GHG emission reductions are calculated and credited ex post, the VCS also requires project developers to include ex ante estimates in the Project Description that is validated and registered. Ex ante estimates are necessary in order to evaluate the significance of certain forest carbon pools and emission sources (3.1.2 above), and therefore, to determine whether some can be excluded from project accounting. Ex ante estimates are also important to establish anticipated project performance from the perspective of a potential investor or capital provider to a project. Projections of ex ante estimates beyond 10 years are not required.

Often, little guidance is provided on developing ex ante estimates, in particular regarding ex ante assumptions of leakage and with-project performance. The level at which deforestation will actually be reduced in the project case depends on the ability of the project to address the drivers of deforestation and project developers are asked to make conservative assumptions about the effectiveness of the proposed project activities and leakage prevention measures. It is beyond the scope of this guidebook to elaborate or provide guidance on the process of developing ex ante estimates for REDD projects. In general, however, they are based on best available information, with priority given to empirical, peer-reviewed research findings that can be demonstrated to be representative and relevant to a project's circumstances. Preference is also given to increasingly site-specific sources of data.

4.0

METHODOLOGY ACCOUNTS

This section contains a detailed summary for each of the approved VCS REDD methodologies, referred to here as methodology accounts. Project developers can refer to these accounts to gain a rapid understanding of the key elements for each of these methodologies. Each account contains an overview and summary of key applicability conditions and approach to project boundaries, baseline, leakage, monitoring, and uncertainty. To each methodology, we also ascribe a short "nickname" that will be used hereafter to reference the methodology.

All VCS approved methodologies presented in this section are valid for use, regardless of whether they were developed and validated under a previous version of the VCS Standard. A process to update methodologies to new versions of the VCS Standard, where inconformities become apparent, is expected to be instituted by the VCS.

4.1 VM0004 METHODOLOGY FOR CONSERVATION PROJECTS THAT AVOID PLANNED LAND USE CONVERSION IN PEAT SWAMP FORESTS ("SE ASIA PEAT APD") [14]

Approved: 23 August 2010

4.1.1 Overview and applicability conditions

Methodology VM0004 was developed by Infinite Earth, Ltd to account for projects that stop planned deforestation of tropical peatland forests. The methodology is only applicable to intact (i.e. not already drained) peat swamps in southeast Asia, in part because of the specificity of some of the default emission factors it employs. Applicability is further restricted to deforestation by "corporate or governmental entities." No other deforestation pressures may exist in the project area, for example, settlements or unplanned (unauthorized) activities that "lead directly to deforestation, such as clearing for agriculture or grazing land."

- Key applicability conditions, as discussed above, for VM0004 include:
- The project activity involves preventing planned deforestation on undrained tropical peat swamp forests in southeast Asia;
- The baseline scenario is restricted to conversion of forest to palm oil plantations, pulpwood plantations, or cropland, preceded by harvest of commercial timber, fire, and then drainage through establishment of a system of canals;
- Deforestation in the baseline must be caused by corporate or governmental entities;
- The project area must not be affected by any drainage activities surrounding it; and
- The parcels of peat swamp forest to be converted to another land use must not contain human settlements or human activities that lead directly to deforestation, such as clearing for agriculture or grazing land (i.e. no unplanned deforestation). Activities that involve the utilization of natural resources within the project boundary that do not lead to deforestation are permitted as this degradation is accounted for in the monitoring methodology.

4.1.2 Project Boundaries

Geographic boundaries

As methodology VM0004 is for avoiding planned deforestation (APD) project activities, there is no reference region for determining baseline emissions. As mentioned above, for the methodology to be applicable the project area must not be affected by any drainage activities surrounding it. If the project boundary does not conform to a discrete hydrologic unit, lack of impacts from neighboring activities must be confirmed by monitoring (ex post) activities in a 3 kilometer wide (default width) buffer zone surrounding the project area.

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[14] It should be noted that this methodology was approved prior to development of VCS guidance for PRC activities and may be subject to future change to conform with new guidance issued in the VCS version 3.

Carbon Pools and GHG Emission Sources
The carbon pools and sources of GHG emissions included in this methodology are listed in Table 4.1 below.

Table 4.1. CARBON POOLS AND SOURCES OF GHG EMISSIONS IN VM0004.

Aboveground tree biomass	Included
Aboveground non-tree woody biomass	Included
Belowground biomass	Excluded
Litter	Excluded
Dead wood (standing and lying)	Excluded
Soil	Included (peat)
Wood Products	Included (timber removal assumed in baseline per applicability condition)
Carbon dioxide (emissions, apart from stock change in pools), CO2	Excluded
Methane, CH4	Included (from biomass/peat burning)
Nitrous Oxide, N2O	Included (from biomass/peat burning)

4.1.3 Baseline Emissions

Land Use/Land Cover Change (Activity Data)
Because this methodology is for a APD project, there is no need to model the baseline scenario to determine either the rate (extent) or location of deforestation. Instead, project developers must provide verifiable documentation (e.g. permits and implementation plans) to substantiate the rate (extent) and location of deforestation.

Carbon Stock Change/Emission Factors
A forest inventory using permanent or temporary sample plots is required to estimate carbon stocks in aboveground tree and woody non-tree biomass in the project area. Aboveground tree biomass may also be estimated on the basis of high-resolution aerial imagery. Inputs to the wood products pool (not emitted) are estimated based on assumptions regarding commercial species and size classes (from common practice based on market surveys or harvest records) and percent of harvested round-wood going to long term wood products (from government statistics for example). Peat bulk density is estimated from samples of soil cores taken from the project area. Non-CO2 emission sources included in the project boundary are methane and nitrous oxide from biomass/peat burning.

Emissions from drainage of peat are modeled from assumptions regarding the depth of peat drainage, obtained from surveys or using a conservative default value provided by the methodology. Peat depth must be mapped to ensure that projections of peat loss due to drainage and burning do not exceed peat stocks. Baseline (post conversion) land use stocks (and growth) are estimated from proxy sites or default values.

4.1.4 Leakage

Activity Shifting

The applicability condition that the project area "must not contain human settlements (towns, villages, etc.) or human activities that lead directly to deforestation" allows for the assumption that there is no displacement of activities to forested areas outside the project area, other than those caused by the authorized agent of deforestation (i.e. there is only potential for planned deforestation to be displaced). Where it cannot be demonstrated that planned activities are shifted to non-forest land, lands under the control of the baseline agent must be monitored against existing (pre-project) management plans to identify (and deduct for) any leakage that occurs (per VCS AFOLU guidance). Leakage from activity shifting need only be tracked for 5 years following the anticipated date of deforestation, after which monitoring is no longer required.

Market Effects

Market leakage from displacement of commercial timber harvest that would have occurred prior to land use conversion, is quantified using default values provided in the VCS AFOLU Requirements document.

4.1.5 Monitoring

Measurement of forest carbon pools and peat bulk density takes place only once at the beginning of the project. Project proponents seeking credits from tree growth within the project area must monitor forest carbon stocks on permanent plots at least every five years.

Project implementation, peat drainage activities in the project area and hydrologic buffer zone (if applicable), and emissions resulting from unavoided deforestation, logging or fire that occur in the project area must be monitored annually, and can be accomplished using remote sensing, aerial photography, or field surveys.

4.1.6 Uncertainty

Errors around carbon stock estimates and around any default values applied are combined via simple propagation of errors to produce an estimate of total uncertainty in calculation of GHG emission reductions. The methodology sets a precision target of +/-10 percent of the mean with 90 percent confidence.

4.2 VM0006 METHODOLOGY FOR CARBON ACCOUNTING IN PROJECT ACTIVITIES THAT REDUCE EMISSIONS FROM MOSAIC DEFORESTATION AND DEGRADATION ("MOSAIC AUDD")

Approved 3 December 2010

4.2.1 Overview and applicability conditions

Methodology VM0006 was developed by Terra Global Capital for projects that reduce emissions from mosaic deforestation and degradation. The methodology has fairly wide applicability, and may be used for a wide range of baseline scenarios (deforestation/degradation drivers) and project activities. Baseline deforestation and degradation rates are projected from historic trends (i.e. not on basis of correlated drivers). The methodology incorporates fairly involved ex ante analysis requirements, including detailed assessment of the anticipated effectiveness of project implementation (deforestation/degradation prevention and leakage management/prevention) activities. This methodology is unique in requiring spatial modeling for application in any mosaic deforestation configuration.

Key applicability conditions for VM0006 include:

- Minimum annual deforestation rate in the reference region of 0.5 percent during the historical reference period;
- Large-scale, industrial, agriculture and perennial crops including agroforestry, oil palm plantations and short rotation woody crops are some important potential REDD baseline land uses that are excluded by the applicability conditions;
- Comparatively specific remote sensing time series requirements – "At least one remote sensing image (i.e., data) from 0-1 years before the project start date, at least one image from 2-5 years before the project start date, at least one image from 6-9 before the project start date, and one image from 10-15 years before the project start date must be available. No images older than 15 years may be used for the historical reference period"; and
- No commercial timber harvest may occur in the project area during the crediting period.

4.2.2 Project Boundaries

Geographic Boundaries

VM0006 requires delineation of a reference region and leakage belt. The reference region is the area where the historic rate of deforestation/degradation is determined for the baseline scenario. Its boundary is determined to ensure similarity of agents and drivers of deforestation, landscape and socio-economic circumstances with the project area. The minimum size of the reference region is from 2 to 20 times the project area (depending on the scale of the project). The reference region should contain both forest and non-forest, and be at least 25 percent forested at the start of the project. For determination of the first (historic) baseline, the reference region must include the project area and leakage belt, after which the reference region must be revised to exclude leakage belt and project area for determination of subsequent baselines.

The leakage belt is the area surrounding the project area where activity shifting leakage is expected to occur. The leakage belt must contain both forest and non-forest at the start of the project and width of the belt is determined via a cost of transportation analysis using GIS in conjunction with participatory rural appraisals (to quantify transportation costs).

Carbon Pools and GHG Emission Sources
The carbon pools and sources of GHG emissions included in this methodology are listed in Table 4.2.

Table 4.2. CARBON POOLS AND SOURCES OF GHG EMISSIONS IN VM0006.

Aboveground tree biomass	Included
Aboveground non-tree woody biomass	Excluded
Belowground biomass	Included
Litter	Excluded
Dead wood (standing and lying)	Included
Soil	Excluded
Wood Products	Included
Carbon dioxide (emissions, apart from stock change in pools), CO_2	Included (from biomass burning and fossil fuel emissions)
Methane, CH_4	Included (only if prescribed burning is applied in the project)
Nitrous Oxide, N_2O	Included (if nitrogen fertilizer applied in the project, e.g. as part of enrichment plantings)

4.2.3 Baseline Emissions

Land Use/Land Cover Change (Activity Data)
A historical rate of deforestation and/or degradation is calculated for the reference area using classified satellite imagery from four or more time periods covering the period from 0 to 15 years prior to the project start date. In practice, project developers will want to use 5 or more time points from the historic reference period to avoid a 10 percent uncertainty discount if only 4 time points are used. Degradation is observed as persistent transitions from higher to lower forest carbon stock classes or strata that can be recognized from the remote sensing data.

The historical rate of deforestation and degradation is modeled deriving a regression of observed deforestation /degradation rate as a function of time. The model is extrapolated into the future to project deforestation/degradation rates in the baseline. It should be noted that where a significant increasing trend in the deforestation/degradation rate is detected (i.e. where rates are projected to go up), the *lower* 95 percent confidence bound of the slope is conservatively used for projections. The extrapolated rate is then applied in combination with a spatial model, predicting likelihood of deforestation/degradation as a function of spatial driver variables, to produce a land cover/forest strata transition matrix from which baseline emissions are estimated. The methodology incorporates a forest scarcity factor to adjust the projected rate of deforestation downward as forest cover in the reference region decreases.

Carbon Stock Change (Emission Factors)

Specific emission factors are determined for each land use/forest strata transition. Forest carbon stocks in the project area must be estimated through direct measurement (inventory) using permanent sample plots. Stock estimates for baseline (post forest conversion) land uses can be determined either through measurements on temporary plots from representative areas or sourced from the literature.

4.2.4 Leakage

Activity Shifting

Drivers of activity shifting leakage are identified and classified as either geographically-constrained (i.e. local) or geographically-unconstrained agents (e.g. migrants). Leakage from geographically-constrained agents is tracked in the leakage belt. Baseline for the leakage belt uses the same deforestation/degradation rate as for the project area (set from the reference region). Leakage from cropland clearing from geographically unconstrained (migrant) drivers is quantified using a default factor approach, multiplying avoided deforestation by a "leakage cancellation rate" from 0 to 100 percent times an emission factor for the forest type with the highest average carbon stocks in the country. Any rate applied representing less than 100 percent leakage from unconstrained drivers (presumed default) must be substantiated from rural surveys or government data, for example.

Market Effects

The methodology uses the market leakage approach from the VCS AFOLU Requirements to quantify leakage from stopping or reducing commercial timber harvest.

4.2.5 Monitoring

The two main monitoring requirements are the monitoring of forest carbon stocks in the project area and the monitoring of the deforestation/degradation in the project area and leakage belt.

Forest carbon stocks are monitored every five years or before each verification event by conducting a forest inventory using permanent fixed area sample plots in forest areas and temporary plots in non-forest areas.

Deforestation and degradation are monitored using classified satellite imagery at least every five years (prior to verification). Forest degradation is witnessed as a transition from a higher to a lower forest biomass strata.

4.2.6 Uncertainty

Methodology VM0006 deducts for uncertainty associated with imagery classification, applying uncertainty discounts where accuracy is below 85 percent (and disallowing classifications with less than 70 percent accuracy). Uncertainty of emission factors for land use class transitions (i.e. difference between stock estimates) is quantified using simple propagation of errors (of the two classes), and error exceeding +/-15 percent of the emission factor value results in a deduction of up to 30 percent being applied; if the calculated deduction exceeds 30 percent, the precision of stock estimates must be improved before emission factors can be applied in accounting.

4.3 VM0007 REDD METHODOLOGY MODULES (REDD-MF) ("MODULAR METH")

Approved: 3 December 2010
Revision approved: August 2011

4.3.1 Overview and applicability conditions

Methodology VM0007 was developed by Avoided Deforestation Partners, and designed for wide applicability across a range of REDD project types and circumstances. The methodology is constructed using the modular approach (VCS Standard V3, section 4.1) in which a series of modules can be arranged in various combinations to accommodate a range of REDD project types. Modules are self-contained to produce specific accounting elements, like estimation of pools and baselines, which in combination form complete methodologies. The REDD Methodology Framework module (REDD-MF) is the overarching guidance to the methodology, and governs the construction and overall operation of the component modules.

This methodology is applicable to planned and unplanned deforestation, including mosaic and frontier configurations. While VM0007 also covers degradation, it is restricted to cases where degradation is solely caused by non-renewable fuel-wood collection (and for example, does not cover degradation due to illegal logging or forest fires).

Key applicability conditions for VM0007 include:

- No reforestation in the baseline;
- No large-scale industrial agriculture in unplanned deforestation baselines (but is allowed for planned deforestation baselines);
- Degradation is restricted to non-renewable fuel-wood collection; and
- Leakage mitigation activities must not include flooding of agricultural lands (e.g. in rice production) or livestock production intensification through feedlots or manure lagoons.

4.3.2 Project Boundaries

Geographic Boundaries

VM0007 requires delineation of a reference region and leakage belt. Reference regions are established to determine the reference rate of deforestation (RRD) as well as the reference location of deforestation (RRL) in the baseline and are fully discussed below. Specifications differ depending on the approach selected for deriving baseline deforestation rate (further explained below under Baseline Emissions). When using the "simple historic" baseline approach, the RRD must be 100 percent forested at the start of the historical baseline period. It must also not include the project area and leakage belt, and must be at least the size of the project area. The similarity of the RRD to the project area must be demonstrated across a range of criteria including drivers of deforestation, landscape, transportation and infrastructure, and socio-political environment. The RRL includes the project area and the leakage belt (which are 100 percent forested at the project start date).

When using the "population driver" baseline approach, the RRD has no minimum area requirement and can include the project area. The leakage belt is defined as the area of the RRD outside of the project area, and also has no minimum area requirement. The RRL is the same as the RRD.

Carbon Pools and GHG Emission Sources

The carbon pools and sources of GHG emissions included in this methodology are listed in Table 4.3.

Table 4.3. CARBON POOLS AND SOURCES OF GHG EMISSIONS IN VM0007.

Aboveground tree biomass	Included
Aboveground non-tree woody biomass	Included (if significant or greater in baseline than project)
Belowground biomass	Included
Litter	Optional
Dead wood (standing and lying)	Optional
Soil	Optional
Wood Products	Included
Carbon dioxide (emissions, apart from stock change in pools), CO_2	Optional (from fossil fuel emissions)
Methane, CH_4	Included (from biomass burning)
Nitrous Oxide, N_2O	Included (from biomass burning or N fertilization)

4.3.3 Baseline Emissions

The methodology provides modules to estimate baseline emissions for: (1) planned deforestation (module BL-PL), (2) unplanned deforestation (module BL-UP, covering both mosaic and frontier configurations) and (3) degradation due to fuel-wood consumption (module BL-DFW).

Land Use/Land Cover Change/Activity Data

Planned Deforestation - For planned deforestation, baselines are developed by first identifying the agent, or likely class of agent, responsible for deforestation. Immediate threat of deforestation must be substantiated with documentation demonstrating both permission and intent to deforest, and the module identifies a range of suitable evidence that can be provided for validation. Expected rate of deforestation is based on a pre-existing plan of execution or on similar activities observed in a proxy area. Planned deforestation in areas under government control must also establish the likelihood of planned land use conversion activities to be carried out based on demonstrated common practice (i.e. the demonstrated likelihood that a government will follow through with a given plan).

Unplanned Deforestation - For unplanned deforestation, baselines are developed in two steps. The first step involves developing a projection of the amount of deforestation (i.e. rate of deforestation) over the baseline period. Using the "simple historic" baseline approach, projections are based on observations of historic deforestation in a defined RRD. Deforestation rates in the reference region are derived from historic analysis of a time series of 3 or more satellite images covering a period up to 12 years prior to project start (being sure to include one date within 2 years of project start). Projections are then based on the historic average deforestation, or on historic trends modeled as a function of time using linear (power or logarithmic) relationships.

An alternative, "population driver" baseline approach can be utilized to derive projections of the amount of deforestation (provided in revision to module BL-UP approved in August 2011). When using this approach, baseline deforestation is modeled based on projections of future population, using the observed historic relationship between deforestation and population. Projections of population are obtained from official government projections or from trends derived from historical census data.
The second step in developing baselines for unplanned deforestation involves predicting where deforestation occurs on the landscape through spatial modeling. Spatial modeling is required for frontier configurations or where <25 percent of the project boundary is within 50 meters of areas recently deforested. Spatial modeling is not required for mosaic configurations that do not meet this criterion; however, if spatial modeling is not performed, then the project developer must operate with the conservative assumption that deforestation in the baseline progresses over time from the lowest to the highest carbon stock strata. Spatial modeling must always be applied when using the "population driver" approach.

For spatial modeling, a reference region for location (RRL) must be designated, that unlike the RRD, must include the project area and leakage belt. Images of the RRL from 3 time points in the past (i.e. two intervals) are required. Relationships between historic deforestation in the RRL and spatial drivers (at least one from each of four classes including landscape, accessibility, anthropogenic and land tenure/management factors) are assessed using GIS data for the first time interval. This "calibration" stage serves to identify the spatial factors with the highest power to explain where deforestation occurs.

Selected spatial drivers are then used in various combinations to develop a range of "test" risk maps of the RRL. Risk maps essentially rank forest units (pixels on a satellite image) in terms of anticipated probability of deforestation. The relative success of the risk maps to predict where deforestation occurs is then assessed against observed deforestation in the second (most recent) time interval in the "confirmation" (or validation) stage. From this analysis, the risk map with the best fit (predicted to observed, quantified as "Figure of Merit" or FOM) is selected for use in the project baseline. The module sets minimum FOM thresholds of 40 percent for frontier and 80 percent for mosaic, below which the risk map cannot be used. A number of spatial modeling software programs have been developed to produce the required analysis, and the module is not specific in prescribing the use of any one.

In summary, rate and location modeling are used to predict how much and where deforestation occurs, and thus how much forest carbon is emitted, in unplanned baselines. Constraints on deforestation rates due to scarcity are imposed by requiring revision of the baseline if/when annual rates exceed 1/50 of the remaining potential forest area, effectively imposing a maximum annual average deforestation rate of 2 percent.

Baseline revisions follow the same procedures used to construct the initial baseline. Rates and location projections of deforestation are to be revised every 10 years to incorporate new observations (from satellite imagery) from the reference regions over the preceding baseline period (over which project implementation was carried out).

Degradation - For degradation due to fuel-wood collection, baseline emissions from volumes removed are estimated referencing population data and information on consumption rates and areas accessed derived from local surveys.

Carbon Stock Change/Emission Factors
Forest carbon stocks in the project area must be estimated through direct measurement (inventory) using permanent or temporary sample plots. Pre-existing inventory data, up to 5 years old, may be used. Stock estimates for baseline (post forest conversion) land uses can be sourced from the literature.

4.3.4 Leakage

Activity Shifting
Planned Deforestation - Leakage from avoiding planned deforestation is covered by module LK-ASP. Where the deforestation agent is known, a deforestation (leakage) baseline is set for all lands under the agent's control based on historic averages or trends substantiated with official records. Leakage is then monitored across all of the agent's holdings and quantified as any increase in deforestation over the baseline.

In cases when the specific agent of deforestation cannot be identified (e.g. in cases of market leakage), leakage is estimated by first identifying the commodity whose production is potentially displaced. Suitable areas in the country where production could be displaced are identified and compared with the project area in terms of average productivity. Leakage is then applied as a default factor ranging from 20 to 70 percent (of baseline emissions), depending on relative productivity of suitable areas outside the project area, and reduced by the percent of those areas without forest (i.e. where displacement would not cause deforestation). Special provisions are also provided for estimation of leakage to peatlands.

Unplanned Deforestation - - Leakage from avoiding unplanned deforestation is covered by module LK-ASU, including leakage caused by direct activity shifting and leakage caused by immigrant agents. Direct activity shifting leakage is monitored in the leakage belt, and is quantified as the emissions from deforestation in the leakage belt that exceed the baseline emissions from deforestation in the leakage belt (derived in the same way as the project area baseline described above).

Leakage caused by redirection of immigrants outside the project area and leakage belt, and which cannot be observed locally, is estimated by first determining (through surveys) the proportion of historic deforestation near the project area/leakage belt produced by recent immigrants. This proportion is used to infer (1) the amount of baseline deforestation in the project area generated by immigrant agents and (2) the amount of observed deforestation in the project area and leakage belt generated by immigrant agents. Where the former exceeds the latter (i.e. deforestation observed ex post in the project area and leakage belt attributable to immigrants is less than baseline deforestation in the project area attributable to immigrants), leakage due to immigrant agents is assumed to occur and quantified as the resulting difference multiplied by the average forest carbon stocks of forest areas in the country potentially subject to deforestation as a proportion of stocks in the project area and leakage belt.

Degradation - Leakage resulting from displacement of fuel-wood collection activities from avoiding degradation in the project area is addressed in module LK-DFW and is monitored by tracking fuel-wood collection and biomass collected from demonstrably renewable sources (e.g. sources introduced as project activities to reduce reliance on non-renewable sources; criteria for determining "renewable" are provided in the module). The projected baseline fuel-wood collection minus the amount collected from demonstrably renewable sources equals the displacement of biomass as a result of project implementation and is converted into leakage emissions using relevant formulas.

Market Effects
Leakage due to market effects from reducing wood production from the project area is estimated using module LK-ME. Leakage resulting from decreased timber and fuel-wood supply uses default factors provided in the VCS AFOLU Requirements (Table 3), together with assumptions on supply reductions and logging damage factors (to convert volumes removed to total biomass emitted as a result of deforestation).

4.3.5 Monitoring

The module M-MON covers monitoring of forest cover change in the project area and leakage belt, forest carbon stock change, either due to loss (from degradation) or growth (in successional forests or resulting from enrichment activities), and non-CO_2 GHG emissions.

Changes in forest cover in the project area and in the leakage belt are monitored from satellite imagery. New satellite imagery to conduct monitoring of forest cover change must be of the same source as that used in developing the baseline, unless switching to higher resolution imagery or if the former source is no longer available. New imagery must be calibrated with the old imagery.

Changes in carbon stocks are not required to be monitored (assume forest carbon stocks are steady state) if the project developer can demonstrate that degradation is not occurring or is insignificant. Changes in carbon stocks may be monitored by the project developer using ground sampling, and increases in carbon stocks in those areas that would have been deforested in the baseline may be quantified and included in calculating the project's GHG emission reductions.

Degradation is monitored by first surveying the population in the area every 2 years to determine potential for degradation. If potential exists, rapid ground samples of the accessible area of the project area and leakage belt are carried out to confirm the presence of recently harvested stumps. If degradation is confirmed, a more intensive ground sampling effort must be carried out (at least every 5 years) to quantify biomass removals from measured stump diameters. Degradation due to burning is monitored via satellite imagery or aerial photographs from which burn areas can be determined.

Other GHG emissions within the project area are monitored by tracking fossil fuel combustion, biomass burning and nitrogen fertilization (that may result for example from forest conversion in the project area during the crediting period) and are covered in the emission modules E-BB, E-FCC and E-NA.

4.3.6 Uncertainty

Uncertainties accounted for in this methodology include errors around the deforestation/ degradation rate (quantified as 1 – R^2 value of the regression for "simple historic" and the lower 95 percent confidence bound for "population driver") and confidence bounds around estimates of pools/sources. Simple propagation of errors is used to estimate total uncertainty. Combined uncertainty (at the 95 percent confidence level) exceeding 15 percent of the mean is deducted as a percent of GHG emissions reductions.

4.4. VM0009 METHODOLOGY FOR AVOIDED MOSAIC DEFORESTATION OF TROPICAL FORESTS ("CUMULATIVE MOSAIC AUD")

Approved 11 January 2011

4.4.1 Overview and applicability conditions

Methodology VM0009 was developed by Wildlife Works Carbon for projects that reduce unplanned mosaic deforestation. The methodology employs a unique "cumulative deforestation model" that is developed from historic deforestation trends observed from sample points across the reference region. This "sampling for deforestation" approach permits modeling without wall-to-wall coverage of the reference region, and therefore the approach holds promise for use in regions subject to variable and often substantial cloud cover. The methodology is also unique in that the baseline model is not spatially explicit and in that it does not require monitoring of forest cover change in the project area. Lastly, unlike the other REDD methodologies, explicit Project Description (PD) requirements are provided to facilitate project development and validation.

Key applicability conditions for VM0009 include:

- Baseline restricted to deforestation due to forest conversion to permanent agriculture of annual crops (i.e. baseline does not include shifting agriculture; that is, agriculture must be permanent and without an extended fallow period);
- No harvest of commercial timber products occurs in the baseline or with project scenarios; and
- The leakage area must be accessible for monitoring degradation.

4.4.2 Project Boundaries

Geographic Boundaries

VM0009 requires delineation of a reference area and leakage area. The reference area and leakage area are defined using knowledge of the agents and drivers of deforestation in the region, as well as physical features of the landscape, to ensure their similarity to those expected to operate in the project area. The reference area is established in the region of the project, but may not include the project area. The reference area must be equal to or greater than the project area in size, and must have an equal or greater area of forest cover as the project area at any point in the historic reference period (i.e. must be much larger than the project area, which must have 100 percent forest at project start).

The first (historic) reference area may overlap the leakage area, however, reference areas for determination of subsequent baselines (after the first baseline period) must not include any parts of the leakage area. The leakage area is identified in much the same way as the reference area, with the added requirement of demonstrating the likelihood that the leakage area will receive activities displaced from the project area (e.g. proximity to project and agents, mobility of agents, access constraints and predicted direction of displacement). It should be noted that in VM0009, the leakage area is not necessarily a "belt", and may in fact be discontinuous and not necessarily directly adjacent to the project area boundary (see Figure 6.4 and 6.5). The leakage area must be in the same region as the project and be at least as large as the project area, with 100 percent forest cover at the project start.

Carbon Pools and GHG Emission Sources
The carbon pools and sources of GHG emissions included in this methodology are listed in Table 4.4.

Table 4.4. CARBON POOLS AND SOURCES OF GHG EMISSIONS IN VM0009.

Pool	VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests
Aboveground tree biomass	Included
Aboveground non-tree woody biomass	Optional
Belowground biomass	Optional (belowground biomass of large trees is only partially emitted due to deforestation)
Litter	Excluded
Dead wood (standing and lying)	Optional (standing and lying dead wood can be included or excluded independently)
Soil	Optional
Wood Products	Included (baseline only, non-commercial wood products)
Carbon dioxide (emissions, apart from stock change in pools), CO2	Excluded
Methane, CH4	Excluded
Nitrous Oxide, N2O	Excluded

4.4.3 Baseline

Land Use/Land Cover Change (Activity Data)
Methodology VM0009 uses a "cumulative deforestation model" to project the baseline amount of deforestation in the project area. The model is an "S"-shaped logistic function that describes the general progression of deforestation, starting slowly in the initial stages of colonization, then progressing rapidly, and finally slowing as remaining forest becomes scarcer and less accessible.

A collection of at least 2000 or more systematic or random sample points from the reference region is used to derive a forest to non-forest transition rate across a historic reference period, depending on the desired level of precision. The samples are drawn from a time series of imagery and visually classified as forest/non-forest. The logistic model describes the cumulative amount (percent) of the forest area that has transitioned to non-forest at any given point in time.

The shape of the model, dictating projected rates of deforestation in the baseline, is developed (parameterized) using information from the sample points (on historic rates of transition/deforestation) and optionally, information on deforestation covariates (e.g. population density or head of cattle). Specifically, the reference period is defined as: "the arrival time of specific foreign agents of deforestation, if any; the times when the drivers of deforestation became apparent, if any; and the times of significant economic growth or decline." Imagery from which sample points are drawn should include dates before, during, and after the above mentioned events. The logistic model is then fitted from the sample point data and deforestation is projected forward in the baseline period, either in the logistic shape (with varying rates of deforestation) or in a conservative linear shape below the logistic (but with a constant rate of deforestation).

Model results of the projected deforested area are combined with information on mean carbon stocks (see below) to estimate baseline emissions. The model is not spatially explicit, only projecting how much deforestation occurs over time, not where it occurs; and thus though not explicitly stated, the methodology is not applicable to mosaic AUDD projects that do not meet criteria in the VCS AFOLU Requirements document section 4.4.8.

It is important to note that construction of the model does not require a series of wall-to-wall classified land cover maps of the entire reference area. The only requirement is that 90 percent of the reference area has at least two time points represented. The imagery used to construct the model can range from satellite, aerial photography, radar or combination. For the sampling to be effective to construct an adequate time series, however, likely five or more time points (albeit of not necessarily complete coverage each), which are well distributed throughout the reference period, are needed.

Carbon Stock Change (Emission Factors)

VM0009 uses permanent fixed area sample plots to measure and monitor live aboveground biomass and standing dead biomass. Lying dead wood is estimated using a line intersect sampling approach. Unlike other REDD methodologies, only a portion of belowground biomass (of large trees) is assumed to be emitted following deforestation, unless 100 percent can be justified at project validation. Standing and lying dead wood pools are treated separately, and may be included or excluded independently from the project accounting boundary. Also unique to VM0009 is the soil carbon loss model used in estimating baseline emissions, which does not require an extensive field inventory of soil carbon stocks in the project area (although monitoring is required), as do all other currently approved REDD methodologies that include soil carbon. Instead, a default loss factor is used if the project is in a tropical or semi-arid tropical region, or a loss factor is determined sampling a chronosequence of proxy sites in the reference area representing the transition from forest to non-forest in the baseline scenario.

4.4.4 Leakage

Methodology VM0009 requires that leakage mitigation activities be implemented, and that direct activity shifting leakage be monitored in a defined leakage area against a leakage baseline. Leakage from immigrant agents and market leakage are not covered by the methodology.

Baseline emissions in the leakage area are estimated using a leakage model. This model is similar to the cumulative deforestation model, as described above, however it also includes degradation. The leakage model essentially shifts the cumulative deforestation model to account for degradation preceding deforestation, and effectively advances the onset of emissions. The leakage model may be developed ex post during the first monitoring period, estimating the lag period from monitoring results.

Deforestation and degradation are monitored in large (2+ hectares) permanent fixed area sample plots in the leakage area. The proportion of degradation and deforestation on these plots is simply observed and does not require tree measurement. A leakage factor is determined as the difference between observed proportion deforestation/degradation (from monitoring) and predicted proportion deforestation/degradation (from leakage model projections) or the previous monitoring result. Leakage emissions are then calculated as the resulting leakage factor multiplied by the baseline emissions in the project. The leakage factor will always be between 0 and 1, and thus leakage cannot exceed 100 percent (an important constraint not addressed in leakage area approaches of other methodologies).

4.4.5 Monitoring

All included carbon pools must be monitored at least every five years to account for any increases or decreases in biomass. Unlike all other REDD methodologies, separate monitoring of forest cover change is not required, but is inherently captured when the carbon pools are re-measured (forest inventory) in the project area. Any emissions in the project area resulting from deforestation or degradation are assumed to be detected through re-measurement of the permanent plots and delineation of monitoring strata. Occurrence of any significant fires must also be monitored and documented with maps or satellite imagery to update strata.

4.4.6 Uncertainty

Uncertainty is calculated as the weighted-quadratic average of the relative precision of baseline model estimates, soil carbon loss model estimates and forest carbon stock estimates. It is then deducted in net emission reduction calculations when the average uncertainty exceeds 15 percent at the 95 percent confidence level.

4.5 VM0015 METHODOLOGY FOR ESTIMATING REDUCTIONS OF GHG EMISSIONS FROM UNPLANNED DEFORESTATION ("AUD")

Approved: 12 July 2011

4.5.1 Overview and applicability conditions

Methodology VM0015 was developed by the World Bank BioCarbon Fund, IDESAM, the Amazonas Sustainable Foundation and Carbon Decisions International for project activities that reduce GHG emissions from unplanned deforestation in either the mosaic or frontier configuration. Emissions from degradation cannot be included in the baseline and therefore need to be excluded from project accounting. The methodology is applicable to a wide range of unplanned deforestation configurations and baseline land-uses. VM0015 is also currently the only methodology that permits logging in the with-project case.

Key applicability conditions include:

- The project activity involves avoiding unplanned deforestation with mosaic or frontier configuration
- Baseline activities that may be displaced by the project activity include logging, fuel-wood collection and charcoal production, agriculture and grazing (settlements are not specifically disallowed).

4.5.2 Project Boundaries

Geographic Boundaries

Delineation of a reference region and leakage belt is required. The reference region must be larger than and include the project area and leakage belt. It may include one or more areas, and should be similar to the project area in terms of access to forest, topography, agent and drivers, land use/land use change categories, ecological and socio-economic conditions, enforced policies and regulations. The leakage belt surrounds the project area and is the location to which baseline activities are most likely to be displaced. It is defined through a spatial analysis of opportunity cost or mobility of deforesting agents.

Carbon Pools and GHG Emission Sources

Methodology VM0015 requires inclusion of the following pools: aboveground tree biomass, aboveground non-tree woody biomass (if the baseline includes perennial crops) and wood products (where timber harvest occurs in the baseline) (Table 4.5). Optional pools include belowground biomass, dead wood and soil. Emission sources from leakage mitigation activities outside the project area are accounted if significant (see section 3.1 for further discussion).

Table 4.5. CARBON POOLS AND SOURCES OF GHG EMISSIONS IN VM0015.

Pool	VM0015 Methodology for Estimating Reductions of GHG Emissions from Unplanned Deforestation
Aboveground tree biomass	Included
Aboveground non-tree woody biomass	Included (only if baseline includes perennial crops)

Pool	VM0015 Methodology for Estimating Reductions of GHG Emissions from Unplanned Deforestation
Belowground biomass	Optional
Litter	Excluded
Dead wood (standing and lying)	Optional
Soil	Optional
Wood Products	Included
Carbon dioxide, CO_2	Included (if significant changes in carbon stocks in leakage management areas)
Methane, CH_4	Included (if significant emissions from livestock intensification in leakage management areas)
Nitrous Oxide, N_2O	Included (if significant emissions from livestock intensification in leakage management areas)

4.5.3 Baseline

Land Use/Land Cover Change (Activity Data)

The historical rate of deforestation is determined through analysis of forest cover change from a time series of (at least three) classified satellite images of the reference area from the last 10-15 years, with one time point within 2 years of the project start date. Satellite imagery must have a 100 meter minimum resolution (permitting use of a wider range of imagery sources than most other methodologies) and forest:non forest classification accuracy must be 90 percent or greater. Helpfully, no minimum cloud free percent is specified, permitting added flexibility.

Three options are provided for projecting the future baseline rate of deforestation. The simplest is the historic approach whereby the average historical rate deforestation is projected into the future. An alternate approach is to project forward historic trends in deforestation rate using a fitted regression equation. This approach is useful where there is a clear upward or downward trend in the rate of deforestation. The final approach to setting future baselines is through modeling with covariates to model the rate of deforestation from drivers of deforestation (e.g. population). Where the annual rate of deforestation exceeds 1 percent, projected deforestation is subject to constraints based on forest access and suitability.

Location of deforestation must be modeled on the basis of drivers in both mosaic and frontier configurations. Goodness of fit of "deforestation risk maps" must achieve a minimum Figure of Merit (explained in Section 4.2) of 50 percent for frontier deforestation and 80 percent for mosaic deforestation.

Emissions from degradation cannot be included in the baseline under this methodology. Therefore, changes in forest biomass stocks for areas undergoing degradation prior to deforestation in the baseline need to be assessed using a series of land cover maps. These maps must depict forest classes with successively lower biomass stocks to account for degradation occurring prior to deforestation. The methodology requires the use of credible and verifiable sources of data from existing studies, or measuring the biomass of degraded forests of different known ages using field plots.

Carbon Stock Change (Emission Factors)
Default forest carbon stock values referenced from the literature or inventories of representative areas (using temporary plots) may be used, in place of direct inventory of the project area and leakage belt, however only conservative default values can be used (i.e. low end of the range for forest and high end of the range for non-forest classes), hence project developers may want to consider undertaking a forest inventory of the project area. Forest inventories may use permanent or temporary plots.

4.5.4 Leakage

Activity shifting leakage is quantified using a leakage belt approach. With this approach, the project developer determines a baseline rate of deforestation (without the project) in the leakage belt, which is derived from the reference region. Over time, the project developer monitors changes in forest cover in the leakage belt, and treats any deforestation and consequent emissions in excess of the baseline as emissions due to leakage. Leakage emissions are deducted from the project's GHG emission reductions, unless it can be substantiated that the increase is not attributable to the project. In addition, other GHG emissions occurring due to leakage mitigation activities (tracked in defined "leakage management areas") is quantified and deducted similarly. This methodology does not address activity shifting leakage due to immigrant agents, or market leakage (although the VCS AFOLU Requirements and default factors contained therein for market leakage would apply in case of reductions in timber harvest resulting from project activities).

4.5.5 Monitoring

Monitoring of forest cover change in the project area and leakage belt using classified satellite imagery is required and must occur prior to each verification. Emissions from forest fires or other catastrophic events are also monitored using classified satellite imagery. The minimum monitoring interval is one year; the maximum interval is equal to the crediting period (although credits cannot be issued without a monitoring/verification event).

Unless decreases in stocks are expected in either the project area or leakage management areas (e.g. through degradation due to logging), forest carbon stocks do not need to be monitored. Forest growth on areas that would be deforested in the baseline can be estimated ex ante using peer-reviewed growth models or literature sources (i.e. need not be monitored and is factored into baseline emissions).

4.5.6 Uncertainty

Uncertainty is addressed prior to calculation of GHG emission reductions. Minimum 90 percent accuracy criteria is established for satellite imagery classifications (used in setting baseline deforestation rate). Minimum precision of +/-10 percent with 90 percent confidence is required to permit use of any mean carbon stock estimate (i.e. without a confidence deduction). Where precision of the estimate exceeds this threshold, the lower (for with-project forest carbon stocks) or higher (for baseline post-conversion land use stocks) 90 percent confidence bound of the estimate must instead be employed.

5.0

COMPARING APPLICABILITY OF REDD METHODOLOGIES

This section presents a summary of the key applicability conditions for VCS REDD methodologies and contains a methodology key to assist project developers in identifying methodologies that could be used to account for their REDD project activity. In the next section, we present additional comparisons of accounting approaches and data and task requirements for implementing these methodologies to assist project developers in making a selection when one or more methodologies are applicable. In the comparison of these tables, we refer to the VCS number that uniquely identifies each approved REDD methodology, which are also listed in the previous section 4.0, Methodology Accounts.

5.1 VCS REDD PROJECT TYPES AND FOREST CONFIGURATIONS

Table 5.1 below contains a summary of the VCS methodologies that have been developed for the eligible REDD project activities and forest configurations as described in section 2.0. It should be noted that while some methodologies (for example, VM0007) cover more than one type of REDD project activity category, it is not a requirement that the project developer implement all of the activities that are covered by the methodology.

Table 5.1. METHODOLOGY COMPARISON TABLE ACROSS REDD PROJECT TYPES. CHECK MARKS INDICATE THAT INDIVIDUAL METHODOLOGIES COVER THE ASPECT MENTIONED.

VCS REDD Project Activity	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Avoiding Planned Deforestation (APD)	✔		✔		
Avoiding Unplanned Deforestation (AUDD)		✔	✔	✔	✔
Avoiding Unplanned Degradation (AUDD)		✔	✔		

There are two methodologies --VM0004 and VM0007-- that are applicable for avoiding planned deforestation projects. There are four methodologies --VM0006, VM0007, VM0009, and VM0015 -- that are applicable to avoiding unplanned deforestation projects. Only two of them --VM0006 and VM0007-- can also be used for avoiding unplanned degradation projects, of which VM0007 can only be used for degradation resulting from unsustainable fuel-wood collection.

All approved AUDD methodologies are applicable to the mosaic configuration, two of which – VM0007 and VM0015 –are applicable to frontier deforestation and/or degradation (Table 5.2).

Table 5.2 METHODOLOGY COMPARISON TABLE BY CONFIGURATION OF UNPLANNED DEFORESTATION AND/OR DEGRADATION. CHECK MARKS INDICATE THAT THE METHODOLOGY IS APPLICABLE TO THE CONFIGURATION.

Forest Configuration of AUDD Project	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Mosaic	✔	✔	✔	✔
Frontier		✔		✔

5.2 APPLICABLE BASELINE ACTIVITIES

In addition to meeting the eligibility requirements related to project activity type and forest configuration (discussed above), the proposed REDD project activity must also meet a number of applicability conditions contained in each of the methodologies. The most common of these applicability conditions relates to the activities that result in deforestation and/or degradation in the baseline scenario. The table below compares these baseline activities.

Table 5.3. BASELINE ACTIVITIES ACROSS VCS REDD METHODOLOGIES. CHECK MARKS INDICATE THAT INDIVIDUAL METHODOLOGIES COVER THE ASPECT MENTIONED.

Baseline activity leading to deforestation and/or degradation	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Permanent subsistence and small-scale farming		✔	✔	✔	✔
Shifting, small scale agriculture (not permanent or with an extended fallow period)		✔	✔		✔
Industrial agriculture	✔		✔1	✔	✔
Perennial crop (e.g. agroforestry)	✔		✔2		✔2
Illegal commercial logging	✔	✔	✔		✔
Fuel-wood collection or charcoal production		✔	✔	✔	✔
Forest fires/burning		✔	✔	✔	✔
Settlements		✔	✔		✔3

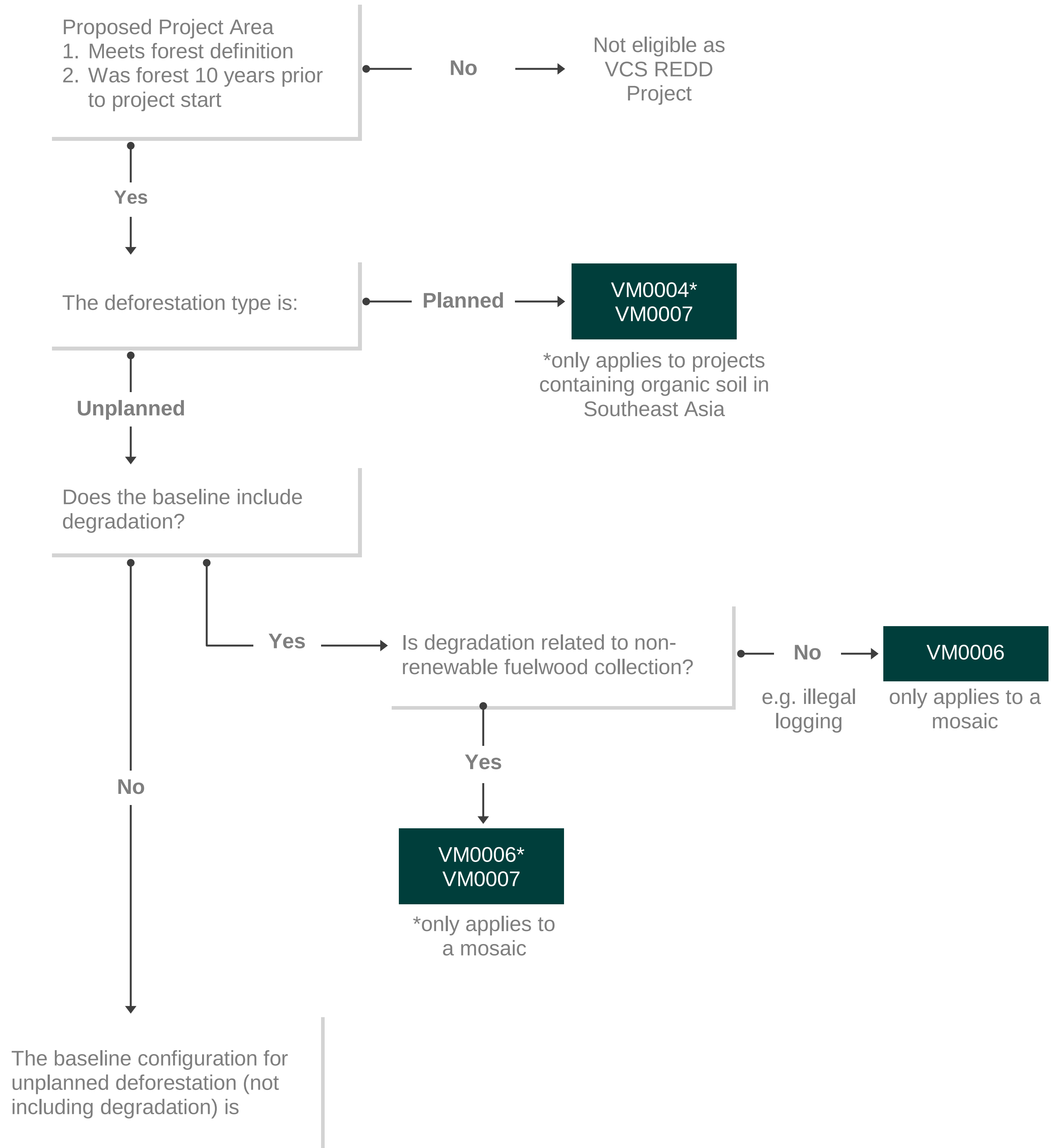
1 Industrial agriculture only allowed in a planned deforestation baseline with VM0007 (not in unplanned).
2 Provided perennial crop does not meet definition of forest.
3 Not specifically disallowed.

As illustrated in the table above, most of the REDD methodologies are applicable to baseline scenarios where the agricultural activities drive deforestation and/or degradation in the baseline scenario. However, project developers will need to assess the specific agricultural activities that are undertaken to determine if the methodologies are potentially applicable for the proposed REDD project. For example, VM0006 and VM0007 do not allow industrial agriculture activities in the unplanned deforestation baseline scenario.

Deforestation due to the (illegal) commercial harvesting of forest wood products in the baseline scenario is also allowed by methodologies VM0004, VM0006, VM0007 and VM0015. Perennial crops, e.g. agroforestry, are allowed in the baseline with VM0007 and VM0015, and only where they would not meet the forest definition (otherwise this transition would qualify as forests remaining as forests and IFM). In general, VM0009 is the most restrictive, not allowing commercial logging, shifting (non-permanent) agriculture, or conversion to settlements in the baseline.

5.3 SELECTING AN APPLICABLE METHODOLOGY

A diagnostic tool for selecting potentially applicable methodologies is presented on the following page. Once a methodology has been identified by process of elimination using the criteria elaborated upon in the diagram, full applicability conditions should be consulted to confirm that the project meets all other applicability conditions contained in the methodology. Where projects meet the applicability conditions of more than one methodology, project developers should also evaluate the relative accounting approaches and resources required to implement each methodology, as further discussed in section 6.0.



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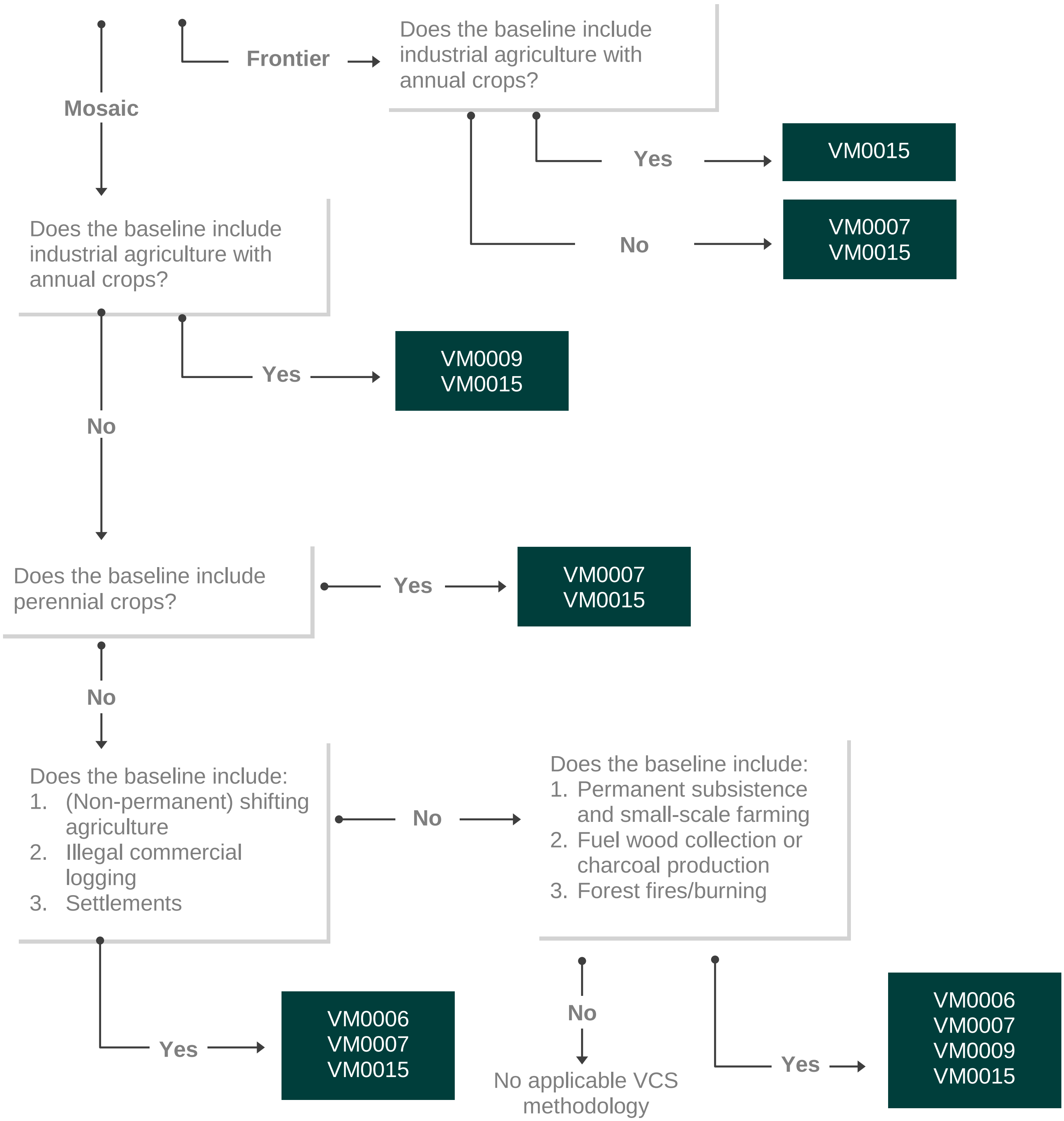


Figure 5.1. REDD Methodology Key

To provide examples to illustrate the process of identifying applicable REDD methodologies, we refer back to the scenarios presented in Section 1.

Text Box 1.11. **SCENARIO 1 – ILLEGAL DEFORESTATION OF A FOREST AUTHORIZED FOR CONVERSION (AVOIDING UNPLANNED DEFORESTATION, AUDD)**

Scenario: A large intact forest area is under threat of deforestation from illegal land invasion and clearing by migrant colonists for short-term subsistence agriculture (annual crops with extended fallow period). The landowner of the forest area holds permission to convert the forest to another land use, but has no plans or intent to do so, and instead seeks to protect the area by enforcing the property boundary.

Applicable VCS REDD methodology(ies): If the project is unplanned frontier deforestation (likely with a large, intact forest area), then the applicable methodologies would be VM0007 and VM0015. If the project qualified as mosaic, then VM0006, VM0007 and VM0015 would be applicable (VM0009 does not allow for shifting agriculture).

Text Box 1.12. **SCENARIO 2 – NEW HIGHWAY CONSTRUCTION THROUGH A REMOTE FORESTED AREA (AVOIDING UNPLANNED DEFORESTATION, AUDD)**

Scenario: A new highway is planned that will traverse a large expanse of previously inaccessible forest. Authorization and plans for construction of the highway exist. The highway is expected to facilitate new settlement and clearing of the surrounding area by immigrants. A local conservation organization successfully lobbies for the highway construction to be stopped.

Applicable VCS REDD methodology(ies): The project activity avoids unplanned deforestation, most likely with a frontier configuration, and therefore applicable methodologies are VM0007 and VM0015. If the project baseline only contemplated deforestation in the immediate highway right of way (i.e. no new unplanned colonization expected), the project would be APD and the only applicable methodology would be VM0007.

Text Box 1.13. **SCENARIO 3 – FOREST CONSERVATION WITH THE INTRODUCTION OF SUSTAINABLE FOREST MANAGEMENT (AVOIDING UNPLANNED DEFORESTATION, AUDD)**

Scenario: A forest area is under threat of deforestation by local communities who are clearing land for shifting agriculture. The project developer engages the communities in authorized sustainable forest management for commercial timber production in the forest area as an alternative livelihood activity compatible with forest conservation, which together with other project activities reduces the need for agricultural expansion by the communities.

Applicable VCS REDD methodology(ies): The REDD methodology applied must allow and account for emissions from legal timber harvest in the project. As of the time of writing, the only methodology that covers this scenario in the with-project case is VM0015. Although VM0007 provides for monitoring emissions due to illegal logging, it is not currently applicable to legal timber harvest taking place in the project.

Text Box 1.14. **SCENARIO 4 – SELECTIVE ILLEGAL LOGGING ON AN AUTHORIZED LOGGING CONCESSION (AVOIDING UNPLANNED DEGRADATION, AUDD)**

Scenario: A logging concession to a forest area is granted to a concession holder who does not exercise its right to log. Illegal logging focused on scattered high value species is taking place in the area and the concession holder seeks to improve enforcement of the concession boundaries to prevent the entry of illegal loggers.

Applicable VCS REDD methodology(ies): VM0006 is the only methodology applicable to avoiding unplanned degradation due to illegal logging for commercial wood (not for fuel-wood consumption).

Text Box 1.15**. SCENARIO 5 – LEGAL DEFORESTATION FOLLOWED BY PLANTATION FORESTRY (IMPROVED FOREST MANAGEMENT, IFM)**

Scenario: A conservation organization acquires and protects an area of native forest that had been permitted for conversion to Eucalyptus plantations, thereby preventing the cutting of native forest. The Eucalyptus plantations would meet the applicable country definition of forest.

Applicable VCS REDD methodology(ies): The project activity is not a REDD activity (it is an IFM activity), and therefore no REDD methodologies apply.

Text Box 1.16. **SCENARIO 6 – DEGRADATION PRECEDING DEFORESTATION (AVOIDING UNPLANNED DEFORESTATION AND/OR DEGRADATION, AUDD)**

Scenario: A forest area is subject to progressive degradation over time from illegal logging and fuel-wood collection and fires encroaching from adjoining pasture lands that are periodically burned. Degradation eventually leads to total loss of forest cover and conversion to pasture, where continuous grazing pressure prevents natural reestablishment of forest. Forest protection measures are implemented and extension activities are initiated (improved pasture management and fast-growing fuel-wood plantations) to reduce pressures from surrounding communities.

Applicable VCS REDD methodology(ies): Not all REDD methodologies cover degradation in the baseline (though it must always be monitored in the project where significant). The project could ignore emissions from degradation in the baseline occurring prior to complete deforestation, allowing the project developer a wider range of options in terms of applicable methodologies, as well as simplified baseline setting and less costly monitoring. Degradation would still need to be tracked in the project, where significant, in either case.

Should the project be developed to only consider/ include deforestation in the baseline, methodologies VM0006, VM0007 and VM0015 would be applicable if in the mosaic configuration and VM0007 and VM0015 if frontier. Should the project be developed to also consider/ include mosaic degradation in the baseline, only VM0006 would be applicable (VM0007 does not include degradation in the baseline due to illegal logging); there are currently no methodologies applicable to frontier degradation in the baseline resulting from causes other than non-renewable fuel-wood collection.

In either case, recovery of already degraded forests in the project area following protection can be accounted for (and credited, in addition to deforestation emissions avoided) by monitoring forest growth in the project.

6.0

COMPARING ACCOUNTING APPROACHES AND RESOURCE NEEDS OF REDD METHODOLOGIES

In this section, we present a comparison of the different accounting approaches and resource needs, including data and task requirements, for each of the REDD methodologies. The selection of a methodology will always be a nuanced decision that ultimately depends not only on applicability conditions of the methodology but also on the project developer's resources and capabilities.

Although it is not possible to provide explicit cost estimates for the resource needs and tasks detailed below, cost implications should become apparent on review of the comparisons provided. In particular, project developers should pay attention to the carbon pools included and the measurement frequency for these carbon pools, as these measurements (inventories) involve considerable field effort, and are an important driver of project costs. Other important considerations relevant to assessing potential project development costs include comparative accuracy requirements for remote sensing classification (which dictate the intensity of ground-truthing needed), the number of historic dates and the geographic extent (the latter related to geographic boundary requirements) of these images, and the requirement to undertake spatial modeling of deforestation and/or degradation.

6.1 PROJECT BOUNDARIES

6.1.1 Geographic boundaries

Critical requirements for the size and location of the reference region and the leakage area/belt (explained in Section 3.2.1 above) are listed in Table 6.1 below for all AUDD methodologies. In addition, all AUDD methodologies require demonstration of the similarity of the reference and leakage areas to the project area across a range of criteria to ensure that they are representative. APD methodologies (e.g. VM0007) do not employ the use of reference or leakage areas.

Readers should note that geographic boundary requirements have important implications for project development, particularly with regard to those REDD projects developed in countries or regions with limited remaining forest cover, those projects seeking to protect all or the majority of remaining forest cover in the country, or those projects developed in areas with many other REDD project activities planned or already underway. In all of the above cases, there may be insufficient forest area outside the project area that can continue to serve as a reference area/leakage area over the project crediting period.

Table 6.1. GEOGRAPHIC BOUNDARY REQUIREMENTS FOR AUDD METHODOLOGIES.

Geographic boundary requirement	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Reference region: size	Area ≥ 2 to 20x project area (depending on project area).*	RRD: Area ≥ project area. RRL: ≥ project area and leakage belt No minimum area requirements with "population driver" approach.	Area ≥ project area.	Area ≥ project area
Reference region: location	Include the project area and leakage belt in the first baseline period; exclude leakage belt and project area in subsequent baseline periods	RRD: With simple historic approach, must not include the project area and leakage belt. With population driver approach, reference region includes leakage belt and part or all of the project area. RRL: With simple historic approach, must fully include the project area and leakage belt. With the population driver approach, RRL=RRD	May not include the project area.	Must contain the project area and leakage belt.
Reference region: minimum forest area	Not specified	For simple historic approach: RRD: 100% forested at start of historic baseline period; RRL: ≥50% at start of project Not specified for "population driver" approach.	Must have area of forest equal to or greater than the project area at any point in the reference period (i.e. must be much larger than the project area with 100% forest at project start).	Not specified
Leakage area/belt: size	Width of leakage belt determined via cost of transportation analysis.	Area ≥ 75% of project area. Accessibility determined through qualitative analysis. No minimum area requirement for "population driver" approach.	Area ≥ project area. Accessibility determined through qualitative analysis (and need not be in the shape of a "belt").	Width of leakage belt determined via spatial analysis of opportunity cost or mobility.

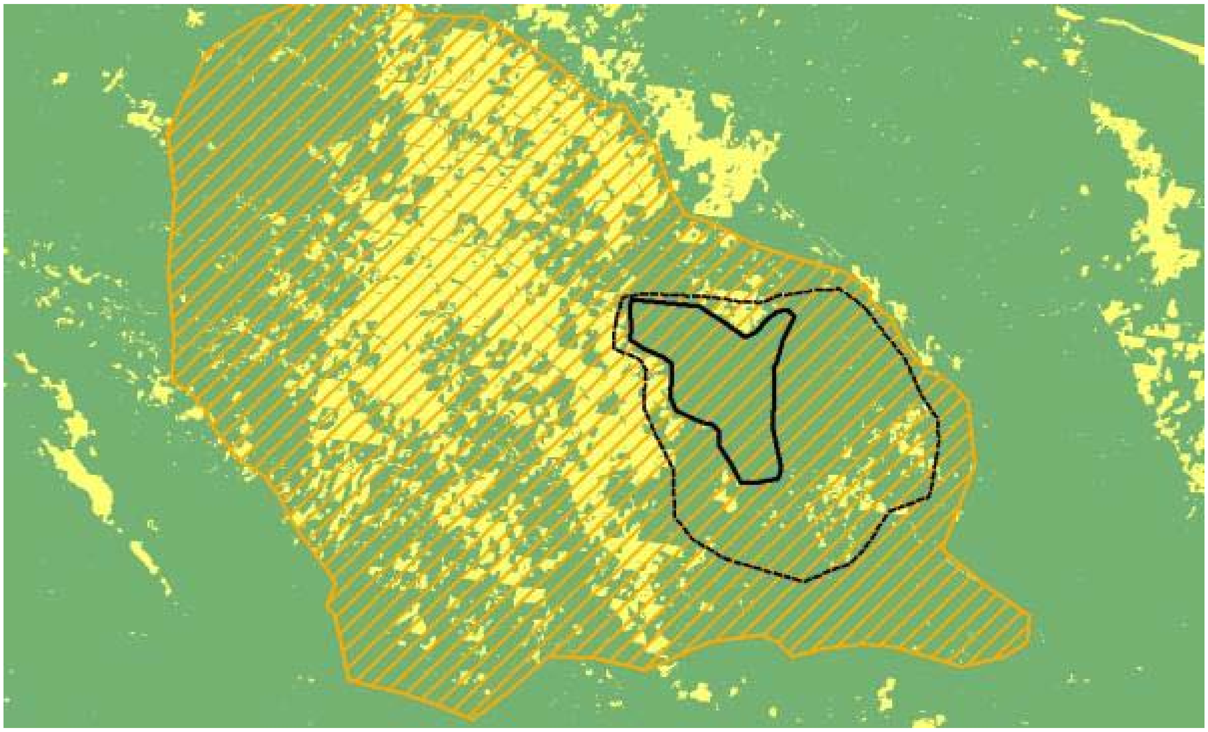
Geographic boundary requirement	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Leakage area/belt: location (in relation to reference region)	Not specified	No overlap with reference region for rate (RRD). With "population driver" approach, leakage belt is the RRD outside of the project area.	May overlap (completely) the first reference region, but may not overlap the reference region during subsequent baseline periods.	Contained within reference region
Leakage area/belt: original land cover	Must include both forest and non-forest.	100% forested at project start.	100% forest at project start.	Not specified

* Note that for setting the first baseline, the reference region prior to project start may include the project area when using VM0006.

Figures 6.1-6.7 provide illustrations of how the geographic boundaries of an AUDD project would be established under each of the approved AUDD methodologies. In all figures, green represents forest and yellow non-forest.

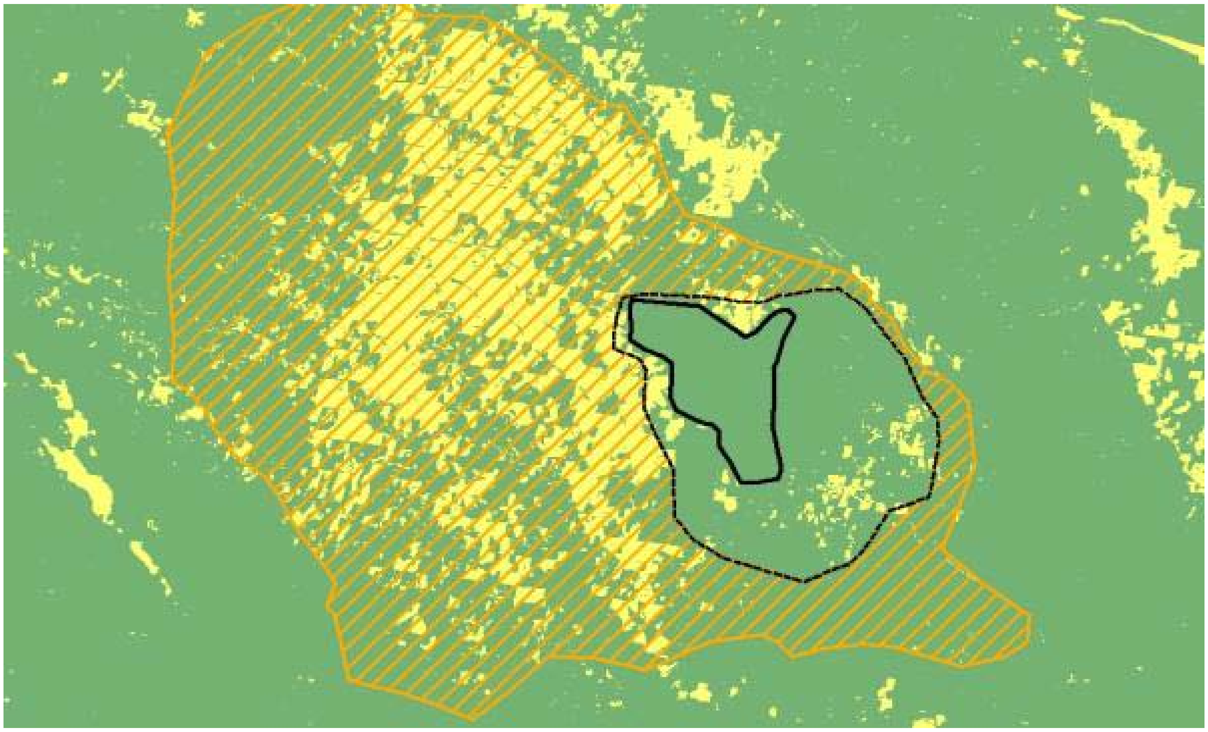
Illustrations for VM0006, Mosaic AUDD

Figure 6.1. Sample project map *prior to project start date* for VM0006 including the project area (black outline), reference region (orange outline with infill), and leakage belt (dotted black line).



Note that that the project area is 100 percent forested at the project start date, but that the leakage belt contains both forest and non-forest land classes. Also note that the reference region includes the project area and leakage belt during the first baseline period, and that the area of the reference region is more than 2x the size of the project area.

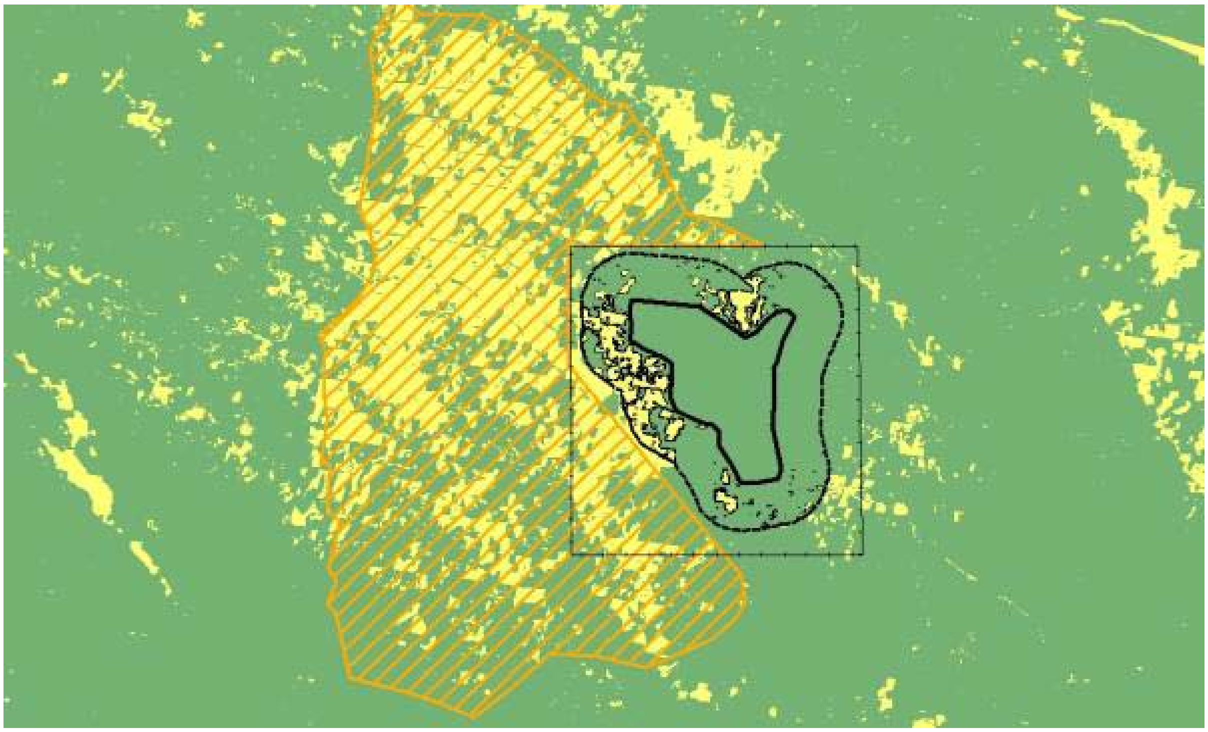
Figure 6.2. Sample project map *after the project start date* for VM0006 including the project area (black outline), reference region (orange outline with infill), and leakage belt (dotted black line).



Note that that the reference region excludes the project area and leakage belt in the second and subsequent baseline periods (since REDD activities are being undertaken in this area after the project start date and therefore the areas do not provide a valid reference for project future deforestation and/or degradation in the baseline scenario. The size of the reference region is still more than 2x the size of the project area.

Illustrations for VM0007, Modular Meth "simple historic"

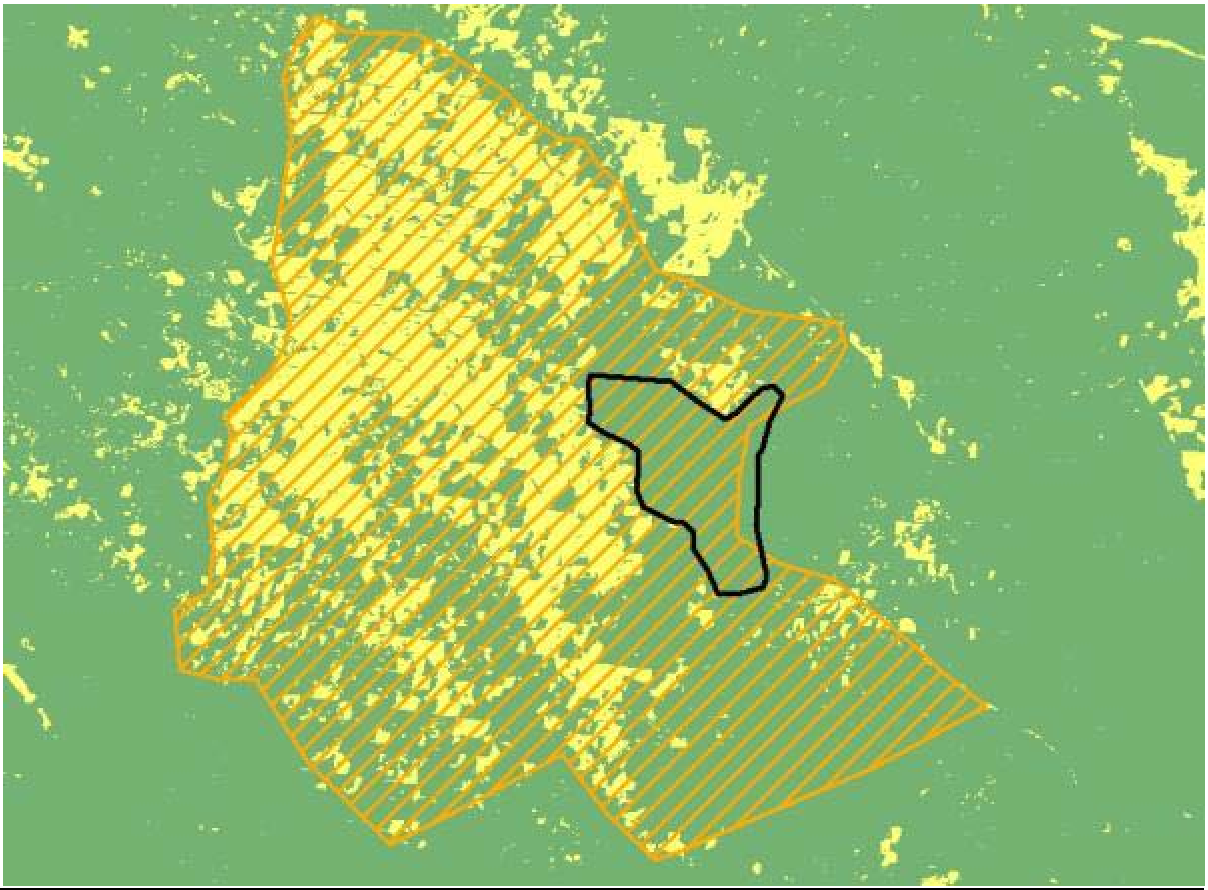
Figure 6.3. Sample project map for VM0007 using simple historic baseline approach, including the project area (black outline), reference region for deforestation rate, or RRD (orange outline with infill), leakage belt (dotted black line; excludes non-forest areas – yellow outlined in black), and reference region for location, or RRL (hashed black line).



Note that project area and leakage belt are 100 percent forested at the project start date. Also note that the reference region for determining the rate of deforestation does not include the project area or leakage belt, and is also larger than the project area. The figure illustrates forest cover at the project start date – the reference region for deforestation rate (RRD) would be completely forested at the start of the historical reference period. Geographic boundaries using VM0007 are fixed over the entire project crediting period.

Illustrations for VM0007, Modular Meth "population driver"

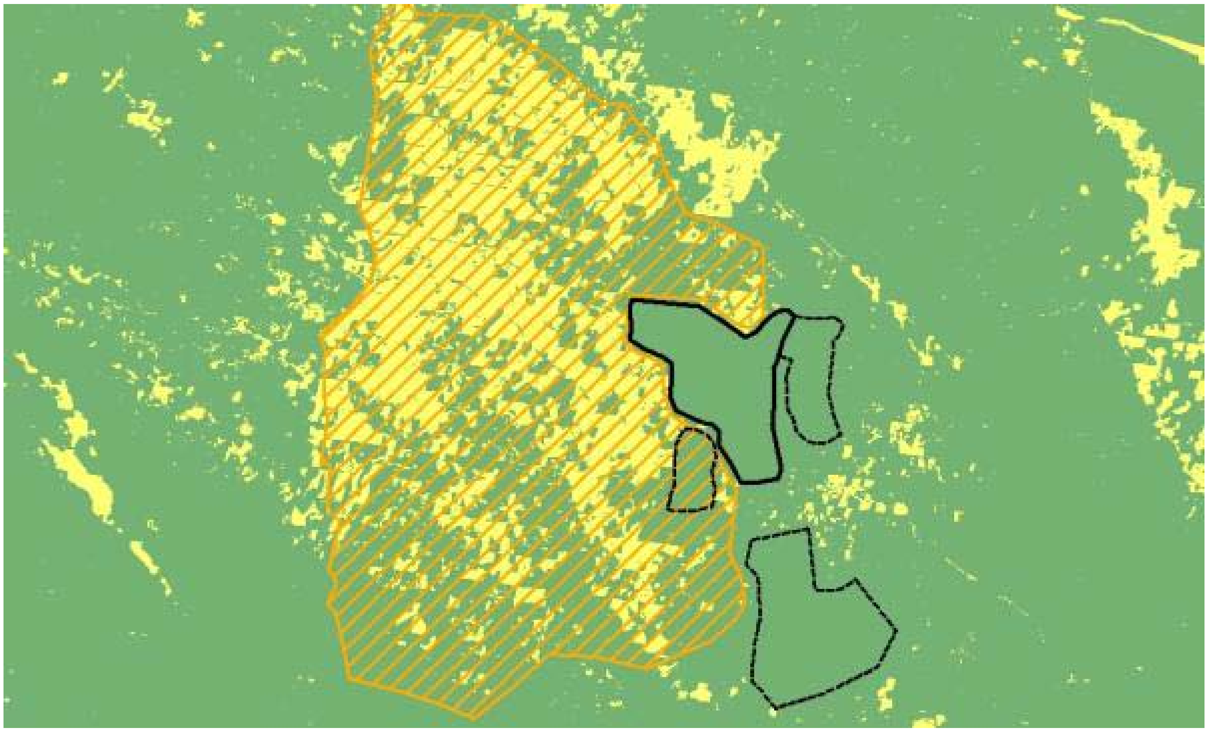
Figure 6.4. Sample project map for VM0007 using the "population driver" baseline approach, including the project area (black outline), reference region for deforestation rate and location, RRD and RRL (orange outline with infill) and leakage belt (green forest areas in the RRD/RRL outside of the project area).



Note here that RRD and RRL are equivalent, and that they include, but not necessarily all of, the project area. The RRD/RRL conforms to the boundary of the selected census area from which population data is derived.

Illustrations for VM0009, Cumulative Mosaic AUD

Figure 6.5. Sample project map *prior to project start date* for VM0009 including the project area (black outline), reference region (orange outline with infill), and leakage area (dotted black line).



Note that the reference region does not include the project area and is greater than or equal to the size of the project area (Figure 6.5 and 6.6). Further note that the reference region includes part of the leakage belt for purposes of the first baseline period (Figure 6.5), but is revised in subsequent baseline periods to exclude it (Figure 6.6).

Illustrations for VM0009, Cumulative Mosaic AUD

Figure 6.6. Sample project map *after the first baseline period* for VM0009 including the project area (black outline), reference region (orange outline with infill), and leakage area (dotted black line). Note that the reference region now excludes the leakage belt.

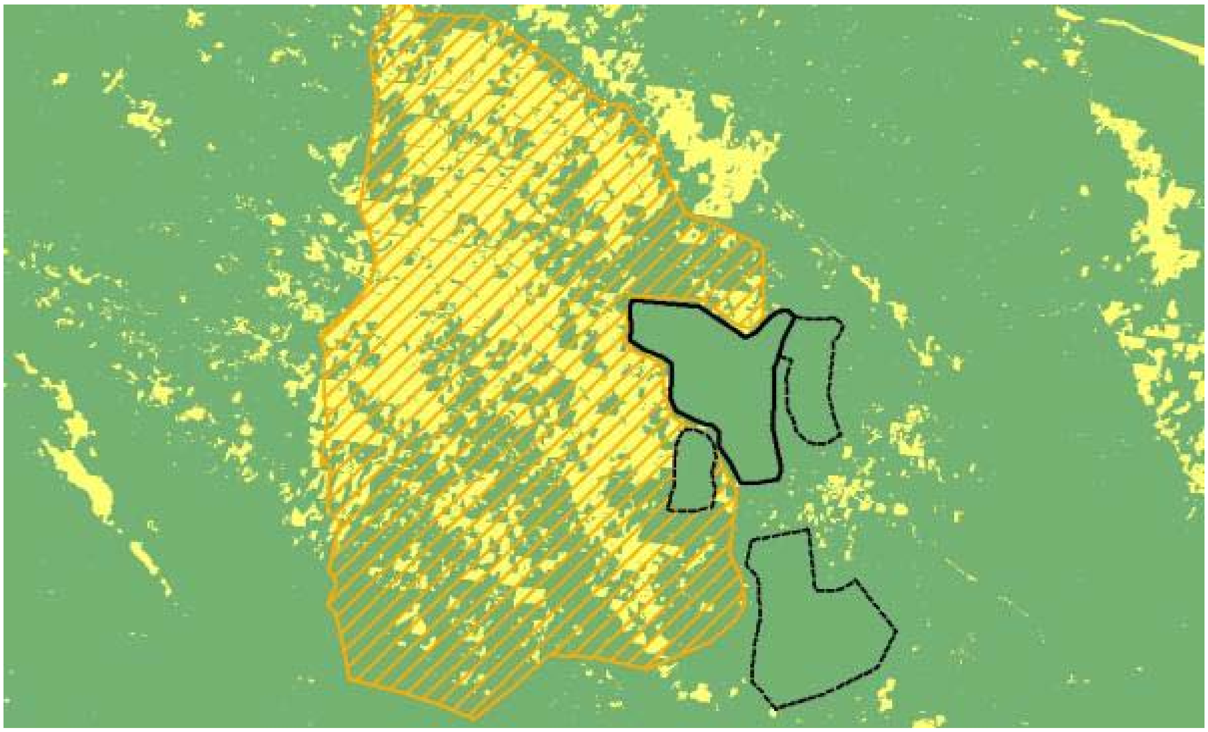
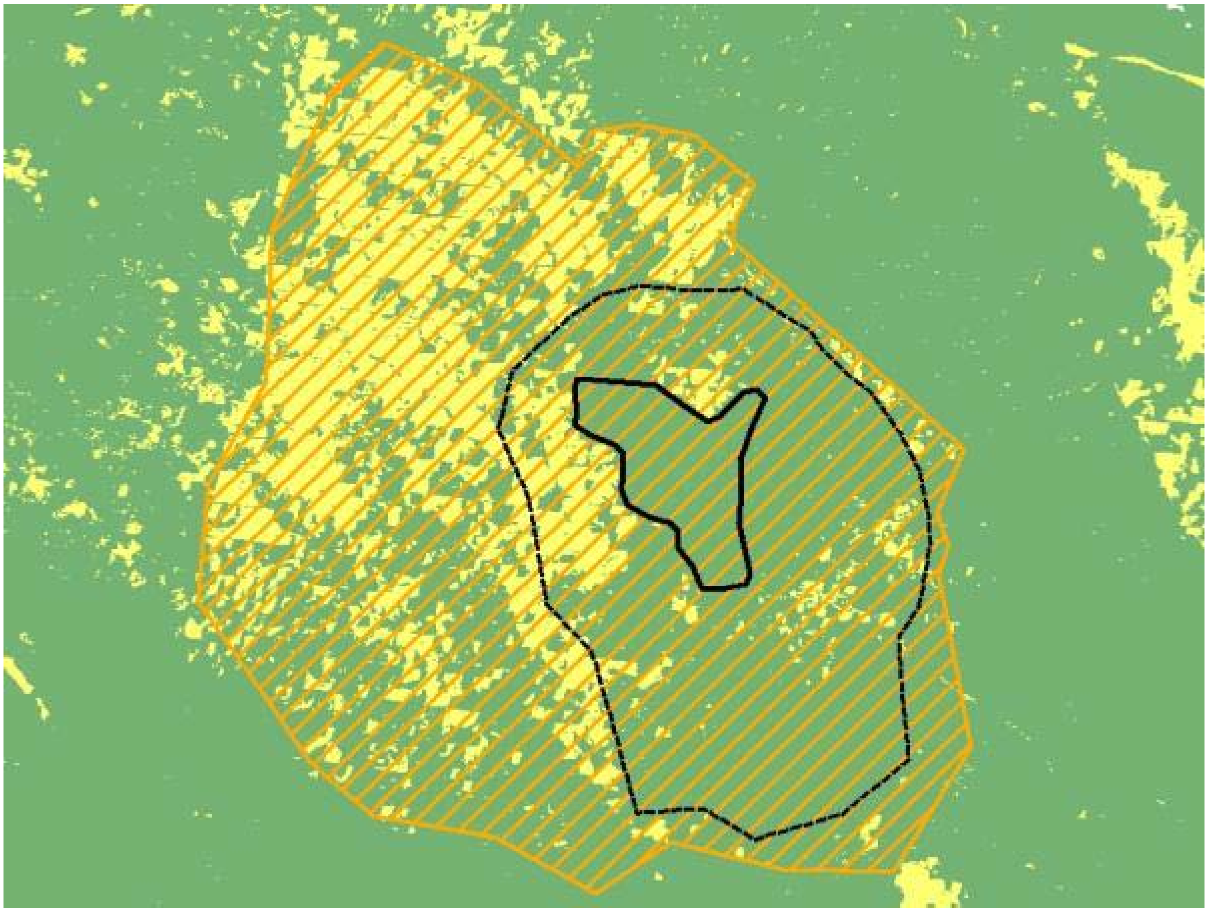


Illustration for VM0015, AUD

Figure 6.7. Sample project map for VM0015 including the project area (black outline), reference region (orange outline with infill), and leakage belt (dotted black line).



Note that the area of the reference region is greater than the project area, and includes the project area and leakage belt, and contains both forest and non-forest. The configuration of the leakage belt is determined through an opportunity cost or mobility analysis.

6.1.2 Carbon Pools and GHG Emission Sources

A comprehensive list of carbon pools and emission sources included in each methodology are detailed below in Table 6.2 and 6.3.

Table 6.2. CARBON POOLS INCLUDED IN EACH METHODOLOGY.

Pool	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Aboveground tree biomass	Included	Included	Included	Included	Included
Aboveground non-tree woody biomass	Included	Excluded	Included (if significant or greater in baseline than project)	Optional	Included (only if baseline includes perennial crops)
Belowground biomass	Excluded	Included	Included	Optional (belowground biomass of large trees may be partially emitted due to deforestation)	Optional
Litter	Excluded	Excluded	Optional	Excluded	Excluded
Dead wood (standing and lying)	Excluded	Included	Optional	Optional (standing and lying dead wood can be included or excluded independently)	Optional
Soil	Included (peat)	Excluded	Optional	Optional	Optional
Wood Products	Included (timber removal assumed in baseline per applicability condition)	Included	Included	Included (baseline non-commercial wood products only)	Included

The aboveground tree biomass is the only pool which must be included for all methodologies in all cases, as required by the VCS. Section 3.1.2 of this document provides an overview of when and why methodologies may include or exclude certain pools and emission sources. Even though exclusion would be conservative and reduce project measurement and monitoring demands, deadwood is required by methodology VM0006.

Table 6.3. OTHER GHG EMISSION SOURCES INCLUDED IN EACH METHODOLOGY.

Other GHG emission sources	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Carbon dioxide(emissions, apart from stock change in pools), CO2	Excluded.	Included (from biomass burning and fossil fuel emissions)	Optional (from fossil fuel emissions)	Excluded	Included (if significant changes in carbon stocks in leakage management areas).
Methane, CH4	Included (from biomass/peat burning)	Included (only if prescribed burning is applied in the project)	Included (from biomass burning)	Excluded	Included (if significant emissions from livestock intensification in leakage management areas).
Nitrous Oxide, N2O	Included (from biomass/peat burning)	Included (if nitrogen fertilizer applied in the project, e.g. as part of enrichment plantings)	Included (from biomass burning or N fertilization)	Excluded	Included (if significant emissions from livestock intensification in leakage management areas)

All other GHG emission sources will need to be included if significant unless exclusion results in a more conservative calculation of GHG emission reductions from the project. In all cases, sources can be conservatively ignored in the baseline.

6.2 BASELINE EMISSIONS

6.2.1 Land Use/Land Cover Change (Activity Data)

Table 6.4 presents a summary comparison of the data and tasks needed to estimate the forest area change component of baseline emissions under each of the VCS REDD methodologies applicable to AUDD.

Table 6.4. DATA AND TASKS TO ESTABLISH AN AUDD PROJECT'S BASELINE DEFORESTATION/DEGRADATION RATE AND/OR LOCATION.

Data / Task	VM0006 "Mosaic AUDD"	VM0007 "Modular meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
GIS analysis to apply criteria demonstrating similarity of the reference to the project area	Required	Required Not required when using population driver approach	Required	Required.
Rate modeling of deforestation (from historic forest cover change analysis)	Simple historic (average or trend)	Simple historic (average or trend) or population driver	Logistic model based on historic and covariates (drivers)	Simple historic (average or trend) or based on covariates
Data on covariates (e.g. population)	N/A (simple historic only)	Optional Required when using population driver approach	Optional	Optional
Spatial modeling of deforestation and GIS coverages (i.e. shape files) of spatial drivers (e.g. digital elevation models, road networks, etc.)	Required.	Required if unplanned frontier deforestation, or if < 25% of project boundary within 120m of recent deforestation (i.e. isolated from areas of active deforestation).	None (not spatially explicit)	Required.
Spatial modeling minimum goodness of fit	Unspecified	40% Figure of Merit (FOM) for frontier, 80% FOM for mosaic	N/A	50% Figure of Merit (FOM) for frontier, 80% FOM for mosaic

For all AUDD methodologies, a GIS analysis is necessary to determine the representativeness of the reference area for determining baseline rates of deforestation in the project area, through assessment of a range of qualitative and quantitative criteria (e.g. demonstrating that elevation and slope classes in the project area are in the same proportion as in the reference region).

With regard to modeling the rate of deforestation in the baseline, the "simple historic" approach, basing projections on historical average rates or trends, is used by methodologies VM0006, VM0007 and VM0015. VM0009 employs a unique model derived from sampling (rather than wall-to-wall analysis) of historic remote sensing data, which can optionally incorporate data on drivers of deforestation (e.g. population) to improve the model. Modeling deforestation from drivers is also provided as an alternate approach in VM0007 and VM0015.

Spatial modeling to project the location of deforestation is required by VM0006 and VM0015 in all cases, and by VM0007 in the frontier cases and mosaic cases where < 25 percent of project boundary is within 120m of recent deforestation.

Remote sensing data is one of the key pieces of information required in all these methodologies for estimating forest cover (land use) change in the baseline from which the above analyses are derived. Remote sensing data for the reference region is needed at various historical dates (prior to the project start date), and will also be needed at future dates when monitoring the forest cover in the project area, leakage belt, and for the reference region when resetting baselines every 10 years (see Section 6.4 below). Table 6.5 presents the remote sensing data requirements across the approved VCS REDD methodologies.

Table 6.5. REMOTE SENSING DATA REQUIREMENTS FOR HISTORIC FOREST COVER CHANGE ANALYSIS FOR AUDD METHODOLOGIES.

Data / Task	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Remote sensing/imagery resolution	≤ 30m	≤ 30m	≤ 30m	≤ 100m
Remote sensing/imagery time series needs for reference area	Iimagery from 4 time points between 0 and 15 years prior to project start.	For unplanned deforestation, imagery from 3 time points between 2 and 12 years prior to project start.	Imagery from at least 2 time points prior to project start. At least 90% of the reference area must have coverage by at least 2 time points.	Imagery from at least 3 time points from the period 10-15 years prior to project start, with one within 2 years of project start.
Remote sensing/imagery minimum classification accuracy (forest: non-forest)	70% of sampled pixels (with uncertainty discounts)	90% of sampled pixels	Not pixel-based. Quality control guidelines to minimize point interpretation error.	90%
Remote sensing/imagery minimum classification method	Review high resolution imagery or database of known classes at locations	Review high resolution imagery or ground truthing	N/A	Review high resolution imagery or ground truthing
Remote sensing/imagery minimum cloud free	80%	90%	Unspecified - shifting sample point approach flexible in regions with significant and variable cloud cover.	Unspecified

Most methodologies require that remote sensing data have a minimum resolution of 30 meters (that is each pixel represents a maximum area of 900 square meters). This corresponds to the resolution of Landsat program satellite imagery, administered by NASA and the U.S. Geological Survey (USGS), which is freely available from the USGS (see Section 9 below). Hence, base remote sensing source data is comparable across methodologies.

Note that as of 2003, Landsat data includes scanner artifacts that result from a mechanical failure. These artifacts appear as stripes across imagery and must be corrected under VM0004, VM0006, VM0007 and VM0015 as these methodologies use pixel-based classifications. These artifacts do not need to be corrected under VM0009 which uses a point-based approach treating stripes like clouds. Additionally, with VM0009 data can come from different sources for different points in time or space.

More important for comparison is the extent (area) of satellite images needed (see 6.1.1 above, geographic boundary requirements) and the duration of the time series of satellite imagery needed (i.e. from how many historic dates). Methodologies VM0006, VM0007 and VM0015 require classified remote sensing images for 3 to 4 time periods ranging from 0 to 15 years prior to the project start date, while VM0009 only requires two such images. Finally, while VM0009 also requires a time series of historic images, it does not require wall-to-wall (100 percent) coverage for each time point as do the other methodologies, and hence offers advantages in regions with extensive cloud cover.

6.2.2 Carbon Stock Change (Emission Factors)

In most methodologies, aboveground tree biomass (and standing dead wood where it is included) must be directly measured in the project area using standard forest inventory temporary or permanent fixed area plots. VM0007 also allows for use of variable radius plots employing prisms or relascopes. VM0015 permits the use of conservative default values for forest carbon stocks, allowing projects to forego undertaking a forest inventory.

Belowground biomass is never directly measured and instead estimated from aboveground tree biomass using default root: shoot ratios, and hence inclusion of the belowground biomass pool has a minimal contribution to project costs. Lying dead wood is measured using line intersect sampling in all methodologies. Where included, aboveground woody non-tree biomass and forest floor/litter are measured using destructive harvest from sample frames. Methodologies VM0007 , VM0009 and VM0015 also allow for measuring aboveground woody non-tree biomass using non-destructive sample plots and allometric equations. Project areas are often stratified, divided into discrete units with similar stocks, as a means of improving precision of stock estimates and accuracy of emission estimates (that the proper stocks are referenced for a given hectare deforested).

It is beyond the scope of this guidebook to elaborate practical guidance on the implementation of the sampling and measurement practices summarized above, and the reader is referred to the extensive literature on sampling and forest inventory[15].

As explained in Section 3 above, for baseline (post forest conversion) land uses, all approved REDD methodologies permit the use of default carbon stock values from local studies or literature, or from direct sampling of proxy sites if verifiable sources of default values are unavailable.

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[15] The World Bank BioCarbon Fund "Sourcebook for Land Use, Land-Use Change and Forestry Projects" (Pearson et al 2005) provides a good introduction to this field as it relates to REDD projects, with extensive literature sources for readers wishing to explore further.

Table 6.6. REQUIRED SOURCES AND FREQUENCY OF RE-ASSESSMENT OF CARBON STOCK ESTIMATES.

Stock estimate	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Baseline (ex ante)					
Project area forest carbon pools	Forest biomass inventory once at beginning of project with permanent or temporary fixed area plots	Forest biomass inventory of each identified forest stratum with permanent sample plots.	Forest biomass inventory with fixed area or variable radius sample plots (must take place within +/-5 years of the project start date)	Forest biomass inventory with fixed area plots (must take place in the first monitoring period, i.e. prior to first verification).	Forest biomass inventory with temporary or permanent plots, or conservative default
Post conversion	Growth of vegetation in future land use based on default factors from literature or field measurements from representative areas.	Default factors from literature or measurements from temporary plots on representative areas.	Default factors from local studies or literature or measurements from temporary plots on representative areas.	Not needed if project area is semi-arid tropical forest. Otherwise requires soil carbon sampling from proxy farms in the reference area to parameterize the soil carbon loss model.	Default factors from literature or measurement s from temporary plots on representative areas.
With project (monitoring ex post)					
Project area forest carbon pools	Not monitored or re-assessed, unless project developer opts to monitor growth, in which case forest biomass must be remeasured on permanent plots every 5 years	Forest biomass inventory at least every 5 years at verification.	Forest biomass inventory at least every 10 years at baseline re-evaluation. Surveys required in and around the project area every < 2 years, with forest transect sampling every < 5 years if evidence that degradation is occurring.	All included pools directly sampled (through forest biomass inventory) at least every 5 years after the first monitoring period (i.e. prior to each verification).	No monitoring/ remeasure-ment required (except where decreases expected in project, e.g. project activities include planned logging)
Leakage area forest carbon pools	Direct forest inventory or estimates referenced from inventory of project area if same strata/forest types are	Direct forest inventory or estimates referenced from inventory of project area if same strata/forest types are	Direct forest inventory or estimates referenced from inventory of project area if same strata/forest types are	Direct forest inventory with permanent fixed area (2 ha minimum) plots with ocular estimation of degradation/defor estation, prior to	Estimated referenced from direct forest inventory of the project area or conservative defaults for

Stock estimate	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
	involved.	involved.	involved.	each verification. Stocks not estimated in the leakage area.	the strata/forest types involved. Monitoring required where decreases in stocks in leakage management areas.

The wood products pool in all methodologies is estimated by assuming, on the basis of surveys or local expert opinion, the proportion of aboveground biomass that is transferred to long-term storage in wood products via timber harvest. Three methodologies, VM0006, VM0007 and VM0015 calculate this proportion by applying default factors derived from Winjum et al 1998[16] (also referenced by VM0009, which is less prescriptive on approach). Aboveground biomass subject to harvest in the baseline is usually estimated from surveys or consulting harvest records.

Differences emerge in approaches to measuring and accounting changes in soil carbon. Direct sampling to determine initial stocks of forest soils is required by VM0007 when this pool is included, however monitoring is not required; soil carbon stocks of baseline (post conversion) land uses are determined by applying IPCC stock change factors. VM0009 requires only targeted sampling of proxy sites before and after deforestation to construct an exponential decay model to estimate emissions over time post-deforestation; projects in tropical or semi-arid tropical regions also have the option to forego soil sampling and use a default emission model provided by the methodology.

No methodologies impose absolute precision requirements on forest carbon stock estimates, however, in practice, uncertainty in these estimates should not exceed +/-15 percent of the overall mean at the 95 percent confidence interval [17], and of the mean for *each strata* in the case of VM0006 and VM0015 (see Uncertainty below), if confidence deductions are to be avoided.

6.3 LEAKAGE

6.3.1 Activity Shifting

Table 6.7 summarizes the types of activity shifting leakage covered by each of the approved VCS REDD methodologies. As explained in Section 3, activity shifting leakage can be caused by local (identified) or immigrant (unidentified) agents.

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[16] Winjum, J.K., Brown, S., Schlamadinger, B. 1998. Forest harvests and wood products: sources and sinks of atmospheric carbon dioxide. Forest Science 44: 272-284

[17] Again, note that the precision threshold for VM0015 is currently +/-10 percent of the mean with 90 percent confidence, and does not conform with the version 3 of the VCS Standard.

As indicated in Table 6.7 below, direct activity shifting leakage is addressed by each of the methodologies. However, only VM0006 and VM0007 address situations with indirect activity shifting leakage where immigrants are likely to migrate to other areas and cause deforestation and/or degradation that would have occurred in the project area or leakage belt in the baseline scenario.[18]

Table 6.7. TYPES OF ACTIVITY SHIFTING LEAKAGE ACCOUNTED FOR IN EACH METHODOLOGY. CHECK MARKS INDICATE THE TYPES OF LEAKAGE ACCOUNTED FOR BY A METHODOLOGY.

Type of leakage	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Activity shifting leakage from local agents	✔	✔	✔	✔	✔
Activity shifting leakage from immigrant actors		✔	✔		

As indicated in Table 6.8 below, all of the AUDD methodologies employ a leakage area approach for determining emissions from direct activity shifting (due to local agents). VM0006 and VM0015 require a spatial analysis to delineate the exact width of the leakage belt around the project area.

Table 6.8. DATA AND TASKS TO DELINEATE LEAKAGE AREAS IN WHICH ACTIVITY SHIFTING LEAKAGE FROM LOCAL AGENTS IS MONITORED.

Data / Task	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
GIS analysis to demarcate leakage belt width	N/A	Required	N/A	N/A	Required (for both "Opportunity cost" and "Mobility analysis")
GIS analysis to apply criteria demonstrating similarity of the leakage areas to the project area	N/A	Required	Required	Required	Required

[18] As stated in Section 3.4, at the time of writing, draft revisions to AFOLU Requirements were released by the VCS in June 2011 for public comment, which include changes in the treatment of leakage.

In all AUDD methodologies, a baseline for the leakage area is established using the same procedures utilized in establishing the baseline for the project area (derived from the reference region). Leakage is then quantified ex post as monitored deforestation in the leakage belt that exceeds this baseline, via remote sensing, except in the case of VM0009, which instead monitors deforestation (and degradation) in the leakage area through re-measurement of permanent plots in the field established there. For activity shifting resulting from avoiding planned deforestation, VM0004 and VM0007 account for leakage by tracking the baseline agent of deforestation where the agent of deforestation is known. VM0007 also provides for estimating leakage from avoiding planned deforestation where only the class of agent is known, by estimating emissions resulting from displaced commodity production (actually market effects, but not limited to timber production) (VM0007, Section 4.3 above).

Activity shifting leakage from immigrant agents is only addressed by VM0006 and VM0007. In VM0006, this form of leakage is quantified by applying a default factor of 100 percent or less (of total baseline emissions avoided) if justified on the basis of verifiable evidence (e.g. from social assessment or government reports). The approach in VM0007 uses survey data to first determine the proportion of baseline deforestation caused by recent immigrants, and then using this proportion to infer the amount of deforestation from immigrant agents *not* observed ex post in the project area and leakage belt. In practice, VM0007, which references average forest carbon stocks in the country to calculate emissions from this leakage source, is slightly less conservative than VM0006, which instead uses an emission factor based on the *highest* average forest carbon stock type in the country.

6.3.2 Market Effects

VM0004, VM0006, and VM0007 address market leakage where project activities affect the production and price of a commodity, thereby resulting in deforestation and/or degradation outside the project area and the leakage belt. These methodologies reference guidance and default factors provided in the VCS AFOLU Requirements. However, these procedures for estimating market leakage are only applicable when timber (and related products) are the commodity whose production is affected by the REDD project activity, though VM0007 considers other commodities displaced due to planned deforestation (see above and module LK-ASP). VM0009 does not apply when there is commercial logging in the baseline, and hence market leakage due to reduced commercial timber harvest should not occur for this methodology to be applicable.

6.4 MONITORING

In most VCS REDD methodologies, updated remote sensing data must be obtained periodically to monitor forest cover (land use) change in the project area, leakage belt, and reference region in order to determine emissions in the project scenario and to re-evaluate baselines at least every ten years (Table 6.9). The exception is VM0009 which does not require a forest cover (land use) change assessment for monitoring, other than for detection and delineation of any catastrophic fires.

Table 6.9. FREQUENCY OF FOREST COVER (LAND USE) CHANGE ASSESSMENT IN THE PROJECT AREA (AND LEAKAGE AREA WHERE APPLICABLE) FROM UPDATED SATELLITE IMAGERY.

Item Monitored	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Frequency of monitoring forest cover change.	Annual for the project area and lands controlled by the deforestation agent (for land use change and forest fires)	Annual for the project area and leakage belt and prior to each verification (or every ≤5 years) for the reference region.	Prior to each verification for the project area and leakage belt, and prior to each baseline re-assessment for the reference region.	At baseline re-evaluation, i.e. every 10 years.	Prior to each verification for the project area and leakage belt, and in the reference region at the beginning, middle and end of each baseline period.

The required frequency of re-measurement of forest biomass carbon pools varies across the approved VCS REDD methodologies. VM0015 does not require stocks to be re-measured, however, because estimates used must not be greater than 10 years old, in practice, stocks will have to be measured, or new conservative default values sourced, every 10 years. VM0007 requires measurement prior to each ten-year baseline period, though stocks can be measured more frequently, for example with permanent plots, if crediting forest growth is desired. VM0006 and VM0009 require much more frequent monitoring of carbon pools. VM0009 requires measurement of all pools, including soil carbon (if included in project accounting), in the project area at least every 5 years. VM0006 requires measurement of forest carbon stocks (live tree biomass and dead wood) at every verification event. Further information on measurement requirements for carbon pools is presented in Section 6.2.2 above.

6.5 UNCERTAINTY

Methodologies VM0004, VM0007 and VM0009 calculate overall uncertainty using simple error propagation, calculating the square root of the sum of component squared errors. Combined uncertainty (at the 95 percent confidence level) exceeding 15 percent of the mean is then deducted as a percent from GHG emissions reductions.

VM0006 and VM0015 use a different approach from the above, assessing uncertainty discounts prior to the calculation of GHG emission reductions, and also apply deductions for uncertainty around stock estimates at the strata level, rather than at the level of the project as in VM0004, VM0007 and VM0009. Which errors are included in the calculation of overall uncertainty differ among methodologies, summarized in Table 6.10 below. Some sources of error are addressed prior to calculation of overall uncertainty, for example, in VM0006 where the baseline deforestation rate model, if projecting an upward trend, must use the lower 95 percent confidence bound of the model, or for example in VM0007 with regard to accuracy of imagery classification, where uncertainty thresholds are established beyond which an estimate cannot be used.

Table 6.10. COMPONENT SOURCES OF ERROR IN OVERALL UNCERTAINTY CALCULATIONS.

Uncertainty source/ component	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
Imagery classification of forest-non forest and forest strata (additional to minimum accuracy requirements – see Table 6.5)	Not included	Included. Discounts applied where accuracy is below 85%.	Not included	Not included	Not included
Carbon stock estimates	Included	Included as uncertainty of emissions (i.e. difference between pre- and post-deforestation/ degradation stocks) quantified by propagating errors from the two classes - errors exceeding +/-15% of the mean are discounted.	Included.	Included. Uses simple propagation of errors to combine errors across all pools.	Included – estimates with 95% confidence bound greater than +/-15% of the mean must use the lower (for with-project forest carbon stocks) or higher (for baseline post-conversion land use stocks) 95% confidence bound
Emission sources	Included	Not included.	Included.	N/A	Not included
Wood products	Included	Not included. Estimates of timber extracted must conservatively use upper (baseline) and lower (with project) confidence bounds.	Included	Not included	Not included
Soil carbon loss model	N/A	N/A	N/A	Included. Quantified as uncertainty of soil carbon stock estimate from reference deforested area.	N/A
Baseline deforestation/ degradation projections	N/A (assumed to be zero)	Not included. Must use lower 95% confidence bound of regression model if increasing trend.	Included. Assumed to be zero unless increasing trend in unplanned deforestation (where	Included.	Not included.

Uncertainty source/ component	VM0004 "SE Asia Peat APD"	VM0006 "Mosaic AUDD"	VM0007 "Modular Meth"	VM0009 "Cumulative Mosaic AUD"	VM0015 "AUD"
			uncertainty quantified as 1 – R2 value of the regression) or planned deforestation based on proxy sites (where uncertainty quantified as 95% confidence interval of observed rate)		

7.0

NEXT STEPS: APPLYING A VCS REDD METHODOLOGY

This section provides further guidance to project developers regarding application of the REDD methodologies to specific project activities. It contains background on the VCS project development process, an illustrative work plan, and suggestions for project developers on using an approved REDD methodology to prepare a VCS Project Description. It is important to note that the exact application of an approved REDD methodology will differ between projects, and reflect differences in project circumstances. In general, project developers will need to have access to internal or external expertise to apply a VCS REDD methodology, including expertise in forest measurement, remote sensing, and spatial modeling where necessary.

7.1 SUMMARY OF THE VCS PROJECT DEVELOPMENT PROCESS

For context, the four major steps in the VCS Project Development Process are summarized by the VCS and presented in the text box below.

Text Box 1.17. **FOUR MAJOR STEPS IN DEVELOPING A PROJECT. TEXT IS SOURCED FROM THE VCS WEBSITE, GUIDANCE ON DEVELOPING A PROJECT, ACCESSED AT HTTP://WWW.V-C-S.ORG/DEVELOP-PROJECT.**

1: Choose a Methodology	2: Prepare and Validate Project Description	3: Monitor and Verify Emission Reductions	4: Register Project and Issue VCU's
To quantify the GHG emission reductions of a project, project proponents must select and use a VCS-approved methodology or a methodology from a VCS-approved GHG program. A methodology must be followed in full. A new methodology may be developed under VCS in the event one does not exist for a proposed project activity.	Project proponents must develop a complete project description and have it validated by an accredited validation/verification body (VVB). The project description can be developed before, during or after project design and implementation, and it must be developed using the VCS template.	Once a project starts, projects proponents monitor and measure GHG emission reductions and other data. All information for a given period, including the calculations of GHG emission reductions, are documented and reported in a monitoring report, using the VCS template, which must be verified by an accredited validation/verification body (VVB).	Projects must open an account and submit all required documents to a VCS registry operator in order to be registered on the VCS Project Database and issue VCUs. Projects can register immediately upon validation or wait until they are ready to issue credits, but all projects must be publicly listed in the database once VCUs are issued.

The following sections of this chapter focus on aspects of steps 1 and 2 of the VCS Project Development Process, Choosing and Applying a Methodology.

7.2 CHOOSING A REDD METHODOLOGY

To illustrate the process of selecting a REDD methodology, we present a generalized work plan below that details the data collection and analysis required. The work plan is not intended to be a comprehensive or exhaustive plan relevant to every REDD project, but rather, a generalized plan that can be adapted with more detail to specific project situations.

Table 7.2. STEP 1: GENERALIZED WORK PLAN FOR SELECTION OF A REDD METHODOLOGY

Task	Tools/Data Needs	Technical Resource Needs
Identify project start date and project area and verify that area meets definition of forest at and for at least 10 years before project start	Satellite image of the project area, classified by land cover (forest/non-forest), as of project start and 10 yrs prior.	Satellite imagery processing and classification expertise
Identify drivers and configuration of potential deforestation and/or degradation	Planned – permits, management plans Unplanned – historical deforestation from a time series of classified satellite imagery of the project region, anecdotal	Satellite imagery processing and classification, land use change analysis

Task	Tools/Data Needs	Technical Resource Needs
	or local expert information on drivers/agents of deforestation and/or degradation	expertise Local context expertise
Identify project activities that will avoid deforestation and/or degradation	Local expert guidance Track records from previous projects	Conservation and rural development planning expertise
Review and select an applicable methodology, or assess need for deviation and/or revision of an approved methodology (see below)	Project data relevant to applicability conditions Approved methodologies REDD methodology key and comparison tables in this guidebook	

In practice, strict application of the approved REDD methodologies may not be possible or practical. In these cases, where the fundamental elements of a methodology still apply to the project, a project developer may consider developing a methodology deviation or revision (see text box below).

Text Box 1.18 **VCS METHODOLOGY DEVIATIONS AND REVISIONS**

Deviations

A methodology deviation is a change in the criteria and procedures relating to monitoring or measurement (but not quantification) of GHG emission reductions or removals set out in the methodology. Deviations generally constitute minor changes that do not affect the conservativeness of project accounting. For example, where a methodology specifies the use of fixed area plots for forest biomass measurement, the use of variable radius plots instead could be justified as a deviation. Methodology deviations must be identified and justified in the Project Description (PD) and are validated as part of the PD validation process.

Revisions

Methodology revisions are changes to a methodology that do not meet the description of methodology deviation. Methodology revisions are generally more substantial, but still maintain the integrity of the methodology. A change to an applicability condition, for example, which would require expanding the scope of a methodology to address new circumstances, would be considered a methodology revision. Methodology revisions must complete the approval process required by the VCS for new methodologies, and thus, involve significantly more time and expense as compared to methodology deviations.

As it is not always clear whether a new approach would constitute a deviation, revision, or development of a new methodology, project developers should consult technical experts, validation firms, and/or the VCS as necessary to evaluate the need and best approach to accommodate new project accounting situations.

Available VCS-approved REDD methodologies cover most REDD project types (and baseline circumstances that are likely to be encountered), and thus development of new methodologies will seldom be warranted. However, methodologies covering degradation in the baseline are currently few and limited in scope, and thus projects involving avoiding unplanned degradation may need to consider new methodologies (e.g. currently, in cases where degradation is not caused by unsustainable fuel-wood collection and cannot be monitored using broad degradation classes interpretable from medium resolution satellite imagery).

7.3 APPLYING A REDD METHODOLOGY

To illustrate the process of applying a REDD methodology, we continue with the illustrative work plan started in Table 8.2. Project developers should use the template provided by the VCS to document the Project Description (PD) that will be submitted for validation, registration, and ultimately that will also be used for verification. In reviewing the data and technical resource needs, the multidisciplinary nature of project development should become apparent and in most cases, the project developer will need to engage professionals with a wide range of expertise to complete all tasks.

Table 7.3. STEP 2: GENERALIZED WORK PLAN FOR APPLICATION OF A REDD METHODOLOGY AND PREPARATION OF VCS PD.

Task	Tools/Data Needs	Technical Resource Needs
Document key details of project (location, activities, project start, etc)	Geo-referenced project area boundary and other relevant information.	GIS expertise
Collect legal documentation to demonstrate control of project area	Proof of title, land use agreements, other relevant statutory or regulatory provisions	Legal expertise
Assess additionality and baseline land use in absence of project. Perform: Analysis of alternative land use scenarios Investment test, or Barrier test Common practice test.	A VCS approved additionality tool. Project financial plan. Financial information on alternative land uses. Expert opinion on barriers. Information on land use trends and similar activities in the region. Evidence of regulatory surplus (i.e. demonstrate that project activity is not required by law)	Legal expertise Financial expertise Carbon project expertise Local context expertise
Define geographic boundaries including reference area and leakage areas (AUDD only).	GIS coverages of spatially explicit variables (e.g. digital elevation model, vegetation cover maps) and classified satellite imagery to demonstrate similarity of reference and leakage areas to project area, and where	GIS expertise

Task	Tools/Data Needs	Technical Resource Needs
	necessary, to delineate leakage belt width.	
Define carbon pools and GHG emission sources included in the project boundary.	Ex ante data from the literature/local sources to carry out significance testing. Monitoring cost data to carry out cost-benefit analysis.	
Estimate baseline rate of deforestation and/or degradation	Planned – documented authorization and evidence of intent (e.g. approved plans) Unplanned – time series of classified satellite imagery. Where applicable, data on correlated deforestation and/or drivers.	Satellite imagery processing and classification, land use change analysis expertise. Regression analysis/ deforestation rate modeling expertise.
7. Produce carbon stock estimates (for the selected pools) for pre- and post-deforestation/degradation land use classes. Implement forest carbon inventory.	Preliminary data for forest carbon inventory planning, including e.g. forest class maps and raw data from previous inventories of representative areas. Data on default stock estimates for baseline post forest conversion land uses from literature.	GIS and forest inventory expertise.
8. Where required, project the location of baseline deforestation and/or degradation.	GIS coverages of spatial variables (e.g. roads, population centers) and classified satellite imagery.	GIS and spatial correlation analysis and modeling expertise.
9. Develop accounting plan for leakage from: Activity shifting, including immigrant leakage where necessary Market leakage	Data to develop baseline emissions (from steps 6, 7 and 8) for leakage area to track activity shifting. Where necessary, survey data to assess composition of deforestation agents among local and immigrant actors to estimate immigrant leakage. National forest data (area and ratios of commercial volume/mass to total volume/mass) to estimate market leakage.	Same as per steps 6, 7 and 8.
10. Develop plan to monitor emissions in the project and leakage area		Satellite imagery processing and classification, land use change analysis expertise Forest inventory expertise
11. Assess non-permanence risk.	Relevant data and information sources to assess external, internal and natural risks to apply the VCS Tool for AFOLU Non-permanence	

Task	Tools/Data Needs	Technical Resource Needs
	Risk Analysis and Buffer Determination.	
12. Produce ex ante estimates of GHG emission reductions (including non-permanence buffer deductions) for the first (10-year) baseline period.	Data and analysis collected from previous steps 9, 10, 11, 12 and 13.	
13. Assess environmental and social impacts.	Expert opinion or studies on environmental and social impacts to be assessed. Results from stakeholder consultations. Relevant environmental data (e.g. environmental impact statements and mitigation plans)	Environmental/ conservation, social and rural development expertise

7.4 RECOMMENDATIONS FOR SUCCESSFULLY APPLYING A REDD METHODOLOGY

To conclude, we provide below general guidance to VCS REDD project developers that has emerged from experience on a wide range of successful AFOLU project development efforts and validations.

1- Start with a Feasibility Study. Develop cost estimates and a work plan for developing and implementing the REDD project. A work plan should follow the selected (applicable) methodology and identify data/expertise gaps and resource needs. Compare costs to potential revenues from the sales of credits from the proposed REDD project and other funding sources; utilize a range of assumptions regarding baseline rates, leakage, risk buffers, project performance (anticipated impact of REDD activities), and credit sales prices.

2- Engage internal and external resources as needed. Seek professional guidance (the VCS, verifiers, technical experts) early in the project design phase to avoid "retro-fitting" a project to meet methodology requirements. Good communication between internal and external resources is critical to ensuring smooth project development and implementation.

3- Consider using conservative assumptions and default factors, where permitted by a methodology, to simplify accounting and reduce costs. For example, if allowed by the methodology, consider conservatively excluding certain carbon pools that will be expensive to measure and that are not expected to contribute significantly to the project's emission reductions. Also, if allowed by the methodology, consider conservatively ignoring forest growth and assuming stable stocks, foregoing the need for cost-intensive re-measurement of permanent inventory plots (unless significant forest growth is anticipated in the project area, e.g. in the case of successional or previously degraded forests).

4- Use data and analyses from existing internal and external sources that meet methodology requirements and forego the cost of producing new data or analyses. For example, look for commercial forest inventories that were recently completed and meet methodology requirements and which can be used to estimate carbon stocks in the project area.

5- Collect verifiable evidence for all assertions and assumptions made in the application of the methodology. Expect that validators and verifiers will question everything. Avoid presenting models as "black boxes" – show base data and include source and justification.

6- Ensure internal consistency of the PD, and that assumptions or assertion made in one section do not contradict those made in other sections. This can often be challenging given that PD's are typically large documents written in a staggered fashion over an extended timeframe.

7- Establish credibility by adhering to principle of conservatism where there are cases of ambiguity in the methodology process or application to the particular circumstances of the project. Some level of misinterpretation is unavoidable – expect some modifications to the PD.

8- Stay abreast of developments concerning jurisdictional REDD initiatives, as some methodologies defer to jurisdictional baselines covering the project area if and when developed. Participate in local jurisdictional initiatives and follow the outputs of the recently launched VCS Jurisdictional and Nested REDD Initiative (VCS JNRI). Technical work on the VCS JNRI is expected to run through the end of 2011, with procedures and guidance (e.g. rules concerning requirements for project use of jurisdictional baselines) expected to be released in 2012. Project developers should consider that their projects may stand to benefit from coordination with jurisdictional REDD initiatives, through, for example, data sharing and the enabling environment that jurisdictional programs can create - the success of individual projects will always be dependent on effective governance and actions taking place beyond project boundaries.

8.0

REFERENCES AND RESOURCES

The VCS Standard, Tools, submission templates and VCS-approved REDD methodologies, as well as methodologies that have been submitted for VCS validation, are all available for download at the VCS website at www.vcs.org

In particular, the following VCS documents are essential resources for understanding the fundamentals of the VCS program and standard and treatment of AFOLU (including REDD) activities:

- VCS Program Guide
- VCS Standard
- AFOLU Requirements
- Program Definitions
- VCS Registration and Issuance Process
- AFOLU Non-permanence Risk Tool

CCBA. 2008. Climate, Community & Biodiversity Project Design Standards Second Edition. CCBA, Arlington, Virginia. Available at: http://www.climate-standards.org/

FAO. 2010. Global Forest Resources Assessment 2010: Main Report. Forest Resources Assessment Programme Working Paper. Food and Agriculture Organization, Rome. Available at: http://www.fao.org/docrep/013/i1757e/i1757e.pdf

FAO. 2010. Global Forest Resources Assessment 2101: Terms and definitions. Forest Resources Assessment Programme Working Paper 177/E. Food and Agriculture Organization, Rome.

GOFC GOLD. 2010. A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation. Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD), Alberta, Canada. Available at: http://www.gofc-gold.uni-jena.de/redd/

IPCC. 2003. IPCC Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol: Methods for Estimation, Measurement, Monitoring and Reporting of Land-use, Land-use Change and Forestry (LULUCF) Activities under Article 3.3 and 3.4 Chapter 4. Prepared by the National Greenhouse Gas Inventories Programme. IGES, Japan. Available at: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html

IPCC. 2006. IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 4 AFOLU (Agriculture, Forestry and Other Land-use). Prepared by the National Greenhouse Gas Inventories Programme. IGES, Japan. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

IPCC. 2007. Climate Change 2007: Synthesis Report.Fourth Assessment Report of the IPCC, Geneva.

Pearson, T., Walker, S. and Brown, S. 2005. Sourcebook for Land Use, Land-Use Change and Forestry Projects. Winrock International and the World Bank Biocarbon Fund. 57pp.

SOCIALCARBON Standard. Available at: http://www.socialcarbon.org/

UNFCCC host country forest definitions. Available at: http://cdm.unfccc.int/DNA/index.html

Winjum, J.K., Brown, S., Schlamadinger, B. 1998. Forest harvests and wood products: sources and sinks of atmospheric carbon dioxide. Forest Science 44: 272-284

Landsat program (http://landsat.gsfc.nasa.gov/) imagery can be downloaded free of charge at the official portals listed below:

http://glovis.usgs.gov/

http://glcf.umiacs.umd.edu/index.shtml

9.0

GLOSSARY

The definitions below are taken directly from a number of sources. Where multiple sources have defined the same term, the VCS definition, the most clear definition, or the most broadly defined definition takes precedence. The superscript character at the end of each defined work indicates the source of the definition.
† - VCS Program definitions, Version 3.
†† - VCS AFOLU Requirements
§ - VM0006 Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation.
? - VM0007 REDD Methodology Modules (REDD-MF).
‡ - VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests.
* VM0015 Methodology for Estimating Reductions of GHG Emissions from Unplanned Deforestation.

Aboveground Biomass[†] - Living biomass above the soil, including the stem, stump, branches, bark, seeds and foliage.

Afforestation, Reforestation and Revegetation (ARR)[†] - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation.

Afforestation[†] - The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

Agent of Deforestation[‡] **-** People or groups of people responsible for deforestation.

Agricultural Land Management (ALM)[†] - Activities that increase carbon stocks in soils and woody biomass and/or decrease CO_2, N_2O and/or CH_4 emissions from soils on croplands and/or grasslands.

Agriculture, Forestry and Other Land Use (AFOLU)[†] - The sectoral scope that covers GHG emissions and emission reductions and/or removals from project activities in the agriculture, forestry, and other land use/land use change sectors and for which the VCS Program has established rules and requirements with respect to specific project categories.

Allometric Equation[‡] **-** A statistical model used to predict biomass given the measurement of closely related attributes of a tree or shrub, such as diameter (DBH) or stem count.

Baseline Emissions[‡] **-** For any monitoring period, baseline emissions are a sum of estimated emissions over selected carbon pools.

Baseline Period[?] - The period of time with a fixed baseline (10 years).

Baseline Reevaluation[‡] **-** Revision of the baseline scenario which occurs every ten years.

Belowground Biomass† - Living biomass of live roots, sometimes excluding fine roots of less than 2mm diameter because these often cannot be distinguished empirically from soil organic matter or litter.

Carbon Density* - The amount of carbon (as CO_2-e) per hectare (ha^{-1}) estimated to be present in the accounted carbon pools of a LU/LC Class at year t.

Carbon Pools† - A reservoir of carbon that has the potential to accumulate (or lose) carbon over time, which for AFOLU projects encompasses aboveground biomass, belowground biomass, litter, dead wood and soil.

Carbon Stock† - The quantity of carbon held within a pool, measured in tonnes of CO_2.

Catastrophic Reversal† - A type of reversal caused by disasters such as hurricanes, earthquakes, flooding, drought, fires, tornados or winter storms, or man-made events over which the project proponent has no control such as acts of terrorism or war.

Commercial Timber Harvesting§ - The extraction of timber wood for further sale on regional/global timber markets outside of the project area or transferred to non-project participants (see VCS 2007.1, 2008, point 25 p 23).

Covariate‡ - A variable possibly predictive of the outcome under study; in this case quantifiable social, economic, or political factors that may improve model fit.

Cropland† - Arable and tillage land and agro-forestry systems where vegetation falls below the threshold used for the forest land category.

De Minimis[19] - Carbon pools and GHG sources which do not have to be accounted for if together the omitted decrease in carbon stocks (in carbon pools) or increase in GHG emissions (from GHG sources) amounts to less than five percent of the total GHG benefit generated by the project.

Dead Wood† - Non-living woody biomass not contained in the litter, either standing, lying on the ground or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10cm in diameter or any other diameter used by the host country for its UNFCCC national inventory accounting.

Deforestation† - The direct human-induced conversion of forest land to non-forest land.

Degradation† - The persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuel-wood extraction, timber removal or other such activities, but that does not result in the conversion of forest to non-forest land, and falls under the IPCC 2003 Good Practice Guidance land category of forest remaining forest.

Drained Peatland† - A peatland having a lower than natural average annual water level due to accelerated water loss or decreased water supply resulting from human activities and constructions, both on- and off-site.

Drivers of Deforestation‡ - Geographic, climatic or other physical, social and/or economic conditions that cause deforestation.

Emissions‡ - The release of a greenhouse gas (GHG) source into the atmosphere.

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[19] VCS. 2011. Agriculture, Forestry and Other Land Use (AFOLU) Requirements: VCS Version 3. Verified Carbon Standard, Washington, D.C.

Ex-ante – "Before the event", generally used to describe estimates (or projections) made prior to project start, e.g. all baseline projections are ex ante (the counterfactual case cannot be measured ex post)

Ex-post – "After the fact", generally used to describe monitoring results, e.g. actual emission reductions

Fixed Baseline Period* - The period of time for which the validated baseline is fixed, which under the VCS is 10 years. After this period of time, the baseline must be reassessed using a VCS approved methodology.

Foreign Agents‡ - Groups originating outside the region in which the project resides (for example, a group of settlers that emigrates a far distance inland from the coast).

Forest† - Land with woody vegetation that meets an internationally accepted definition (eg, UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests.

Frontier Deforestation† - The frontier deforestation and/or degradation pattern can result from the expansion of roads and other infrastructure into forest lands. Roads and other infrastructure can improve forest access and lead to increased encroachment by human populations, such as subsistence farming and fuel-wood gathering on previously inaccessible forest lands.

Grassland† - Managed rangeland and pastureland that is not considered as cropland where the primary land use is grazing, and which may also include grass-dominated systems managed for conservation or recreational purposes.

Grouped Project† - A project to which additional instances of the project activity, which meet pre-established eligibility criteria, may be added subsequent to project validation.

Improved Forest Management (IFM)† - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuel-wood.

Leakage† - Net changes of anthropogenic emissions by GHG sources that occur outside the project boundary, but are measurable and attributable to the project.

Leakage Belt* - The geographical area surrounding or adjacent to the project area which activity displacement leakage could occur.

Leakage Management Area* - Areas outside the project area in which activities are implemented to avoid leakage.

Litter† - Non-living biomass with a size less than a minimum threshold diameter (eg, 10 cm) chosen by the host country for its UNFCCC national inventory accounting, lying dead, in various states of decomposition above the mineral or organic soil, including litter, fumic and humic layers. Live fine roots (of less than the threshold diameter for belowground biomass) are included in litter where they cannot be distinguished from it empirically.

Long-Lived Wood Products‡ - Products derived from wood harvested from a forest, including logs and the products derived from them, such as sawn timber and plywood that are assumed to remain sequestered throughout the lifetime of the project crediting period.

Market Leakage Evaluation† - The evaluation by the project proponent of the project's market leakage impacts and discount factor, documented in the project description or monitoring report, as applicable.

Methodology† - A specific set of criteria and procedures, which apply to specific project activities, for identifying the project boundary, determining the baseline scenario, demonstrating additionality, quantifying net GHG emission reductions and/or removals, and specifying the monitoring procedures.

Methodology Deviation† - A deviation from the criteria and procedures for monitoring or measurement set out in a methodology applied to the project.

Methodology Revision† - A revision to the criteria and procedures of an existing methodology.

Monitoring Period* - The period of time (in years) between two monitoring and verification events. Typically it is a fraction of the fixed baseline period.

Mosaic Deforestation† - The mosaic deforestation and/or degradation pattern can result when human populations and associated agricultural activities and infrastructure are spread out across the forest landscape. In a mosaic configuration most areas of the forest landscape are accessible to human populations. Mosaic deforestation and/or degradation typically occur: where population pressure and local land use practices produce a patchwork of cleared lands, degraded forests, secondary forests of various ages, and mature forests; where the forests are accessible; and where the agents of deforestation and/or degradation are present within the region containing the area to be protected.

Native Ecosystem† - A landscape composed of indigenous vegetation not established by planting and/or seeding.

Non-Permanence Risk Analysis† - The assessment of the risk of a potential loss in carbon stock in the project over a period of 100 years, prepared by the project proponent using the VCS Non-Permanence Risk Report Template.

Non-renewable biomass – Defined in detail in VM0007 module LK-DFW, refers to fuel-wood collection that results in persistent loss of forest biomass stocks (degradation).

Non-tree Woody Biomass‡ - Biomass that includes woody shrubs and any trees too small for carbon stock estimation using the allometric equations derived or selected for trees.

Participating Community§ - A local community of individuals and households who are permanently living adjacent to the project area, and who are participating in project activities and directly benefit from project activities through increased livelihoods and improved forest resources.

Participatory Rural Appraisal‡ - A voluntary survey of the populace surrounding the project area that can be used to identify the agents and drivers of deforestation, delineate the reference region, and identify strategies to mitigate deforestation in the project area.

Peat Soil‡ **-** Organic material with more than 50 percent of organic matter derived from incompletely decomposed plant residues.

Peatland† - An area with a layer of naturally accumulated organic material (peat) that meets an internationally accepted threshold (eg, host-country, FAO or IPCC) for the depth of the peat layer and the percentage of organic material composition. Peat originates because of water saturation. Peat soil is either saturated with water for long periods or is artificially drained. Common names for peatland include mire, bog, fen, moor, muskeg, pocosin and peat swamp (forest).

Planned Deforestation†† - deforestation on forest lands that are legally authorized and documented to be converted to non-forest land.

Project† - The project activity or activities implemented as a GHG project and described in the project description.

Project Activity† - The specific set of technologies, measures and/or outcomes, specified in a methodology applied to the project, that alter the conditions identified in the baseline scenario and which result in GHG emission reductions or removals.

Project Area - The area of forest land that will be protected by the REDD project activities.

Project Boundary‡ - The physical and temporal constraints of the project that encompasses the greenhouse gases (GHG) and carbon pools considered which include the physical boundaries of the project area and the project crediting period defined by the project proponent.

Project Crediting Period† - The time period for which GHG emission reductions or removals generated by the project are eligible for issuance as VCUs, the rules with respect to the length of such time period and the renewal of the project crediting period being set out in the VCS Standard. For REDD projects, is from 20 to 100 years in length.

Project Description† - The document that describes the project's GHG emission reduction or removal activities and that uses either the VCS Project Description Template or the project description template specified by the relevant approved GHG program.

Project Developer - For the purposes of this guidebook used interchangeably with project proponent (see project proponent).

Project Emissions‡ - Project emissions for any monitoring period as estimated by the events of woody biomass consumption.

Project Longevity††[20] - the number of years that project activities will be maintained.

Project Proponent† - The individual or organization that has overall control and responsibility for the project, or an individual or organization that together with others, each of which is also a project proponent, has overall control or responsibility for the project.

Project Scenario* - The expected change in land use and land cover within the boundary of the project area resulting from the undertaking of the project activity.

Project Start Date† - Date on which the project began generating GHG emission reductions or removals.

Reference Area‡ - An area in the same region as the project area that is similar to the project area in regards to acting agents of deforestation, acting drivers of deforestation, socio-economic conditions, cultural conditions and landscape configuration.

Reference Period? - The historical period prior to the project start date that serves as the source of data for defining the baseline.

Reference Region§ - The region from which historical and current deforestation and forest degradation quantities and trends are obtained.

Shifting agriculture –Agriculture that is not permanent or involves an extended fallow period.

Stratification‡ - The process of grouping homogenous subgroups of a given population to reduce sampling measurement error.

Temporal Project Boundary‡ - This is the period of time when deforestation is mitigated in the project area as a result of project activities. The boundaries are defined by the project start and end date.

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[20] AFOLU Non-permanence Risk Tool

Timber harvesting for local and domestic use§ - The extraction of timber wood for direct use within the project area and by the households that are living within the project area, without on-sale of the timber.

Tree[21] **-** A woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown, including bamboos, palms, and other woody plants meeting the above criteria.

Unplanned Deforestation†† **-** Unsanctioned deforestation (contra "Planned" deforestation, see above)

Uncertainty† - A parameter associated with the result of measurement that characterizes the dispersion of the values that could be reasonably attributed to the measured amount.

Wetland† - Land that is inundated or saturated by water for all or part of the year (eg, peatland), at such frequency and duration that under natural conditions they support organisms adapted to poorly aerated and/or saturated soil. Wetlands (including peatlands) cut across the different AFOLU categories. Project activities may be specific to wetlands or may be combined with other AFOLU activities.

Wood Products† - Products derived from wood harvested from a forest, including fuel-wood and logs and the products derived from them such as sawn timber, plywood, wood pulp, paper.

[21] FAO. 2010. Global forest resources assessment 2101: Terms and definitions. Forest Resources Assessment Programme Working paper 177/E. FAO, Rome.