平成25年度

REDDプラスに係る森林技術者講習会 テ キ ス ト ＜応用講習b＞

第1章

REDDプロジェクトの企画からPDDの作成に向けて①

住友林業株式会社
佐藤 裕隆

住友林業

REDDプラスに係る森林技術者講習会
REDD＋プロジェクトの企画から PDDの作成に向けて（FSからの知見）

1 住友林業の事業と植林事業の概要
2 森林経営の事例紹介
3 REDD+プロジェクトの企画から設計に向けて
4 ベトナム JCM FSのプロジェクト紹介

住友林業マスコット
きこりん

住友林業株式会社
山林・環境部

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住友林業

住友林業株式会社

本　社　：東京都千代田区大手町1-3-2

設　立　：昭和23年2月20日（創業元禄4年-1691年）

事業内容：山林事業（山林の経営）

木材・建材事業（木材・建材の流通）
住宅事業（注文住宅の建築等）
海外事業（木質建材の製造と流通、住宅の建築、販売）
不動産事業（開発、住宅分譲、流通、仲介）

（連結）建材製造事業、住宅ストック事業、緑化事業、

生活関連事業等

社有林　：四国・九州・北海道・和歌山　42,868ha（国土の約1/900）

売上高　：約8,452億円　経常利益　253億円　（2013年3月：連結）

ホームページアドレス：http://sfc.jp/

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住友林業

時代に応じた事業構造への組み換え

“木”のプロ集団が川上～川下の事業を世界規模で展開

1691年～ 山林事業　1950年～ 流通事業　1960年～ 製造事業　1970年～ 住関連事業

大造林計画と保続林業の始まり

住友林業

1691年(元禄4年)
別子銅山開坑、江戸幕府より周辺山林の立木利用を許可

1894年(明治27年)
「大造林計画」を樹立木材の過剰伐採と煙害で荒れ果てた別子の山々を大規模な植林で復旧

国土報恩

1903年(明治36年)
民間初の「施業案(森林計画)」編成開始

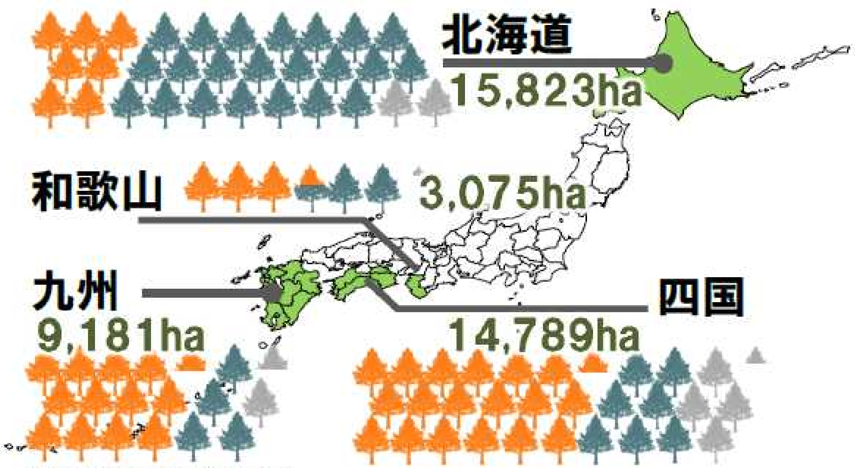
→ “保続林業”理念確立

住友林業

国内外での植林事業

日本国内の社有林	海外の植林事業規模
42,868ha	約190,000ha

=500ha　人工林　天然林　その他



（2012年3月末現在）

インドネシア
155,600ha

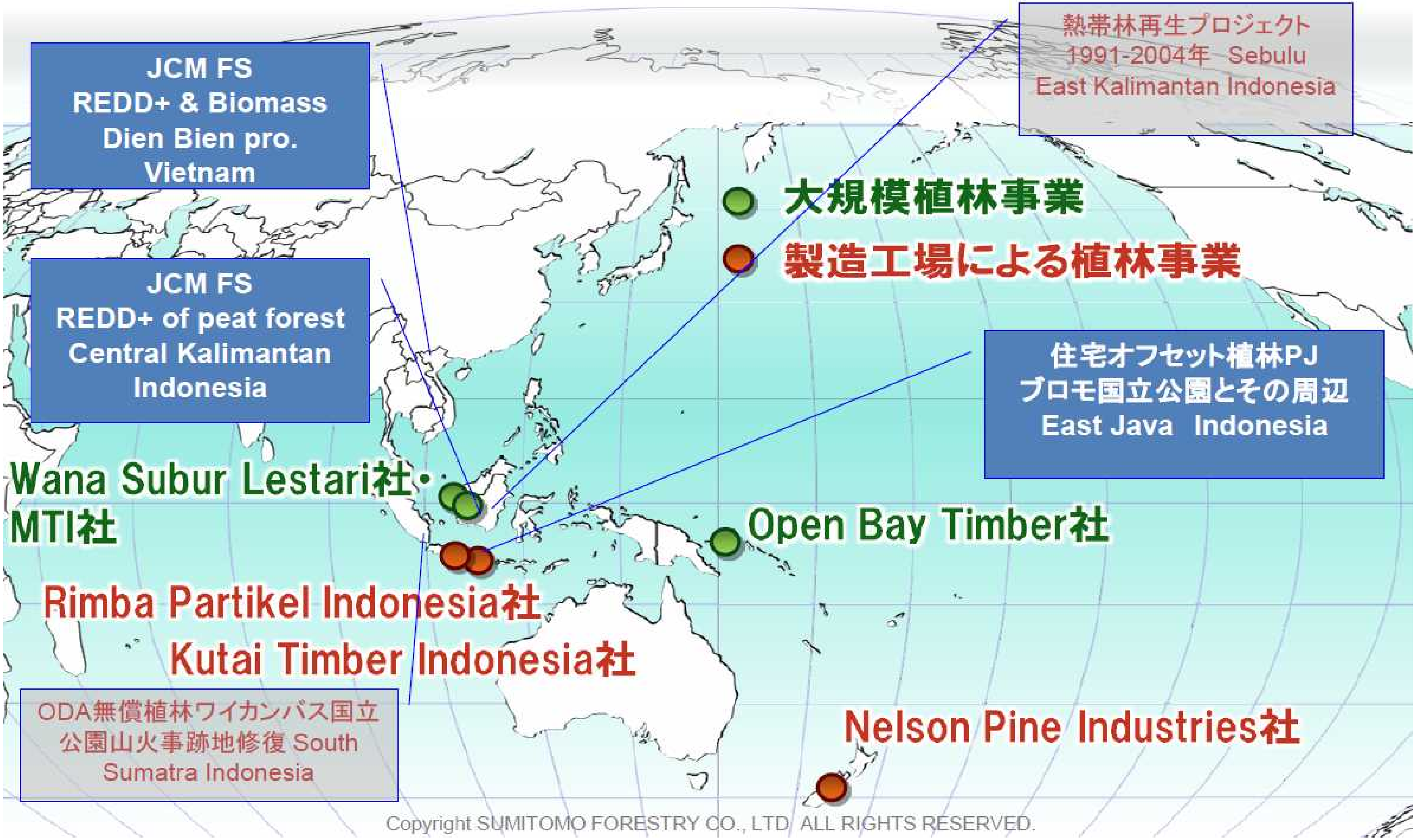
パプアニューギニア
31,000ha

ニュージーランド
3,600ha

=3,000ha

住友林業

海外の植林事業拠点



住友林業

住友林業の経営理念

■ 経営理念

住友林業グループは、再生可能で人と地球にやさしい自然素材である「木」を活かし、「住生活」に関するあらゆるサービスを通じて、豊かな社会の実現に貢献します。

行動指針

- 住友精神　公正、信用を重視し、社会を利する事業を進める。
- 人間尊重　多様性を尊重し、自由闊達な企業風土をつくる。
- 環境共生　持続可能な社会を目指し、環境問題に全力で取組む。
- お客様最優先　お客様満足に徹し、高品質の商品・サービスを提供する。

CSRマネジメントにおける4つの重要課題

■持続可能な森林から木材製品や資材を供給する
■環境にやさしい住まいを提供する
■事業を通じて地球温暖化対策を進める
■社員の家族を大切にはぐくむ暮らし方を追求する

国内外で
保続林業を進める
社会的責任

住友林業

森林経営事例1　産業植林

パプアニューギニア
Open Bay Timber社（OBT）の森林経営

住友林業

海外植林拠点の紹介No.2 パプアニューギニアの植林事業

■OBT社 OPEN BAY TIMBER LTD.

◇植林木: カメレレ、
ターミナリア等

◇植林面積: 13,222ha(2011年)

◇伐期: 約18年

◇用途: 丸太で販売・輸出

住友林業

Location of OBT

直行便（週1便：土曜日）
Cairns経由（毎日）

POM→Flight（1.5hrs）→Rabaul
Rabaul→Boat（3.5hrs）→Open Bay

住友林業

カメレレの植林

採種

育苗

植え付け

育林

カメレレの植林地

住友林業

持続的な木材生産のために

- 自生種による植林
  - カメレレ、ターミナリア
  - その他自生種の利用
- 植林・技術の改善
  - 低インパクトロギング、苗生産技術、育林技術
- 衛星情報を活用した情報管理システム
- 持続的な資源管理
- 環境に配慮した林道や橋梁の整備

FSC

住友林業

環境対応

- 生物多様性のモニタリング
- 保護価値の高い森林
  （HCVF）の保全
- 保全活動の実施
  - ベースキャンプ裏山の環境植林活動
- 環境負荷低減への取り組み
  - 廃棄物の削減
  - 古タイヤのリサイクル
  - CO2削減
  - 使用オイルの分別と再利用

住友林業

社会との共生

- インフラの提供と整備
  - 道路の敷設と整備
  - 陸上輸送、海上輸送の支援
- 地域の生活を支える
  - トレードストアの運営
  - 医療施設の運営
  - 農作物（カカオ等）生産の支援
  - 住宅建設支援（端材の利用）
- 将来を担う子供たちのために
  - 幼稚園、保育園の運営
  - 公立小・中学校教育支援
  - オイスカと連携した人材育成

植林事業が
地域のインフラの
重要な部分を担っている
▼
企業が持続的な森林経営を行なうことが
地域を支える

森林経営事例2　社会林業

インドネシア
Kutai Timber Indonesia社（KTI）の社会林業

住友林業

地域住民による社会林業: インドネシアKTIの事例

公社との契約: 2,000ha　　社会林業: 13,000ha
(内FSC森林認証: 332ha → 1,005haへ拡大)

住友林業

代表的な植栽樹種
ファルカタ（南洋桐）

センゴンラウト　Sengon laut

学名:Albizzia falcataria


マーケット
収穫
利益
Kutai Timber Indonesia社
• 初期費用
• 技術
• etc…
住友林業
協働
植林・育林
FSC
www.fsc.org
FSC C023796
The mark of responsible forestry

住友林業

Hadi Sengon！（センゴンを植えて巡礼地メッカに行こう！）

住友林業

社会林業FSC 地域住民の協力とメリット

- 木材の買い取りを約束
- 工場見学で住民の理解と参加意識の醸成
- 育てた木材が確実に販売できることが、木を植えるインセンティブとなり、信頼と安心感を与える。

マーケットの確保と連動が不可欠

住友林業

Project EARTHの森づくり

インドネシアでの植林を通じて、
住宅建築からの
CO2排出をオフセット

住友林業

きこりんと Project EARTH

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住友林業

Project EARTHがもたらすメリット

- CO2の吸収固定
- 植林木の安定供給(＝天然木依存の低下)
- 地域の森林拡充・環境改善
- 地域住民の収入増加
- 雇用の増加・スモールビジネス
- インフラ整備・地域の持続的な発展


森づくり活動の代表的なアプローチ
産業植林
市場とつなげる
コミュニティ
フォレスト
環境植林
経済
環境
社会
経済
環境
社会
経済
環境
社会
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住友林業

REDD+プロジェクトの企画から設計に向けて

JCM実現可能性調査からの知見
REDD+とは何か？
どこで、誰が行うべきか？
対象とバウンダリー
実施期間
JCMとして取り組む理由
効果の測り方

住友林業

REDD+とは何か？

- 森林と共生する豊かな社会づくり
- 炭素という資産の管理

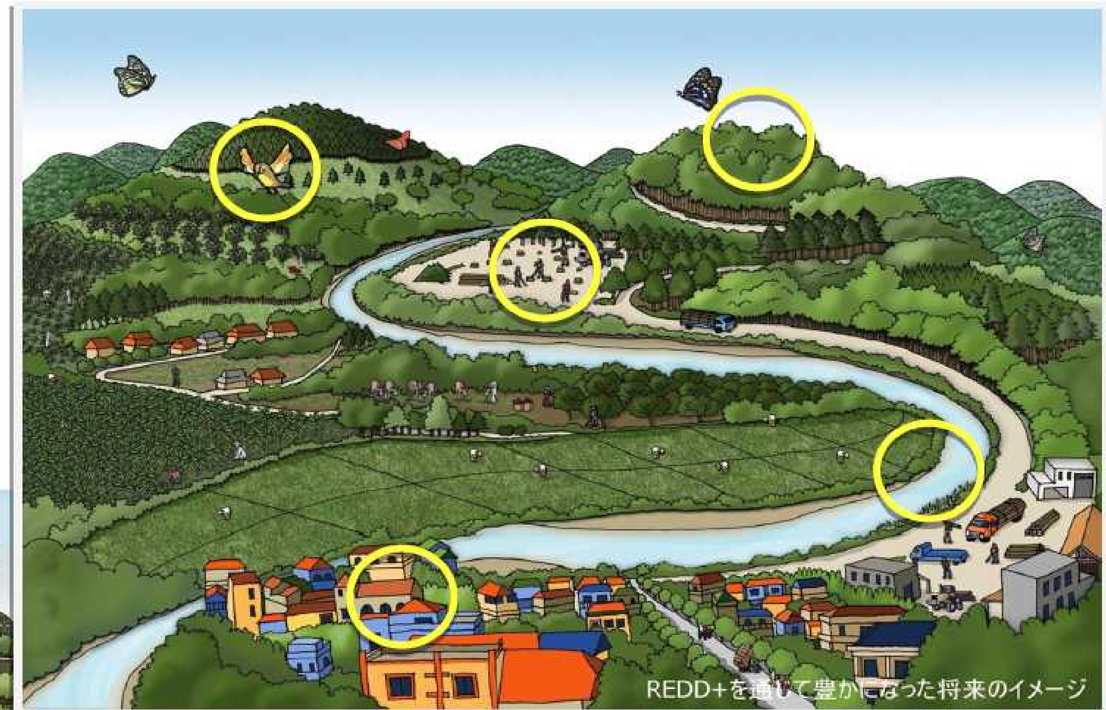
地域にとって本当に
よいことか？

リスクの高い取り組み

- 炭素クレジット（JCM）化

社会的な意義がとても高い取り組みだが、
一方でリスクが非常に高いことを認識すべき
制度作りの段階での工夫が必要

REDD+で目指す森林と共生した社会



経済的な発展と環境保全の両立、バランスをどうとるか？

住友林業

REDD+対策メニューのイメージ

森林の状態

Rich Forest → Non-Forest

森林保護･伐採制限	森林回復 AR-CDMの対象活動 植林
コミュニティフォレストのルール作りと管理	
エコツーリズム / 生物多様性モニタリング ／ 山火事防止	
エコツーリズム / 生物多様性モニタリング ／ 森林保全	

森林パトロール

非木材生産物の開発	生計向上プログラム 農業 / 家畜 / 魚養殖 / 特産物 etc.

インフラの改善

森林モニタリング

森林管理計画

森林管理組織の充実

能力強化 / 住民合意･参加意識醸成

活動リストの例
REDD+のためには
総合的な対策が必要

住友林業

森林の状態に影響を及ぼす様々な要因

道路建設のために、森林が伐採された。

大規模移民政策が行われ、住宅建設用に木材が大量に伐採された。

穀物相場が急上昇し、焼畑の面積が急増した。

鉱物が見つかり、採掘のために森林が伐採された。

ダム建設により、焼畑が禁止された。

穀物の相場が下がり、焼畑栽培が激減した。

大規模な木材加工工場が進出し、独自に植林する人が増えた。

主要道路建設され、野菜の出荷が可能となり、相対的に焼畑が減った。

Land use/Forest status

Rich Forest — Non-Forest

Prohibition on cutting /forest use		Natural regeneration
Rule making of forest use by community		
Eco tourism / Biodiversity research	Forest fire prevention	Plantation
	Forest enrichment	
Forest patrol		
NTFP development	Livelihood improvement programs Agriculture / Livestock / Fishery / Folk craft production etc.	
Infrastructure improvement		
Forest monitoring		
Forest Management Plan		
Forest management board		
Capacity building / community understanding		

間接的な要因、プロジェクトでコントロールできない要因が発生する可能性が高い。

別な環境NGOが森林保全活動を開始した。

新たに進出した工場で雇用機会が増え、焼畑農業人口が減った。

教育水準が上がり、高収入の職業に就く人が増えた。

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住友林業

REDD+の実施期間

- 森林と共生する豊かな社会づくり
- 炭素クレジット獲得

永遠/長期の取り組み

できるだけ短期

**活動を実施と炭素クレジット発生とのタイムラグを
できるだけ減らす制度づくり
幅広い参加を促すなら、短期参加も可能な
柔軟な仕組みが求められる**

多様な参加者を促す

住友林業

プロジェクトバウンダリーと実施主体

プロジェクトバウンダリーの考え方	行政協業アプローチ	コンセッション事業アプローチ
(地方)政府の役割	実施主体	許認可
プロジェクト実施者(JCM事業者)	実施主体を支援	実施主体
活動範囲	全部または一部の活動を支援	すべてを実施
GHG削減量算定	プロジェクトへの配分が課題	リーケージの評価が課題
国・準国REDD+との関係	一体(一貫性を担保)	独立
JCMのREDD+として	適用範囲が広い	条件が良い場合に限る

住友林業

REDD+の実施期間

- 森林と共生する豊かな社会づくり
- 炭素クレジット獲得

永遠/長期の
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多様な参加者を
促す

住友林業

REDD+に取り組む意義・目的

- 気候変動対策
- 生物多様性保全
- 貧困対策
- 木材や非木材林産物の持続的な供給
- 森林多面的機能からの様々な恩恵

- 日本としてREDD+に取り組む理由の明確化
- 途上国の森林保全支援に取り組む戦略づくり
- 森林セクターからの提案が重要

GHG削減効果の測り方

〇MRV方法論(案)「総合的森林管理・対策による温室効果ガス排出削減及び吸収増加」

・先行努力効果の評価ガイドライン

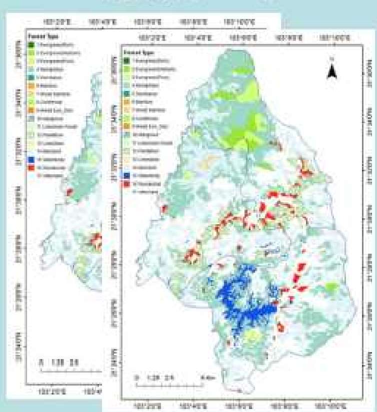
住友林業

検討しているMRV方法論の概要

- 算定方法のオプション
  1) デフォルトアプローチ
     - 公式なデータを用いて、公式な方法で算定する方法
  2) 固有アプローチ
     - 独自のデータを用いて算定する方法
- 基本的な考え方

ベトナム
JICA支援による
整備が進んでいる

活動データ



森林被覆変化 (ha)

×

排出係数

Rich forest	549
Medium forest	296
Poor forest	149
Bare land	0

カテゴリー別の森林炭素蓄積量(CO2t/ha)

=

排出量

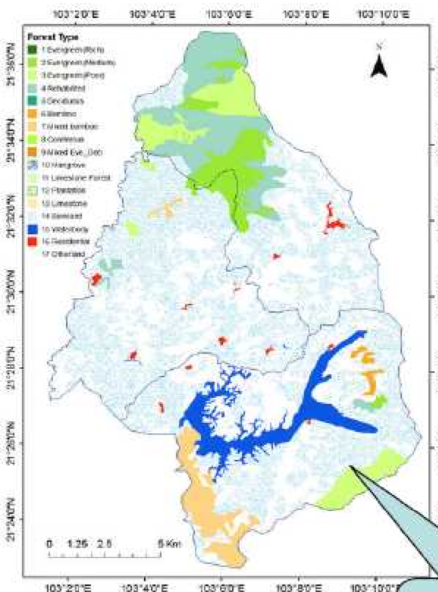
CO2

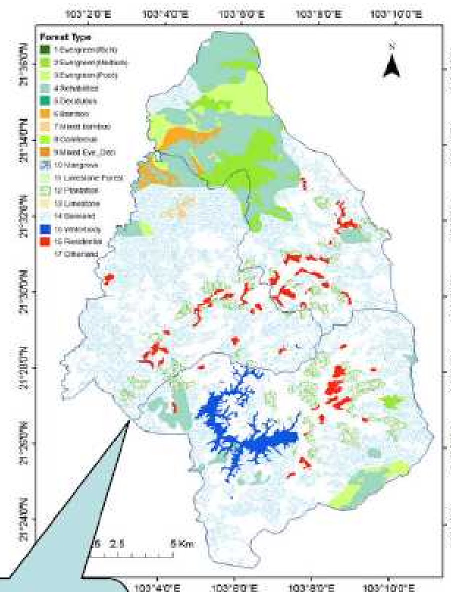
＊2012年度実現可能性調査結果より

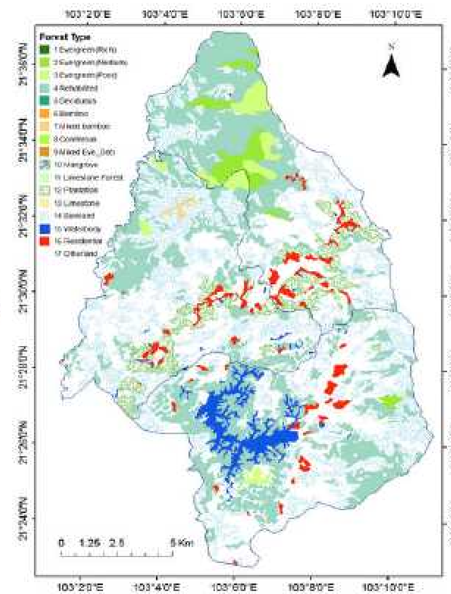
住友林業

REDD+ MRV 方法論

- プロジェクトエリアにおける森林の変化の例





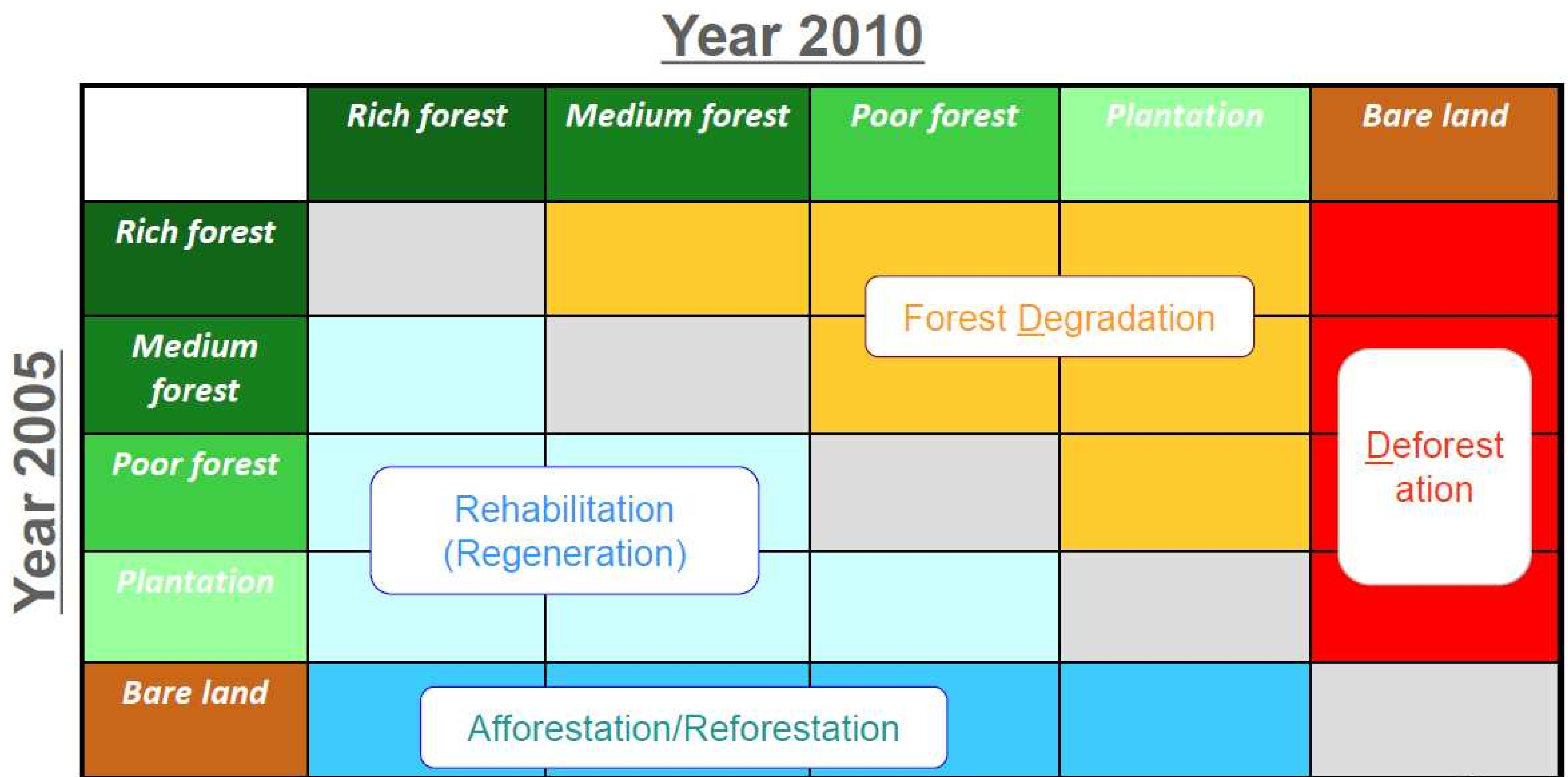


2時点の差を解析

Year 1990	2000	2010
756 (1000 t-CO2)	701 (1000 t-CO2)	999 (1000 t-CO2)

住友林業

森林炭素変化マトリックスのイメージ



There are 17 land cover categories actually in Vietnamese national forest inventory.

住友林業

参照レベルの設定方法

- 1990年から2010年までの森林炭素変化の単純平均
  - 1990-1995年
  - 1995-2000年
  - 2000-2005年
  - 2005-2010年

森林変化マトリックスのイメージ

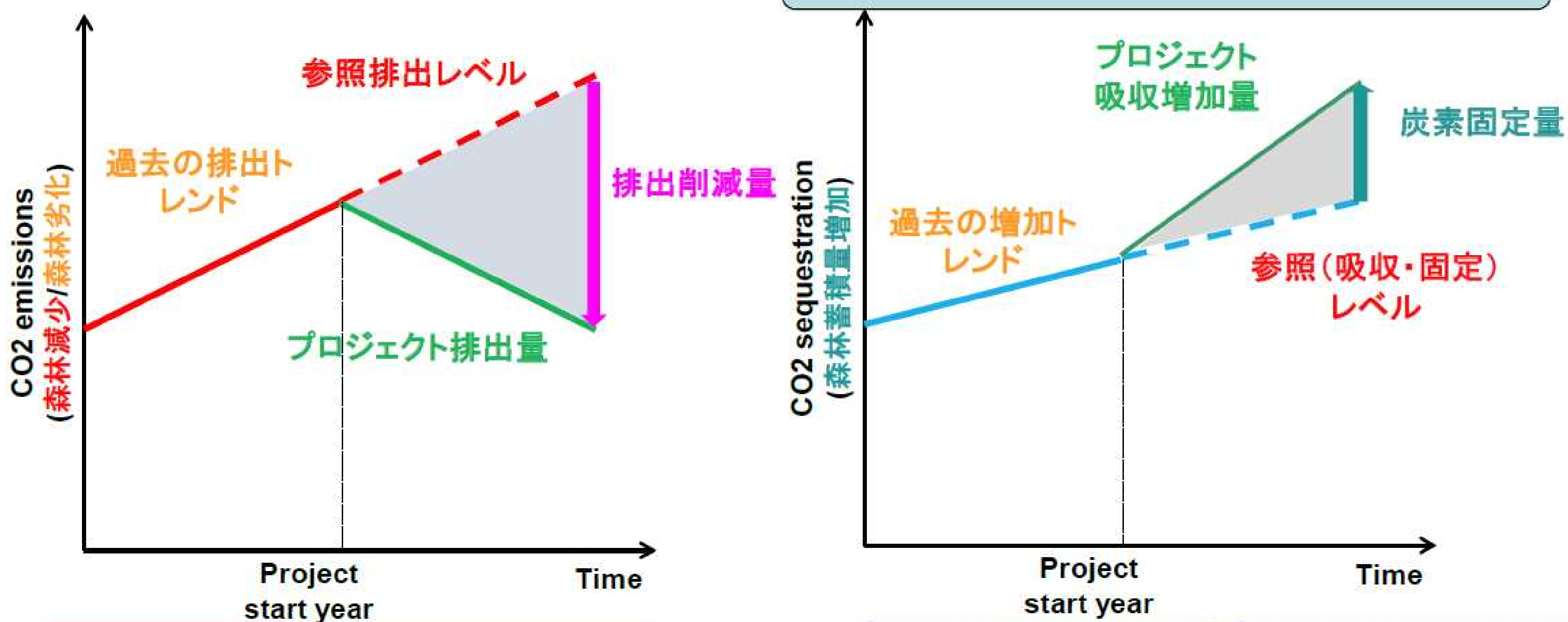
- 過去の森林保全活動（先行努力）の効果算入
  - 定量評価可能な活動のみ対象→661プログラム

住友林業

参照レベルと排出削減量

- GHG排出削減量を算出する基本的な考え方

排出系と吸収系を分けて評価する



森林減少 | 森林劣化 | 森林増加 | 森林回復

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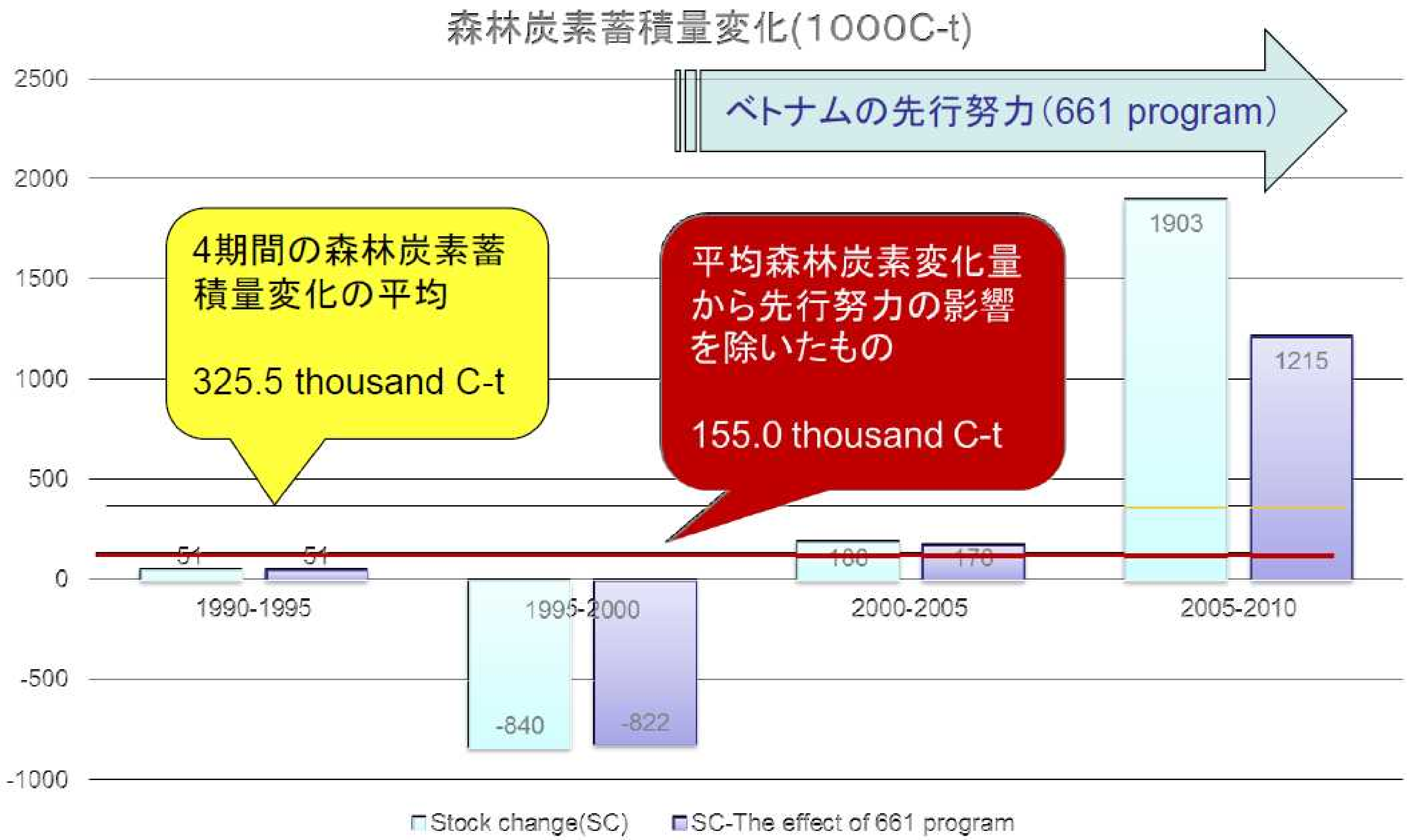
参照レベルの設定



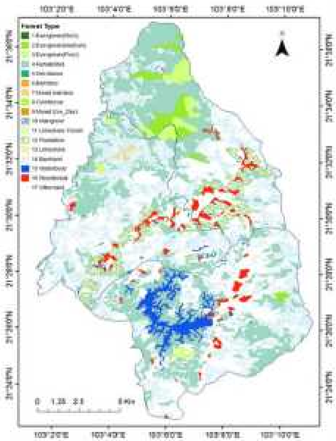
住友林業

モニタリング

GHG削減量を算定するための
モニタリングは2項目のみ

- モニタリングを行うパラメータ

(1)森林分布図



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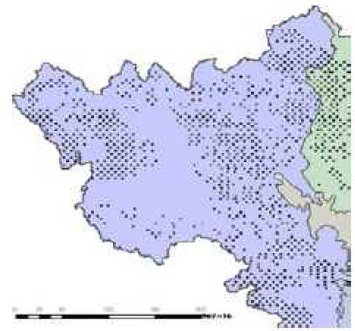
(2)排出係数

森林炭素蓄積量 (Ct/ha)



Rich forest	549
Medium forest	296
Poor forest	149
Bare land	0

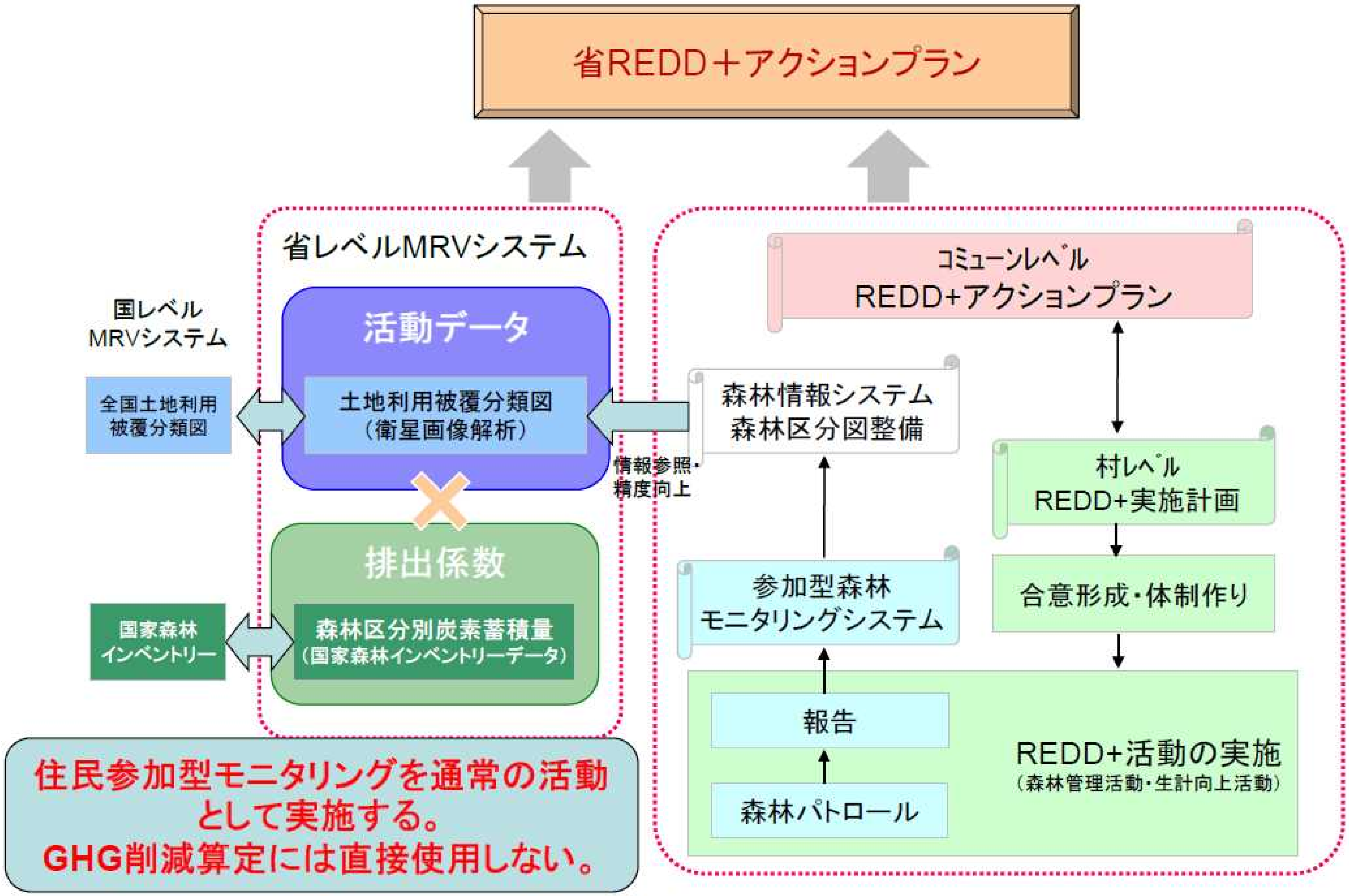
国家森林インベントリ
の結果から算出

- プロジェクトの活動のモニタリング
  - 実施の記録と管理
    - 植林活動、森林保護活動
    - 生計向上活動 等

プロジェクトは活動の実施やその
成果をモニタリングして、REDD+
活動の進捗を把握する

住友林業

コミューン・村落レベルREDD+活動の位置づけとMRV（案）



＊本図は現地調査での入手情報、関係機関への聴取内容等を元に調査者が作成したもので、ホスト国政府の公式見解ではありません。

住友林業

提案する方法論の特長

- 提案する方法論の 3つの特長
  - 簡素化された方法
    - モニタリングに過剰な手間とコストを掛けず、プロジェクトは対策活動にリソースを集中することができる
  - 国、準国レベルとの一貫性が高い
    - 国、準国レベルの方法に基本的には準ずるデフォルトアプローチを採用
    - 国、準国のREDD+との高い整合性
  - 汎用性が高い
    - ベトナムの他の地域や他の国でも利用できる

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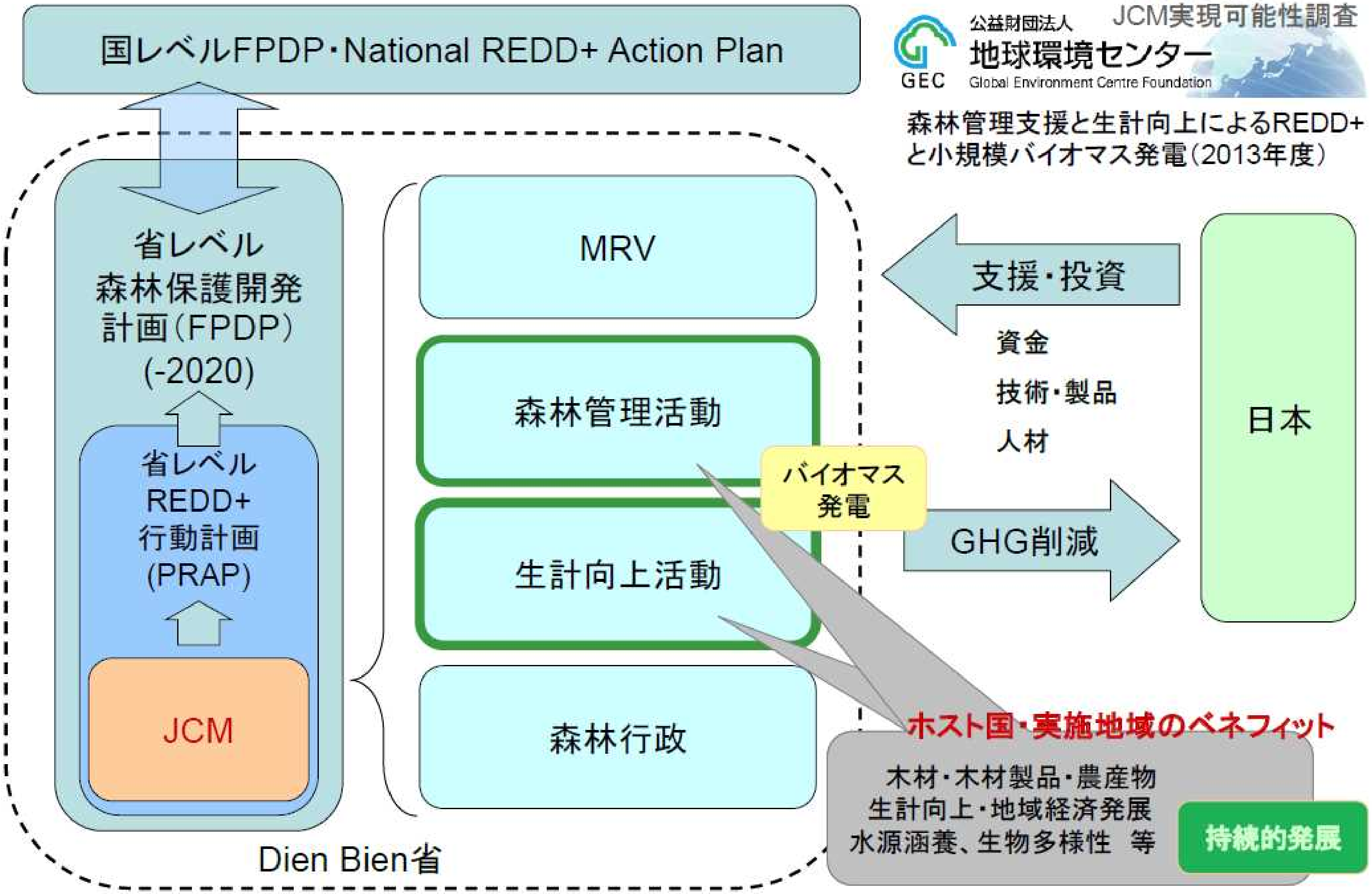
住友林業

JCM 森林管理・バイオマス発電+プロジェクトのコンセプト

環境省委託事業
JCM実現可能性調査

公益財団法人 地球環境センター
GEC Global Environment Centre Foundation

森林管理支援と生計向上によるREDD+
と小規模バイオマス発電（2013年度）



住友林業

二国間REDD+のコンセプト

炭素クレジット

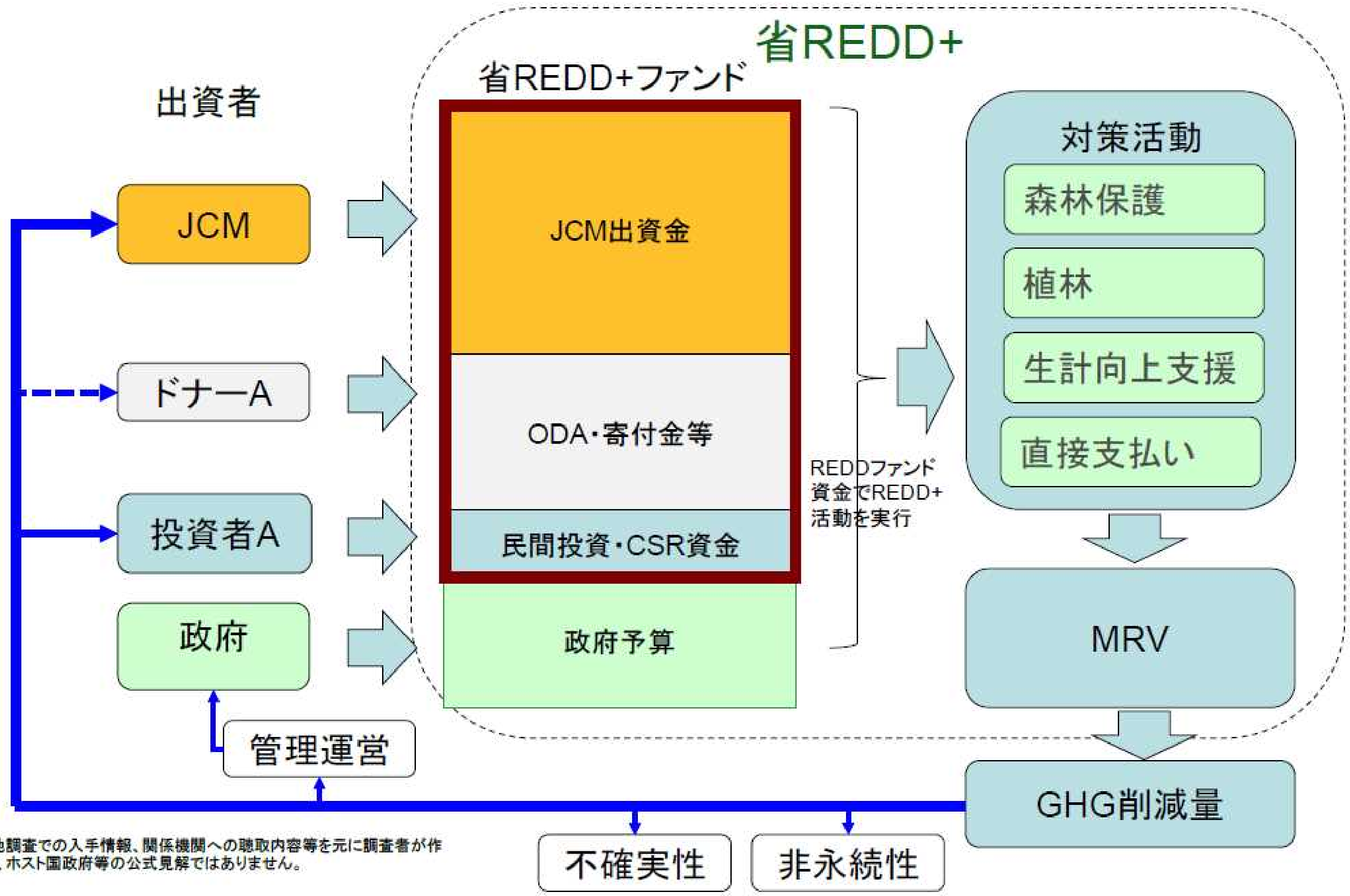
高付加価値の木材製品の製造・販売
林地残材・廃材を利用したバイオマス発電の導入

炭素クレジット

生計向上
農業指導により、生産性が高く持続可能な農業を推進

住友林業

省REDD+とJCM森林管理事業分野の関係(想定案)



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住友林業

REDD+ 活動のポイント～プロジェクトからの視点

- 地域の森林保全に対する包括的な合意形成が重要
- 森林及び周辺の状況に応じた総合的な対策が必須　→　森林管理＋生計向上

森林と共生する持続的な社会づくりに対するコミットメントが必要。

地域の事情に合わせた総合的な対策が必要。

- プロジェクトですべての対策を網羅的に実施するのは困難　→　行政と一体となった取り組み、活動の絞込みの必要性

プロジェクトベースでは鍵となる活動に焦点を当てる方が計画・実施しやすい。

- プロジェクトで制御できない要因の排除が難しい。（行政による様々な施策、森林と無関係な要因、別団体の森林保全活動等）
- プロジェクト活動と排出削減の関係を論理的に証明するのは極めて困難

方法論ではエリア全体の排出削減量を算出。ファンドへの貢献に応じてプロジェクトへの配分を決定する方法が好ましい。

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住友林業

ベトナム　REDD+の取り組み

途上国の森林を保全する
新しいメカニズム構築への貢献

■JCM実現可能性調査

公益財団法人 地球環境センター GEC Global Environment Centre Foundation　JCM実現可能性調査

※環境省委託事業で公益財団法人地球環境センター（GEC）が実施している「二国間クレジット制度の構築に係る実現可能性調査」

■REDD+実証活動

JICA　実証活動協力・連携　Japan International Cooperation Agency

ASKUL　YANMAR Solutioneering Together

ディエンビエン省農業農村開発局

ベトナム林業大学（業務委託）

住友林業

住友林業がREDD+に取り組む目的

1. 企業の社会的責任として
   - 森林保全・環境保全への貢献
   - 途上国持続的な発展への貢献
   - 日本の削減目標達成への貢献
2. 森林の持続的利用への貢献
   - 安定的な木材資源の確保
   - 当社の持続的森林経営ノウハウの活用
3. 新しい環境ビジネスとして
   - 排出権創出ビジネス
   - 調査・請負・コンサルティング

住友林業

本REDD+プロジェクトのポイント

1. 中央・地方政府との連携
   – REDD+の活動を管轄する中央・地方政府との十分な連携による実現可能性の確保

2. 既存政策・制度との融合
   – 森林保護開発計画（FPDP）、REDD+ 行動計画（PRAP）の活動とも整合性を確保した効果的な運用

3. 資源の有効活用
   – モニタリング・検証等にかかる費用を抑制すること等により、プロジェクトの費用対効果を向上

住友林業

ベトナム北西部の状況

ベトナム北西部の典型的な風景
見渡す限りの草原、焼畑農地が広がる

ベトナム北西部の風景
ダム湖周辺にもほとんど森林はない

一部天然林が残っている貴重なエリア

政府と住民による自生ヒメリンゴの植林
筋状になっている場所が植林したところ

少数民族モン族の女性

不適切な伐採が行なわれている

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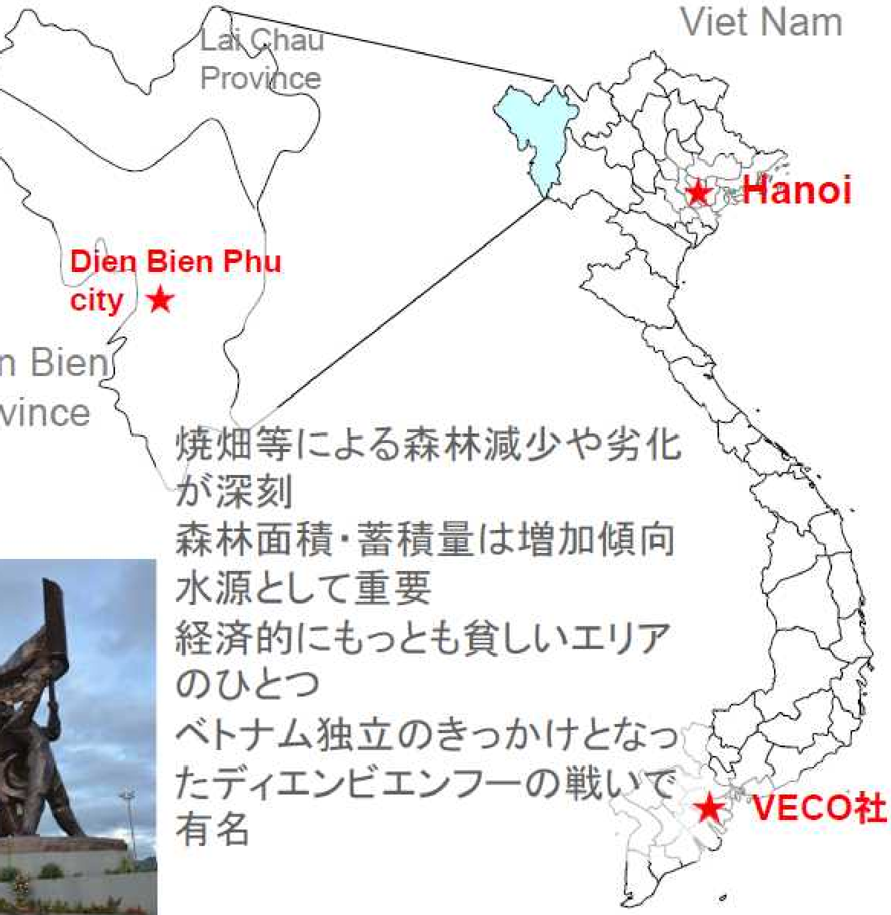
実証活動サイト



- 焼畑等による森林減少や劣化が深刻
- 森林面積・蓄積量は増加傾向
- 水源として重要
- 経済的にもっとも貧しいエリアのひとつ
- ベトナム独立のきっかけとなったディエンビエンフーの戦いで有名

ベトナムJCMREDD+のアプローチ

JCM仕組みづくり

環境省委託事業

公益財団法人 地球環境センター GEC Global Environment Centre Foundation　JCMFS

森林炭素の管理

↓

測定(MRV)システム

↓

GHG削減量

実証活動

森林管理プログラム　生計向上プログラム

↓

森林と共生する豊かな地域づくり

実証活動協力・連携　JICA Japan International Cooperation Agency

■REDD+実証活動　概要

(1)位置　ベトナム北西部ディエンビエン省ディエンビエン郡　ムオンファンコミューン内

(2)実施期間 2013年8月～2015年8月

(3)現地関係機関 ディエンビエン省農業農村開発局、ディエンビエン郡人民委員会、ムオンファンコミューン人民委員会(以上、JICA「ベトナム北西部水源地域における持続可能な森林管理プロジェクト(SUSFORM-NOW)」カウンターパート機関)、ベトナム林業大学(住友林業委託先)

(4)実証活動の内容　森林減少や劣化を防ぐためには、森林の保全や荒廃地への植林等による森林管理活動だけでなく、森林への過度な依存を減らす生計向上支援を総合的に実施することが必要。本実証活動では、森林を守る組織づくりと保全活動、植林、果樹や野菜の栽培支援、魚や家畜の飼育サポートなど、住民参加による総合的な取り組みを支援する。これらのREDD+活動をモニタリングすることにより、気候変動緩和策としての効果を農村レベルで実証する。

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実証活動対象地

BẢN ĐỒ QUY HOẠCH 3 LOẠI RỪNG THEO DỰ ÁN NÔNG THÔN MỚI
CÁC BẢN LỌNG LUÔNG (1+2), LỌNG HÁY VÀ LỌNG NGHỊU

森づくりオフセットプロジェクトとして実施
森林管理活動
生計向上活動

実証活動　村落ミーティング

村長宅に住民を集まってもらい、
どのような活動を行うか議論する

森林管理活動

生計向上活動

実証活動　村落レベルの計画作り

実証活動　森林管理と生計向上

屋敷林や果樹園支援

焼畑地での植林
森林保護活動

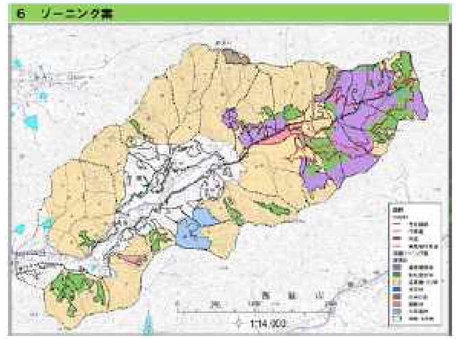
家畜飼育支援

淡水魚養殖支援

稲作や農業支援

JCM/REDD+における日本の技術・製品の貢献





- 森林管理技術
- 低インパクト林業技術
- 木材加工技術
- 農業技術（生計向上）etc.



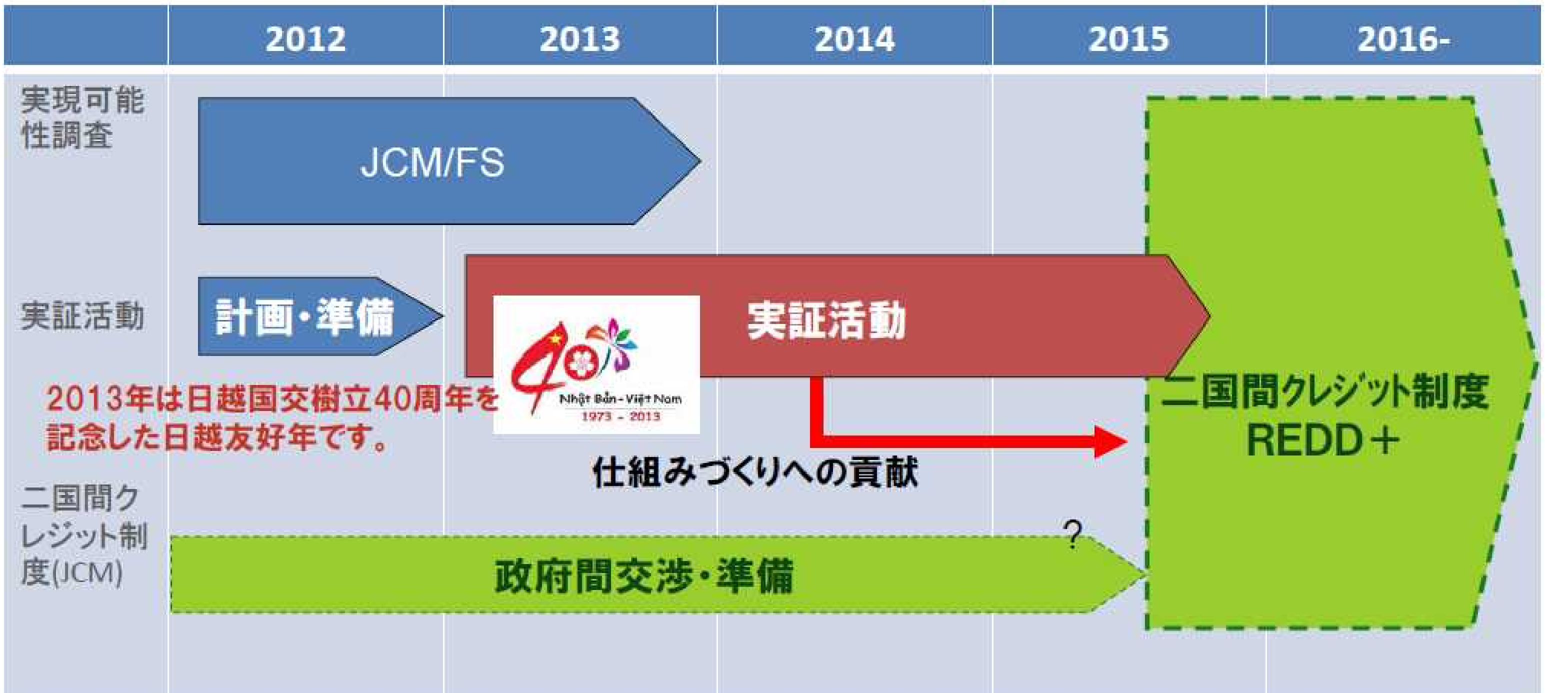

日本企業の貢献・民間企業の意見

- わかりやすい説明、簡便な手続き
  - JCM、REDD+ともに、制度への理解度・関心度が高くなかった。
  - プロジェクトイメージができるような、具体的でわかりやすい説明を行うとともに、参加手続きの簡素化・短期間化、クレジットの計算方法の簡便化を図る必要がある。
- 参加が容易な枠組み
  - REDD＋はクレジット獲得に長期間（10年単位）を要するが、企業が小額予算、短期間でも参加できる枠組みを整える必要がある。
- クレジット以外の企業メリット
  - REDD+が生物多様性保全や地域住民の生計向上に貢献することに資する仕組みになるかどうかも、企業の担当者は関心を持っている。
  - CO2クレジット以外の付加価値をつけることで、企業の関心が増す。

REDD＋実現に向けた住友林業の取り組み

公益財団法人 地球環境センター GEC Global Environment Centre Foundation　JCM実現可能性調査

JICA　実証活動協力・連携 Japan International Cooperation Agency



ASKUL　YANMAR Solutioneering Together

実証活動を一緒に行い、森づくりオフセットの仕組みづくりに貢献するパートナーを募集しています。

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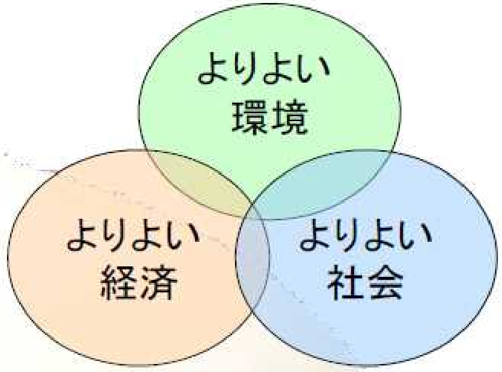
ご清聴ありがとうございました。

本資料に記載した内容は担当者個人の意見であり、組織の公式な見解でありません。



木と生きる幸福。

森づくりで日本を強くする

Nipponブランドイメージ向上
途上国との関係強化
資源確保・サプライチェーンの強化

■問い合わせ先
住友林業株式会社 山林・環境部
担当：佐藤 裕隆
Email：SATOU_hirotaka@star.sfc.co.jp

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第２章

REDDプロジェクトPDDの作成に向けて②

コンサベーションインターナショナル
浦口あや

2014/1/14
REDDプラスに係る森林技術者講習会　応用講習b

REDDプロジェクトPDDの作成に向けて②

コンサベーション・インターナショナル・ジャパン
政策・パートナーシップマネージャー
浦口あや

自然を守ることは、人間を守ること。

CONSERVATION INTERNATIONAL

今日の内容

1. CIのご紹介／自己紹介
2. ペルーの事例：現地から
3. VCSの方法論
4. ペルーの事例：PDから
5. Jurisdictional Nested REDD+
6. Validationの経験談

CONSERVATION INTERNATIONAL
Japan

1. CIの紹介

自然を守ることは、人間を守ること。

CONSERVATION INTERNATIONAL

団体概要

□<u>設立</u>：1987年（日本では1990年より活動開始）

□<u>組織</u>：国際環境NGO

□<u>事務所</u>：30カ国以上　米国バージニア州(本部）、各地域事務所　（アフリカ、アジア太平洋、中央アメリカ、南アメリカ）、欧州事務所、日本事務所

□<u>スタッフ</u>：約900名（ＣＩジャパンは6名＋インターン生）

□<u>活動対象地</u>：生物多様性ホットスポット、原生地域、シースケープ

□<u>活動パートナー</u>：政府、企業、国際機関、大学、NGO等

CONSERVATION INTERNATIONAL

CIのVisionとMission

Vision

自然は、人と地球上すべての生命に長期的な恩恵をもたらしてくれます。この自然を守り、尊重しつづける社会、健やかで繁栄した世界を私たちは目指します。

Mission

「科学」、「パートナーシップ」、そして「世界各地での実践」に基づき、次世代に豊かな自然を引き継いでいく社会を実現し、人類の幸福に貢献します。

CONSERVATION INTERNATIONAL

ミッションの変更、ロゴの変更

People need nature to thrive

人間を守るために、自然を守る。

CONSERVATION
INTERNATIONAL

自然を守るために、自然と調和した人間の暮らしを実現する。

CONSERVATION
INTERNATIONAL

CIが取組む分野

気候変動

淡水

衛生・健康

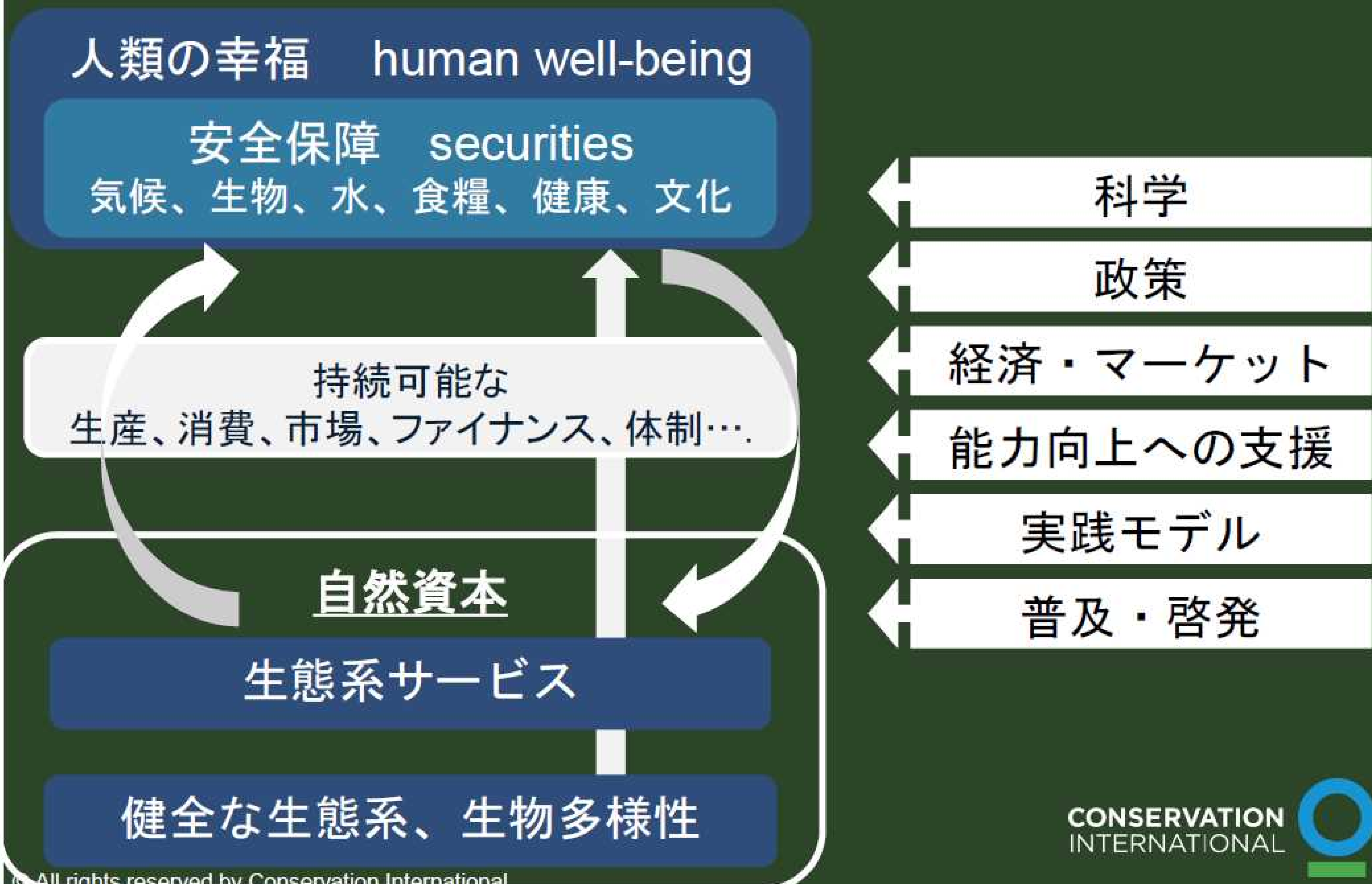
食糧

文化サービス

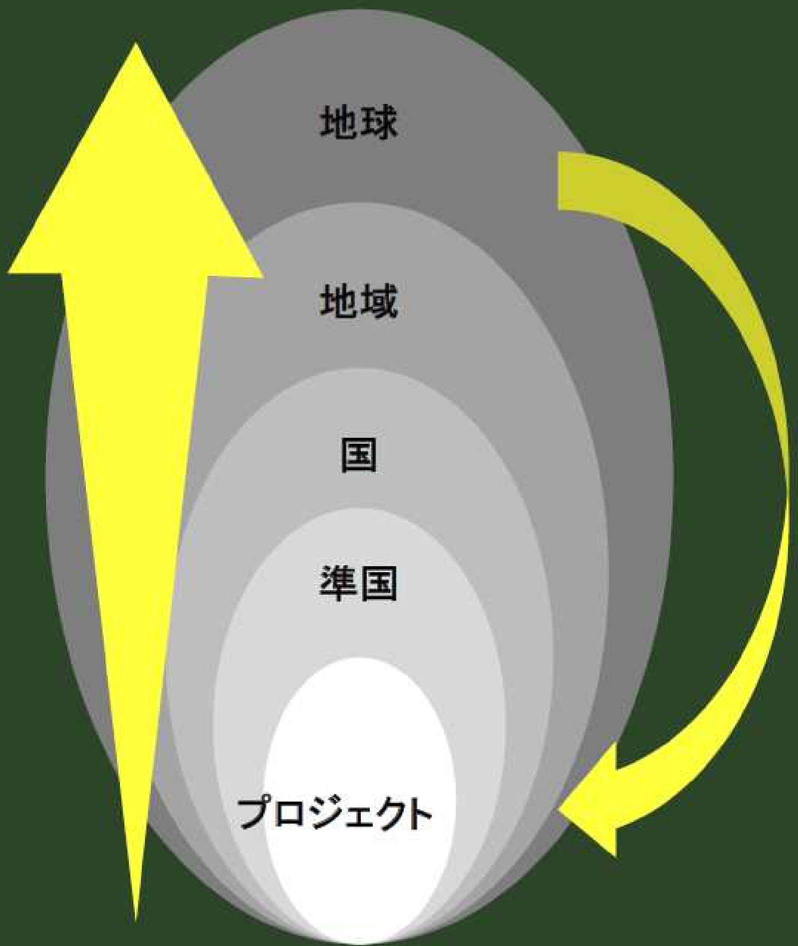
生物多様性

CONSERVATION INTERNATIONAL

中心の考え、アプローチ


人類の幸福 human well-being
安全保障 securities
気候、生物、水、食糧、健康、文化
持続可能な
生産、消費、市場、ファイナンス、体制･･･.
自然資本
生態系サービス
健全な生態系、生物多様性
科学
政策
経済・マーケット
能力向上への支援
実践モデル
普及・啓発
CONSERVATION INTERNATIONAL

拡大・普及（様々なスケールでの取組）



REDD+での例

- □国際的な枠組み・動き（UNFCCC, JCM etc）
- □中南米
- □ペルー
- □サンマルティン州
- □アルトマヨ保護区

CONSERVATION INTERNATIONAL

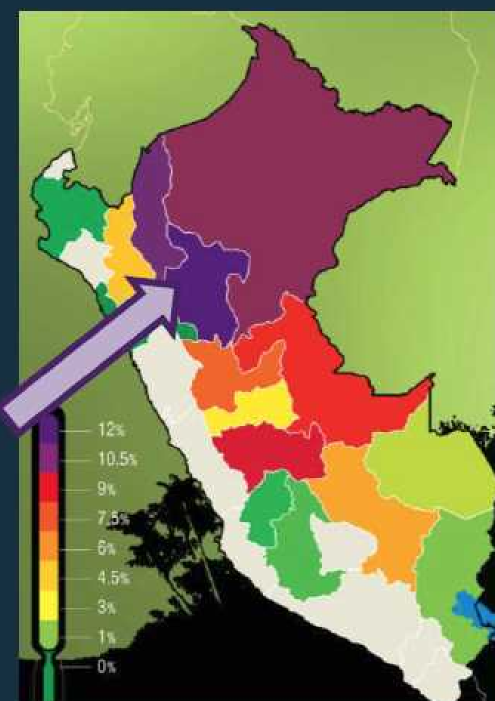
2. ペルーの事例：現地から

自然を守ることは、人間を守ること。

CONSERVATION INTERNATIONAL

ペルーの事例

- □面積：日本の3.4倍 （129百万ヘクタール）
- □森林面積：53%（67百万ヘクタール）
- □年森林減少率1990–2000：0.2%=15万ha
- □2020年までに森林減少を止めることを宣言



- □サンマルティン州：
  高い森林減少率

CIのペルーにおける取組み

国レベル

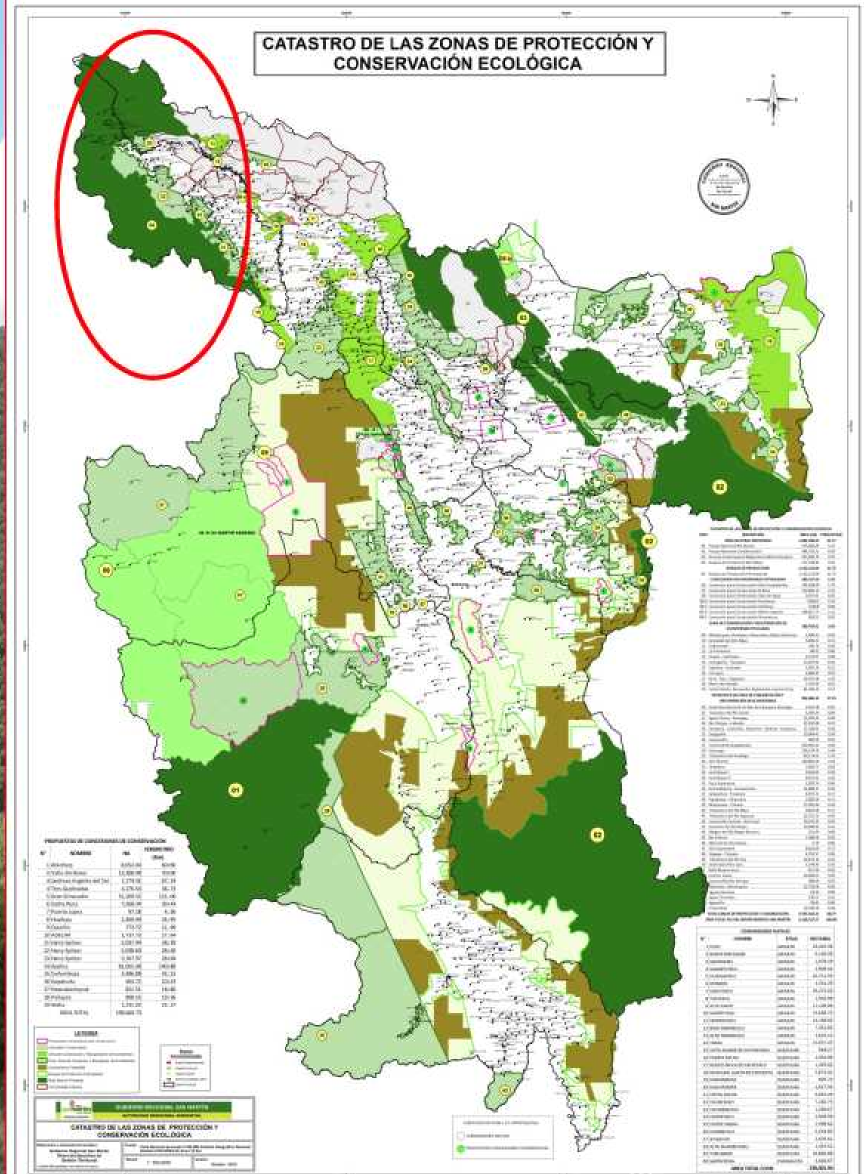
- □能力開発、REDDの準備プロセスの技術的サポート、生態系サービスと自然資本の評価

地域レベル

- □サンマルティン州とマドレデディオス州に注力（大西洋と太平洋を結ぶ大陸横断道路の影響緩和戦略と保全コリドー）
- □REDD準備プロセスと森林減少モデル
- □REDDラウンドテーブル

プロジェクトレベル

- □ アルト･マヨ自然保護区イニシアティブ (Disney and CSP)
- □ アルト･フアヤバンバ（米州開発銀行）
- □ マドレデディオス －初期の資金 (FONDAM and CEPF)


CATASTRO DE LAS ZONAS DE PROTECCIÓN Y CONSERVACIÓN ECOLÓGICA

アルト・マヨ保護区

- □1982年より保護区
- □熱帯山地雲霧林
- □重要な水源地
- □保護区約18万ha（国有地）
- □バッファーゾーン約42万ha（大部分は権利未確定の私有地）
- □ハイウェー開通
- □ペルーで最も森林減少率の高い保護区

アルトマヨ保護区で起きている事

- アンデス地域からの移住者が不法に定住
- 極めて貧しい。多くの場合、水道水、電気、学校、病院へのアクセスなし
- 農地を開拓するため、野焼きを実施。
- 技術を持たず、農地／農園の管理は粗野
  - アンデス地域での農法をそのまま適用（当地では不適切）
  - 肥料の利用が限定的
- 荒廃してしまった土地は放牧地への転換し、新たに森林を伐採、農地を開拓
- 貧困から抜け出すことは困難

CONSERVATION

ペルーで最も森林減少率の高い保護区

持続的コーヒー生産により..

	粗野な生産	日陰 /肥料 (REDD+)
Year 1 Yield	30qq	10qq
Year 4 Yield	37qq (peak)	25qq
Year 7 Yield	17qq	35qq
Year 10	0qq	35qq
After Year 10	0qq (soil depleted)	35qq (indefinite)
CO_2 Released (t/10 years)	1784 (4ha)	0

現地での主な取り組み

- 持続的な経済活動を推進し、地元住民の生活を改善
  - 保全契約を通じた持続的なコーヒー生産の推進
    - 現在までに600以上の農家が契約
  - ツーリズムの推進等
- 国立公園管理の強化
- サンマルティン州へのスケールアップ
- 国レベルへのインプット

プロジェクトの現地の体制

SERNANP/AMPF
国立公園局

Conservation International

AIDER
バイオマス調査

SPDA
法律関係の助言

ECOAN
保全契約の作成と締結、生物多様性、エコツアー等

保全契約

農民1
農民2
農民3
農民4
農民….

保全契約とは？

健全な発展を進めながら、
自然資源を自らの手で管理する社会づくり

保全契約

生物多様性への脅威 ↔ 保全活動

便益 ↔ 機会コスト

保全活動 →
- パトロール
- 森林再生
- 森林伐採の禁止
- 密猟の禁止

便益 →
- 教育への支援
- 保健サービス
- 農業支援
- 保全活動に対する賃金

コンサベーション・スチュワードシップ・プログラム実施に向けたステップ

フェーズ1：実現可能性の分析

係者の能力
ンフリクト、
ション

4件
グアテマラ、インド、PNG、フィリピン

フェーズ2：契約に向けた準備
保全契約のコンセプトを資源利用者に提示
契

6件
中国、コロンビア、マダガスカル、パラオ、
南アフリカ、ベネズエラ

フェーズ3：
保
協議の下で作成

フェーズ4：実施
契約内容の達成、改善

ステップ5：持続的取組み
長期的な契約へ

7件
カンボジア、エクアドル、フィジー、
ガイアナ、ケニヤ、ペルー、ソロモン諸島

アルト・マヨ保護区での保全契約の内容

保全活動

- 天然林の伐採の禁止
- 急傾斜地(>60%)での植生破壊の禁止
- 新たな移住者のコントロール
- 木材搬出の禁止

便益

- コーヒー関係
  - 栽培技術、有機肥料とその作成、収穫後処理の機材と技術等
- その他(女性の巻き込み)
  - 高効率かまど、天竺ネズミ飼育、家庭菜園(種子、肥料)集会所の建設
- パトロールに対する賃金
- 生徒への奨学金

- 移住民からの信頼の獲得には時間が必要。。。
- 2011年133軒、2012年137軒、2013年407軒、現在677軒

保全契約の締結

便益の農家への配布

□コーヒーの生産サイクルに合わせた配布スケジュールが組まれている。
□農家は、保全契約で合意した内容を守っていることが求められる。

保全契約の実施
技術的な支援

コーヒー苗の生産

コーヒー残渣やその他材料を使った有機肥料の生産

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追加的な便益

改良型かまど

テンジクネズミの飼育

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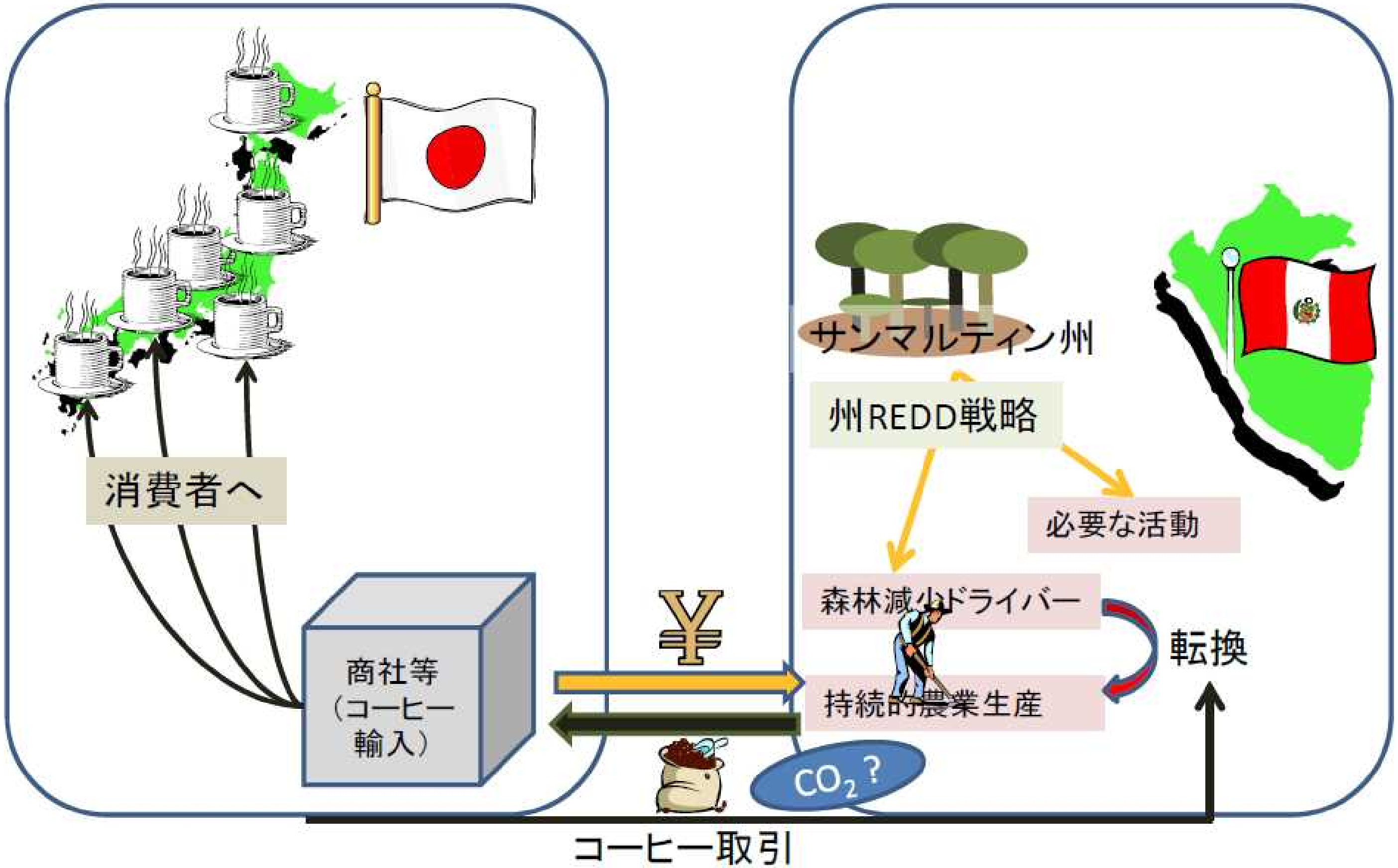
二国間クレジット制度　ＦＳ調査事業（25FY）

「ペルー共和国サンマルティン州における持続的コーヒー生産による森林の減少・劣化の防止等に関する調査」



コーヒー生産技術向上

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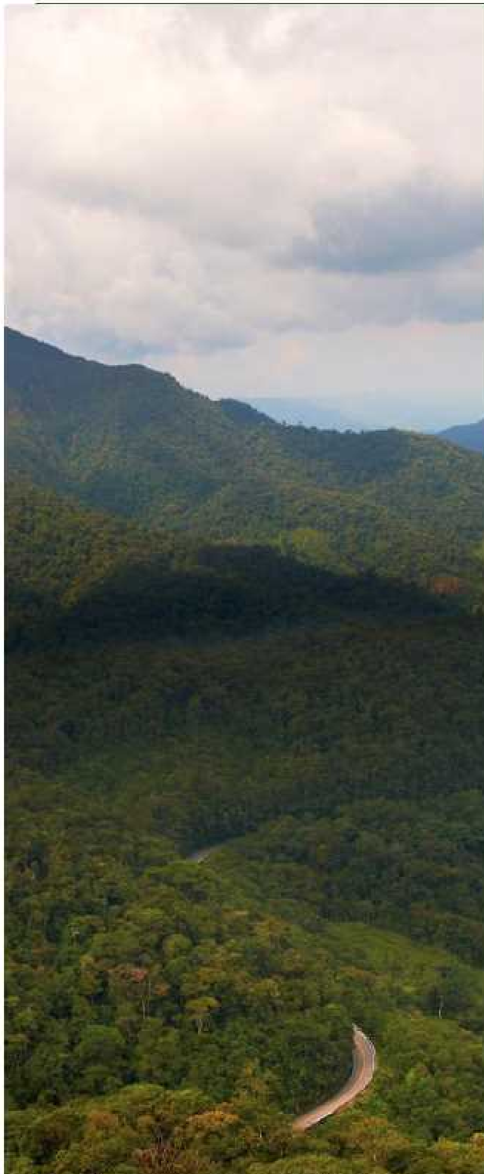
国立公園局の活動の強化

□慢性的な財政不足
- □ マスタープランの不在
- □ レンジャー数が少なく、1ヶ月のうち、20日詰め所に滞在、10日休みという生活。給与は20日分のみの支払。
- □ 詰め所の環境も劣悪

□CIを通じた資金支援
- □ 2008年、マスタープランの採択
- □ 2010年、スタッフ増強



VCS VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

CCB Standards
The Climate, Community & Biodiversity Alliance

□CIのREDDプロジェクトとして初めて検証

□保護区内のREDDプロジェクトとして初めて検証

□REDDプロジェクトとして世界で5番目に検証

現時点で最大規模の検証済みREDDプロジェクト

3. VCS方法論

自然を守ることは、人間を守ること。

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REDDプロジェクトのタイプ

☐ REDDプロジェクトのタイプ

Deforestation vs Degradation

- 森林減少：森林→非森林
- 森林劣化：森林→森林

Planned vs Unplanned

- 計画的：合法的な活動
- 非計画的：非合法な活動
  - 別々にベースライン設定が必要

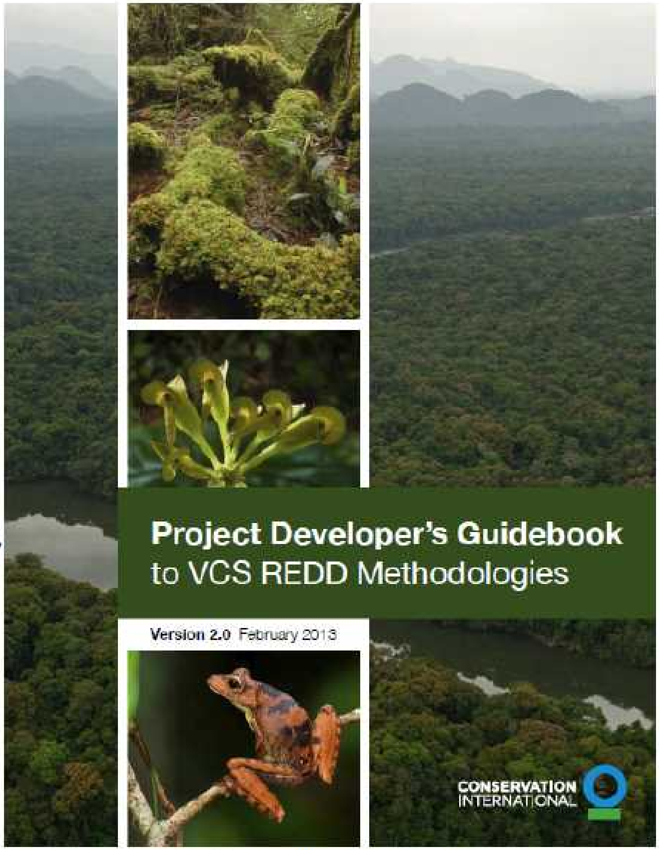
Mosaic vs frontier

- モザイク：域全体が均一のアクセス性を有し、パッチ状に森林減少。
- フロンティア：破壊のなかった森林の周辺部で、道路等の周辺で伐採。

☐ VCSの要件

適格性

- プロジェクト開始時で、過去少なくとも10年間100%森林



Source: Project Developer`s Guidebook to VCS REDD Methodologies

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VCS方法論の概要

プロジェクト開始日
- GHG排出抑制の活動が開始した日
- 2008年3月8日以降の開始の場合、5年以内にバリデーション完了

クレジット期間
- 20年～100年（一部例外あり）
- ベースラインは10年ごとに再設定

プロジェクト期間
- プロジェクト活動が継続する期間
- 最低30年

リスク

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

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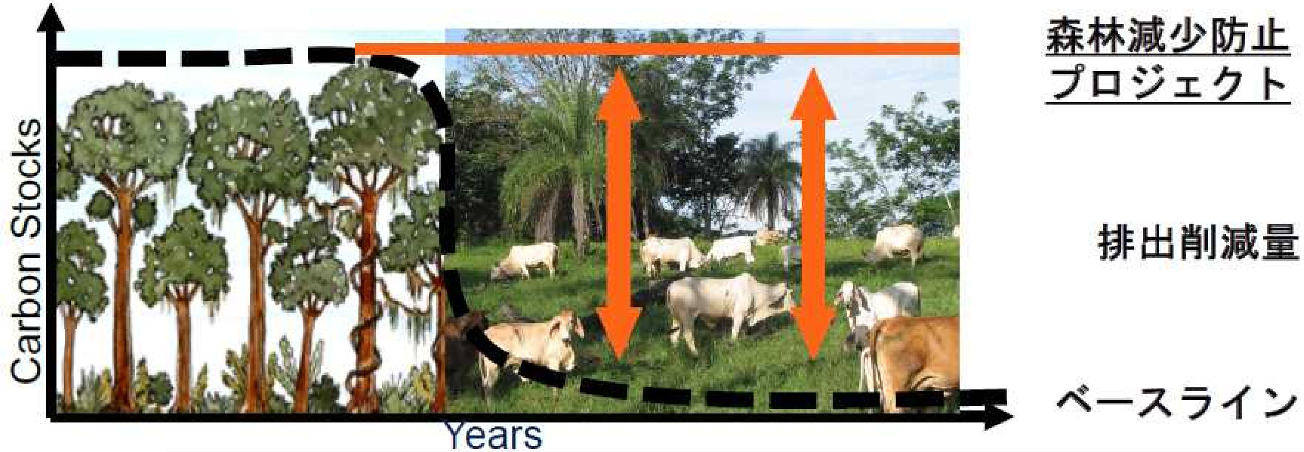
VCSの下で発行されるクレジット(VCUs)



VCUs = ベースライン排出量(事前推定)　－プロジェクト排出量(事後推定)
－リーケージ(事後推定)－不確実性(事後推定)
－非永続性リスクバッファー(事後評価)

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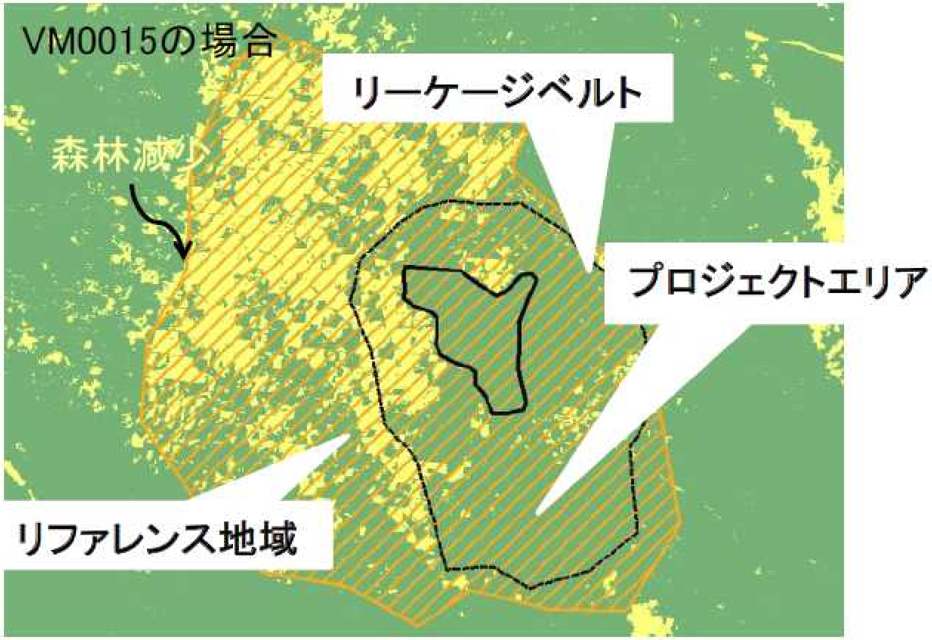
Japan

プロジェクトエリア、リーケージベルト、リファレンスエリア



Source: Project Developer`s Guidebook to VCS REDD Methodologies

- プロジェクトエリア
  - プロジェクト活動によって森林が保護される地域
- リファレンスエリア
  - プロジェクトエリアと同様の条件下にあり、過去・現在の森林減少の対象となる地域
- リーケージベルト
  - リーケージが起こりえる地域

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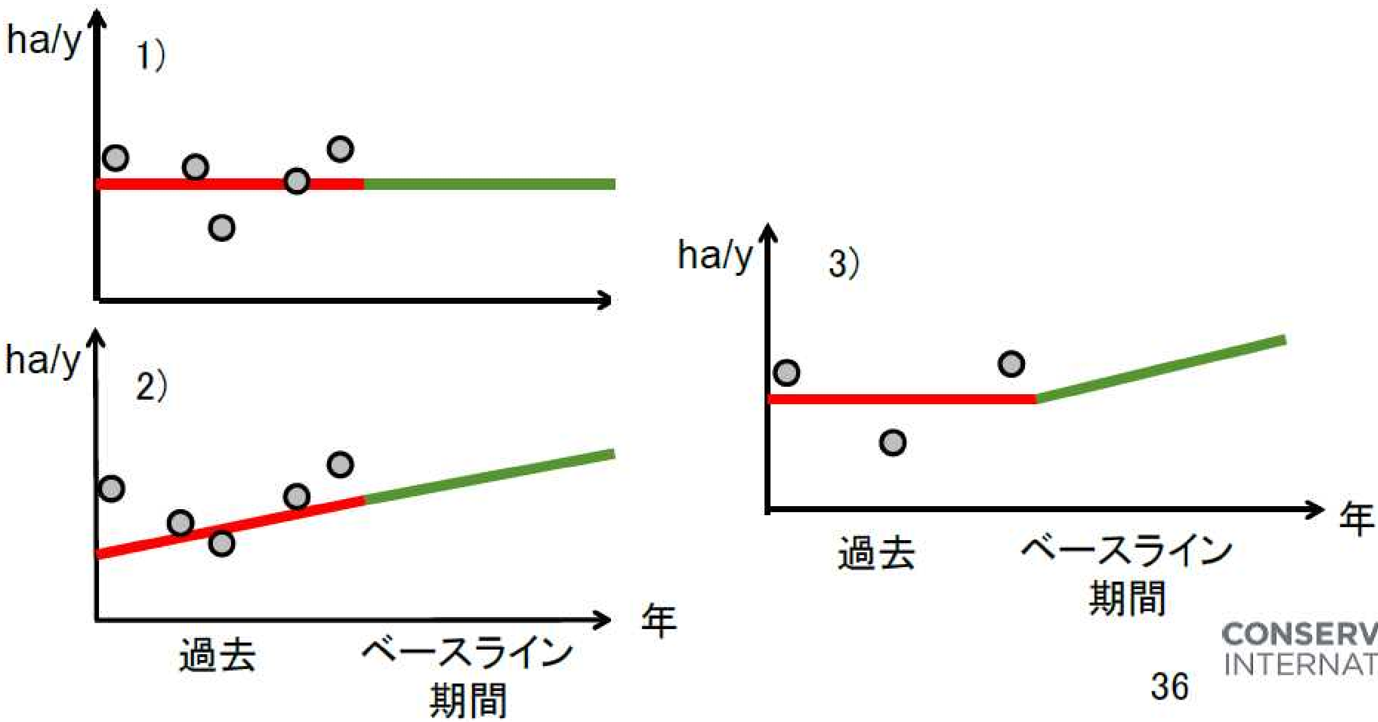
ベースラインでの森林減少面積の予測

- 衛星画像等を用いた森林減少率の計測
- 過去の森林減少率（ヘクタール/年)に基づき予測
- 3つのアプローチ
  1）過去の平均（多くの場合、最も保守的）
  2）過去のトレンド
  3）モデル（例、火災発生率増加、ゴム需要増加、人口増加）



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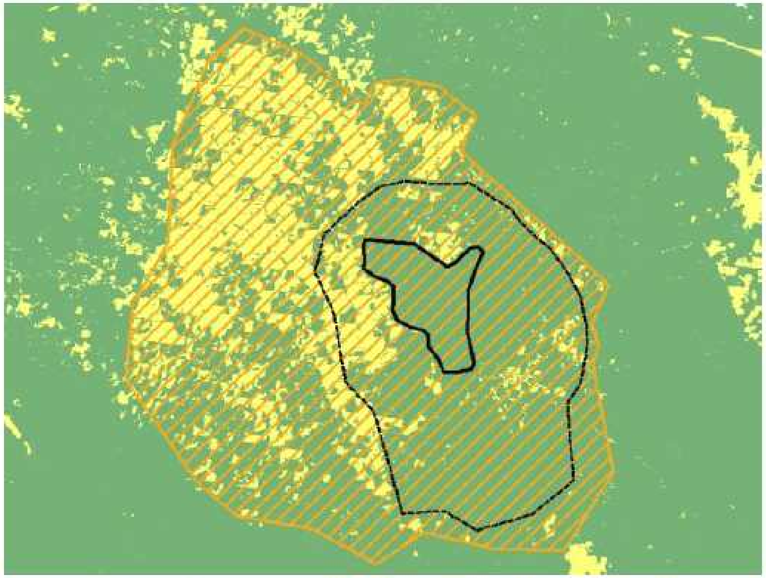
森林減少の発生場所、空間モデル

- VCSでは、フロンティアタイプ及びモザイクタイプの一部で、森林減少の発生場所の予測が求められる。
  - 森林保全の活動を行う地域(＝プロジェクトエリア)の多くは、周囲に比較して森林減少が現状で起こり難い(アクセスが悪い等)
  - リファレンス地域全体で同じように森林減少が進むという想定は、非保守的



Source: Project Developer`s Guidebook to VCS REDD Methodologies

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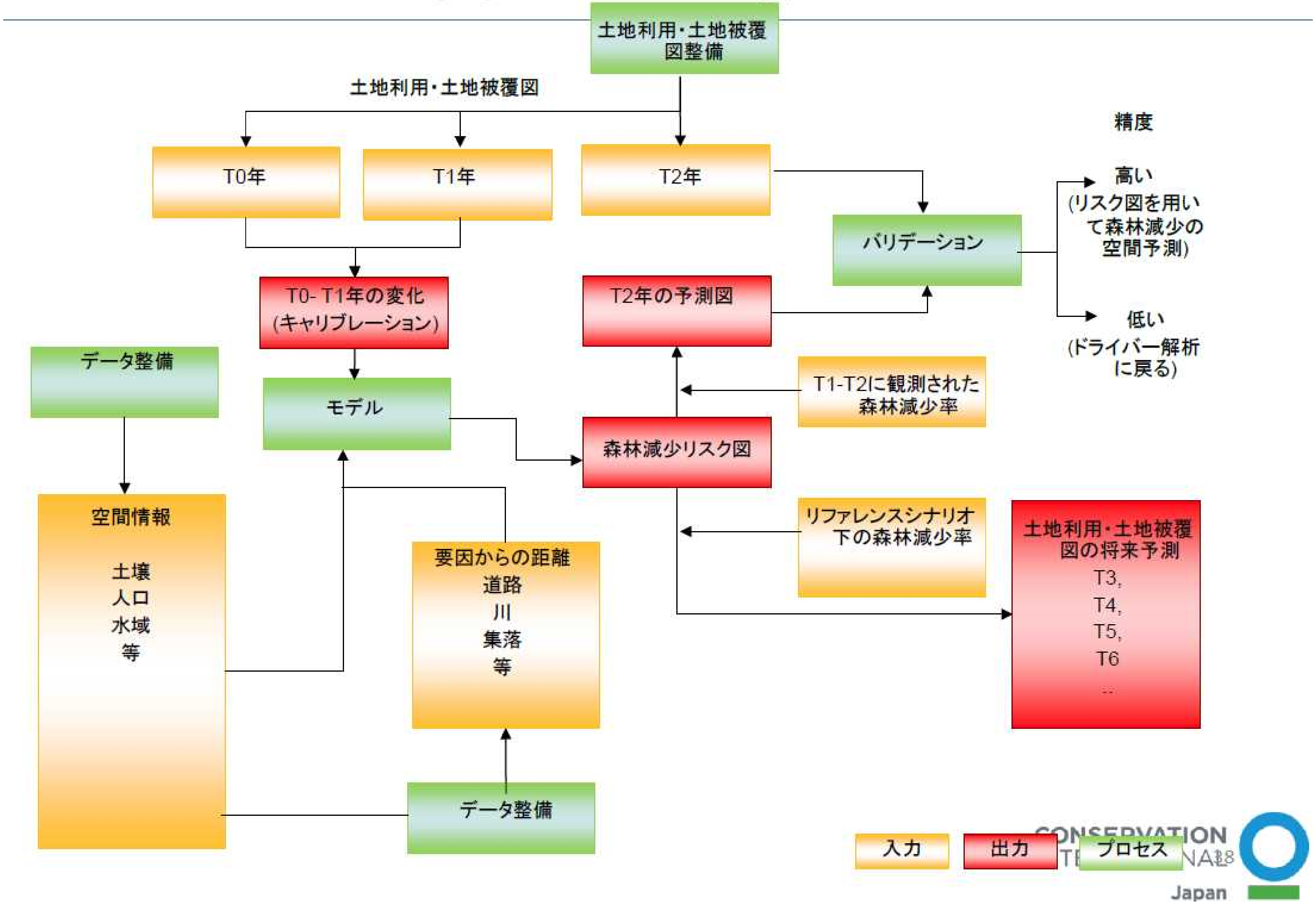
空間モデルの概念図


土地利用･土地被覆図整備
土地利用･土地被覆図
T0年
T1年
T2年
精度
高い
(リスク図を用いて森林減少の空間予測)
低い
(ドライバー解析に戻る)
バリデーション
T0- T1年の変化
(キャリブレーション)
T2年の予測図
データ整備
モデル
T1-T2に観測された森林減少率
森林減少リスク図
空間情報
土壌
人口
水域
等
要因からの距離
道路
川
集落
等
リファレンスシナリオ下の森林減少率
土地利用･土地被覆図の将来予測
T3,
T4,
T5,
T6
データ整備
入力
出力
プロセス
CONSERVATION INTERNATIONAL
Japan

ベースライン排出量の推定

1. 過去のデータに基づき、森林減少率の推定
2. 森林減少の場所を推定→プロジェクトエリア内の森林減少面積推定
3. 森林タイプ毎の蓄積量の推定
4. 二酸化炭素排出量の推定

プロジェクト排出量の推定（事後）

1. 衛星画像を用いて、プロジェクトエリア内の森林減少面積を森林タイプ毎に計測
2. 二酸化炭素排出量を計算

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VCSのREDD方法論

- 現在、REDDでは、4つの方法論が有効
- CDMあるいはClimate Action Reserveの方法論も適用可能

	VM0006	VM0007	VM0009	VM0015
計画的森林減少・森林劣化		○	○	
非計画的森林減少	○	○	○	○
非計画的森林劣化	○	○		
モザイク	○	○	○	○
フロンティア		○	○	○

Source: Project Developer`s Guidebook to VCS REDD Methodologies

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各方法論で認められるベースライン活動

	VM0006	VM0007	VM0009	VM0015
定置型農業	○	○	○	○
焼畑農業	○	○	○	○
工業型農業	○	○	○	○
多年性作物		○	○	○
販売目的の違法伐採		○	○	○
薪炭	○	○	○	○
森林火災	○	○	○	○
住居	○	○	○	○

Source: Project Developer`s Guidebook to VCS REDD Methodologies

方法論選択の例

□ペルー　アルトマヨ保護区の場合

□A国B地域

- □伐採コンセッションを取得したものの、実際には伐採を行っていないコンセッション保有者がいます。林内には高価値の樹種が至るところに生育し、違法な抜き切りが横行しています。
- □コンセッション保有者は、REDDの仕組みで得る資金を使って、違法伐採者の取り締まりを強化しようとしています。

Project Name	Country	REDD Project Type	Methodology
Alto Mayo Conservation Initiative	Peru	AUDD	VM0015
Boden Creek Ecological Preserve Forest Carbon Project	Belize	APDD	VM0007
Bull Run Overseas Forest Carbon Project	Belize	APDD	VM0007
CIKEL Brazilian Amazon REDD APD Project	Brazil	APDD	VM0007
Floresta Santa Maria	Brazil	AUDD	VM0007
Kariba REDD+ Project	Zimbabwe	AUDD	VM0009
Madre de Dios REDD Project	Peru	AUDD	VM0007
REDD in Brazilian Nut Concessions in Madre de Dios	Peru	AUDD	VM0007
Reduced Emissions from Deforestation and Degradation in Community Forests—Oddar Meanchey	Cambodia	AUDD	VM0006
Rimba Raya Biodiversity Reserve Project	Indonesia	APD	VM0004
Rio Bravo Climate Action Project	Belize	APDD	VM0007
The Chocó-Darién Conservation Corridor REDD Project	Colombia	AUDD	VM0009
The Kasigau Corridor REDD Project, Phase 1	Kenya	AUDD	VM0009
The Kasigau Corridor REDD Project, Phase 2	Kenya	AUDD	VM0009
The Mai Ndombe REDD Project	Congo	APD	VM0009

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Source: Project Developer`s Guidebook to VCS REDD Methodologies

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各方法論におけるベースラインの設定手法

	VM0006	VM0007	VM0009	VM0015
森林減少率	単純回帰(平均、トレンド)	単純回帰(平均、トレンド)、人口モデル	ロジスティック回帰	単純回帰(平均、トレンド)、モデル
空間モデル	必須	非計画・フロンティアでは必須 モザイクでも一部必須＊ 人口モデルを使った場合必須	プロジェクトアカウンティングエリアを設定 ＊＊	必須

Source: Project Developer`s Guidebook to VCS REDD Methodologies

＊モデルが不要となるのは、プロジェクトバウンダリの25%以上が新しい森林減少から50m以内にある場合(＝そこら中で森林減少がある場合)。
＊モデルを用いない場合には、森林炭素蓄積量の小さい場所から森林減少が起こる想定で、ベースラインを設定する。
＊＊ベースラインにおいて森林減少が予想される場所をプロジェクトエリア内で特定するひつ必要がある。

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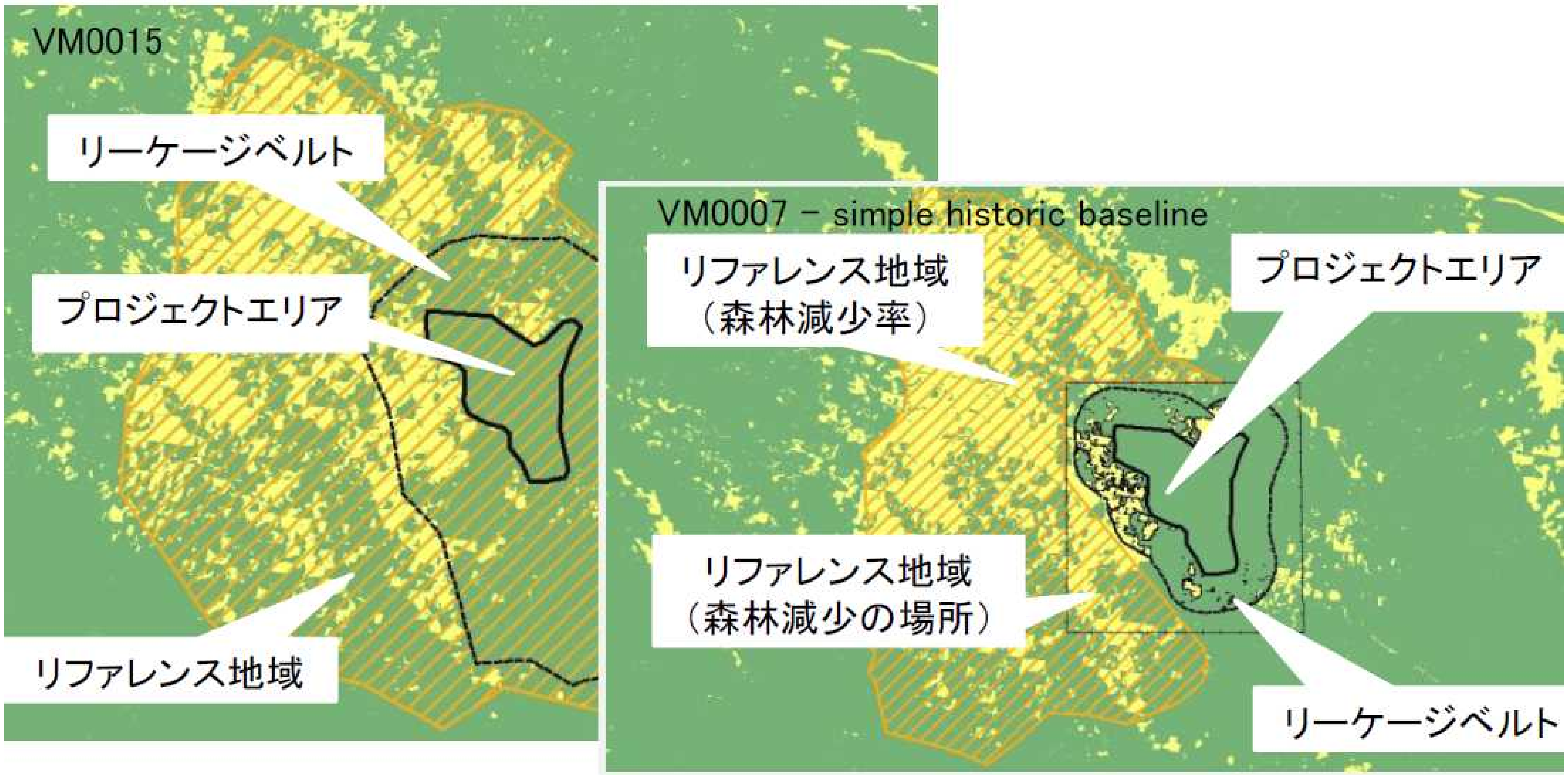
プロジェクトエリア、リーケージベルト、リファレンス地域



その他、要求精度、モニタリング、リーケージ等の要件を検討し、方法論を選択する

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方法論への変更/逸脱

- Deviations
  - 方法論に定められた測定手法に関して変更を加えること。排出削減量の勘定の保守性に影響を与えない軽微な変更を想定している。PDに記載し、有効化審査の過程で審査を受ける。
- Revisions
  - Deviationとは認められない変更を加えること。新規方法論の申請と同じ手続きが必要とされる。

Deviation、Revision或いは新規方法論なのかの判断が難しい場合には、VCS等に問い合わせることが推奨される。

4. ペルーの事例:VCSのPDから

自然を守ることは、人間を守ること。

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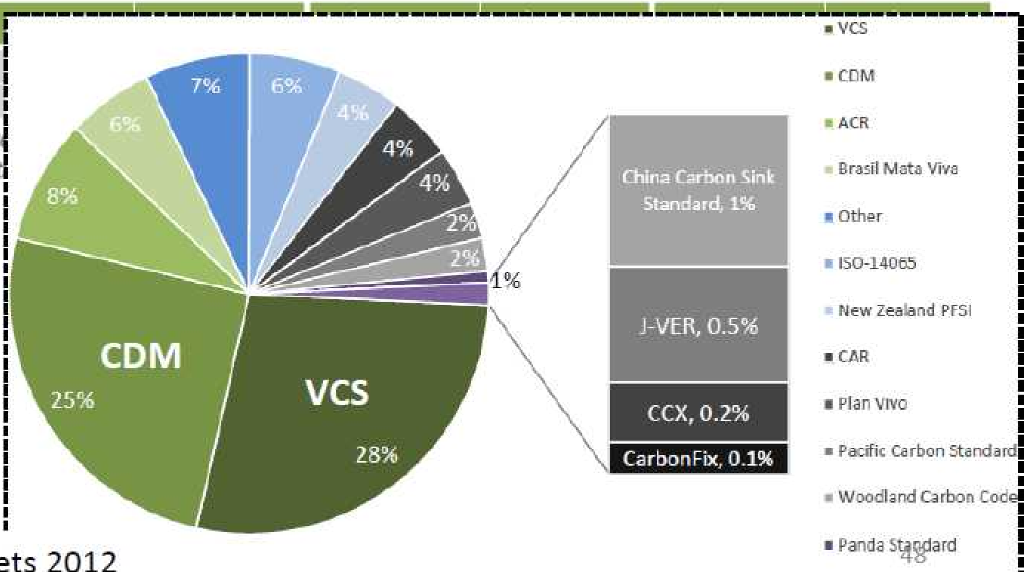
REDD+クレジットの取引とスタンダード

Table 1: Volume, Value, and Prices in the Forest Carbon Markets (Primary & Secondary Markets)[1]

		VOLUME		VALUE		AVERAGE PRICE	
MARKET	HISTORICAL	2010	2011	2010	2011	2010	2011
Voluntary OTC	76.4 M	27.8 M	16.7 M	$157.8 M	$172 M	$5.6	$10.3
California /WC pre-compliance	2.0 M	0.5 M	1.6 M	-	$13 M	-	$8.1
CCX	2.9 M	0.1 M	0 M	$0.2 M	-	$1.2	-
Voluntary Total	**81.4 M**	**28.4 M**	**18.3 M**	**$158 M**	**185 M**	**$5.6**	**$9.2**
CDM/JI	15.3 M	1.4 M	5.9 M	$6.3 M	$23 M	$4.5	$3.9
NSW GGAS	6.3 M	2.3 M	-	$13 M	-	-	-
NZ ETS	0.9 M	0.2 M	-	$0.3 M	-	$13	-
Other / Unknown	1.9 M	0.4 M	1.5 M	-	$29M	-	$19.7
Compliance Total	**24.5 M**	**4.4 M**	**7.3 M**	**$25.0 M**	**$52 M**	**$4.6**	**$7.2**
GRAND TOTAL	**105.9 M**						
Primary Market	*95 M*						
Secondary Market	*11.3 M*						

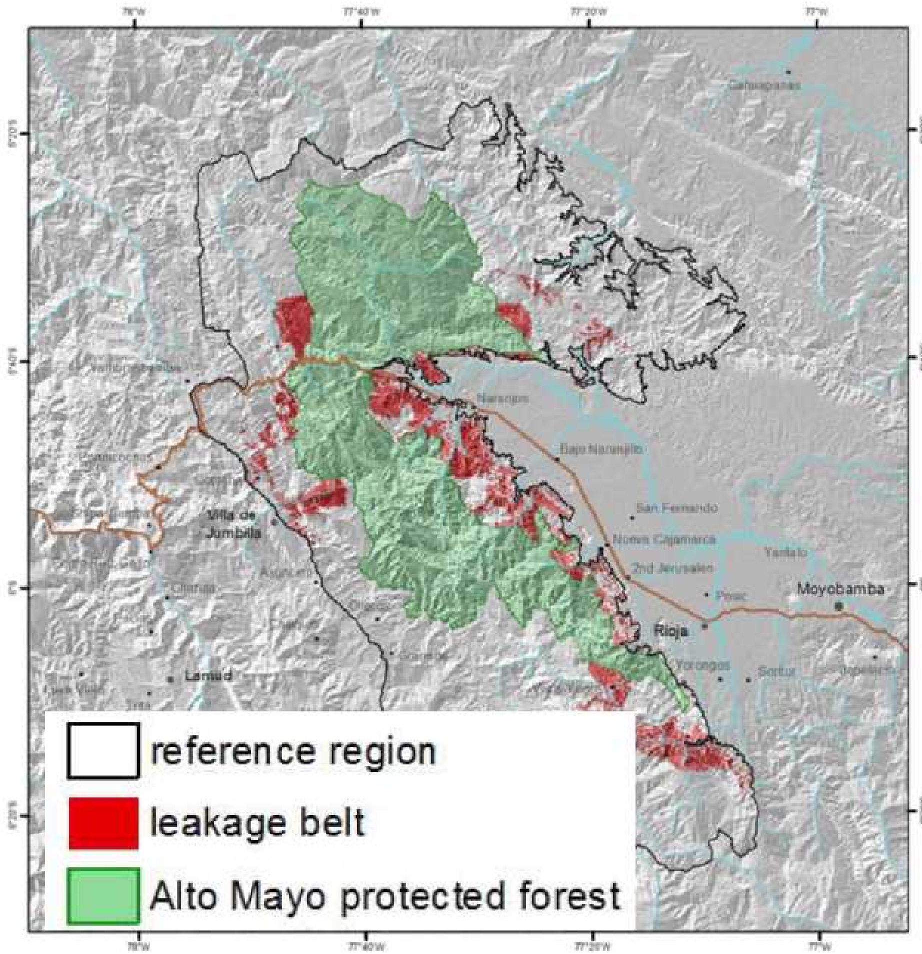
Source: Ecosystem Marketplace. Notes: Based on 965 obs
*than three data points. *2008-2010 values for t*



Source: Ecosystem Marketlace. Note: Based on 948 observations.

出典：State of the Forest Carbon Markets 2012

プロジェクトバウンダリー



- □炭素プール
  - □地上部
  - □地下部
- □リファレンス期間
  - □1996
  - □2001
  - □2006
- □画像解析
  - □Landsat 5/7（30m）
  - □CBERS (2.5m)
  - □RapidEye (5m)
  - □航空写真

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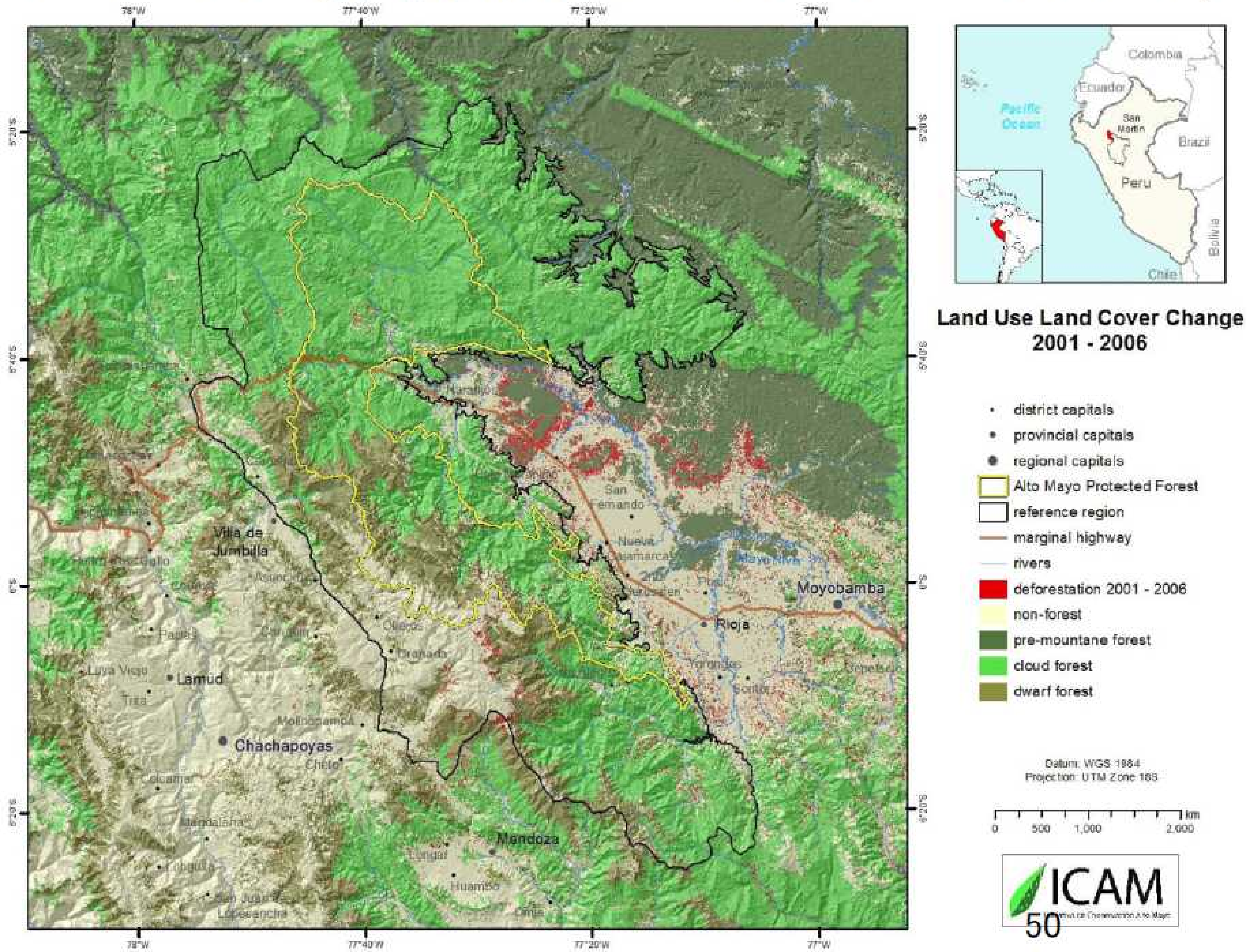
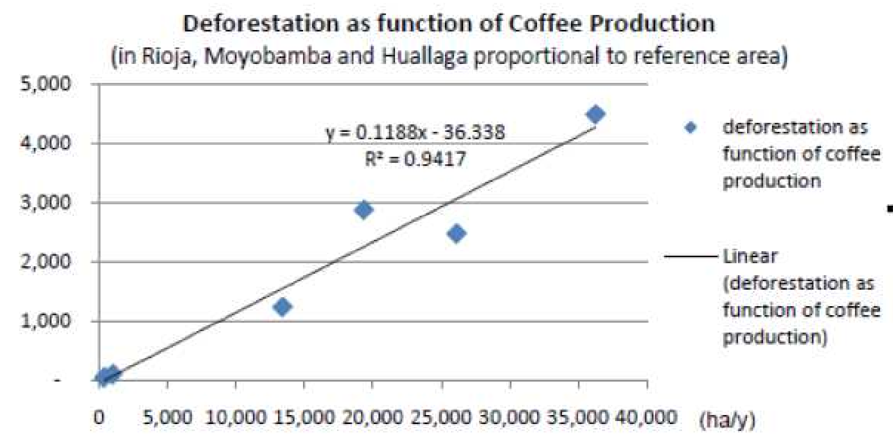
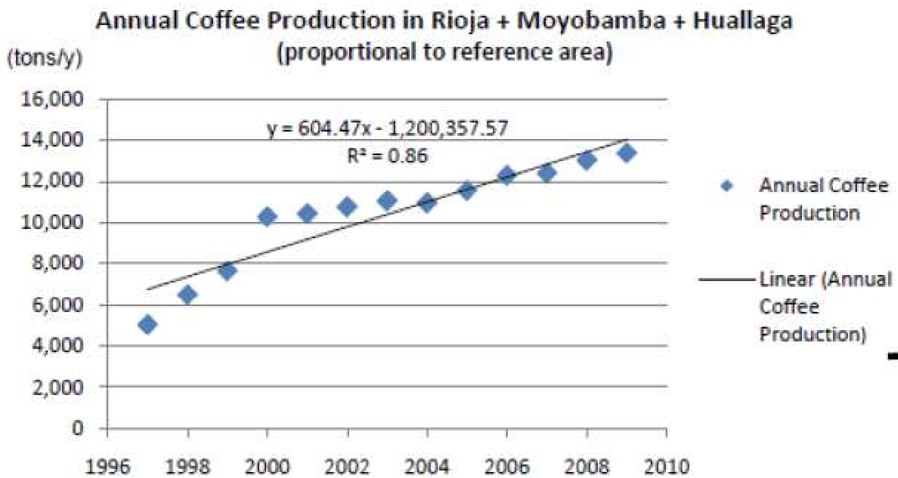
過去の森林減少（1996-2001-2006を解析）



森林減少面積予測(モデルアプローチ)





Project year *t*	Stratum *i* in the reference region *ABSLRR*$_{i,t}$ ha
2009	3,543
2010	3,699
2011	3,855
2012	4,011
2013	4,167
2014	4,323
2015	4,479
2016	4,635
2017	4,791
2018	4,948

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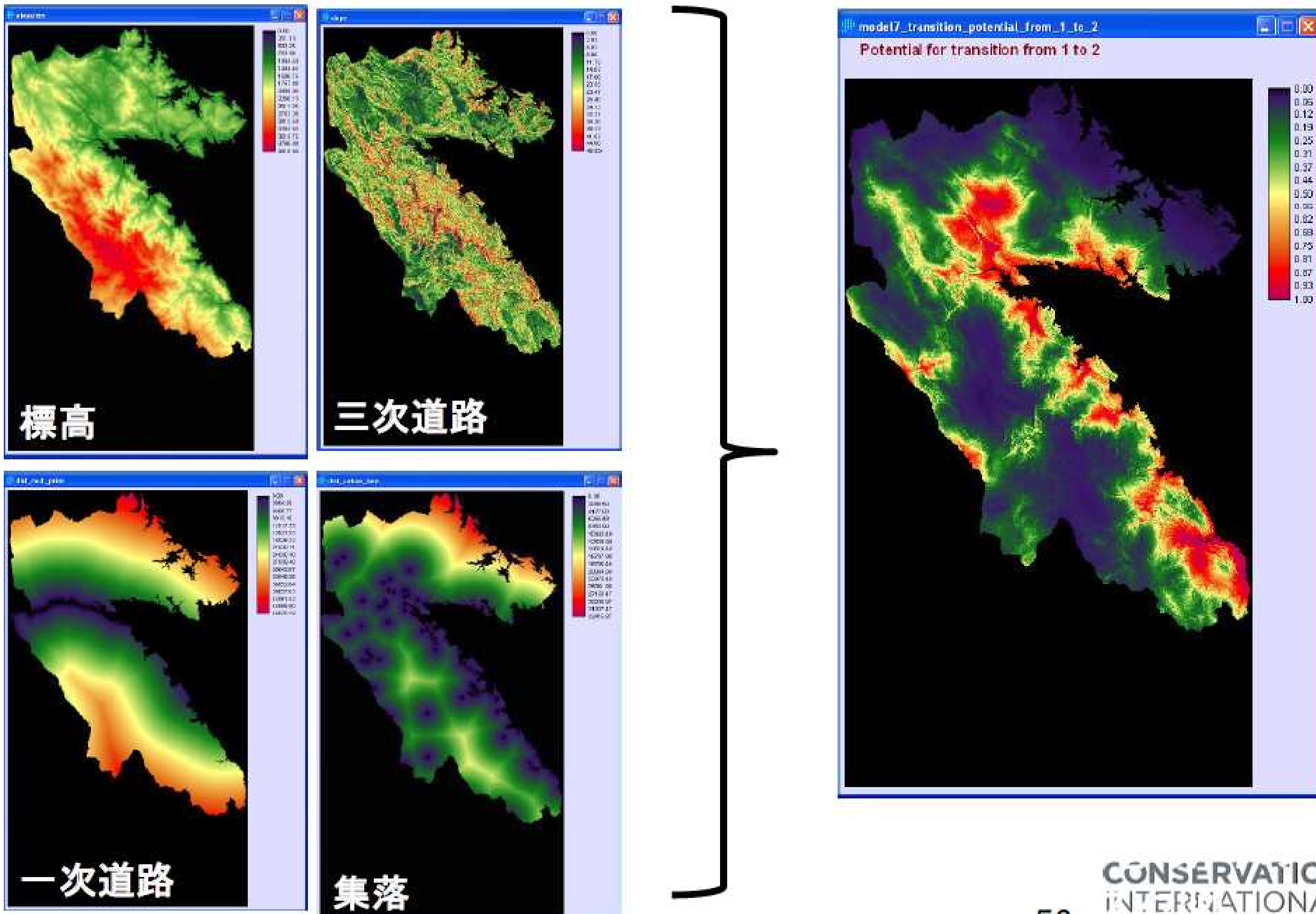
空間モデルを使った森林減少ポテンシャルの解析



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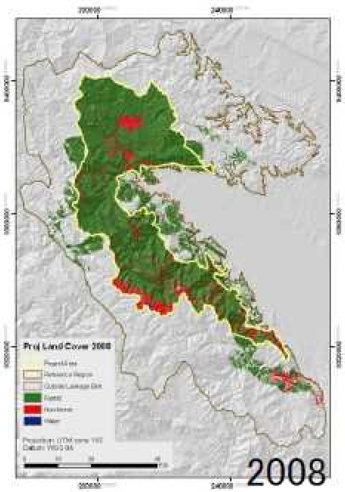
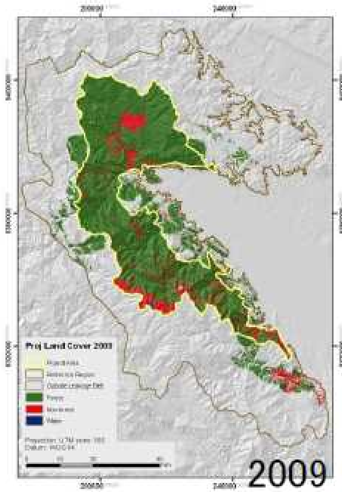
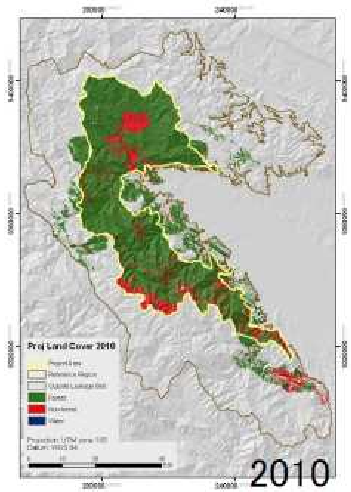
プロジェクトエリア内での森林減少予測



2008



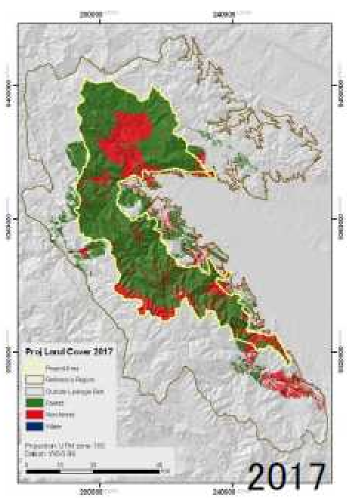
2009



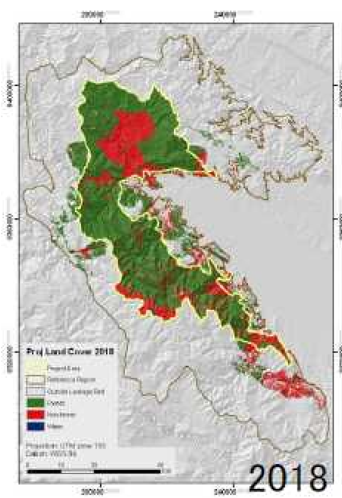
2010

……

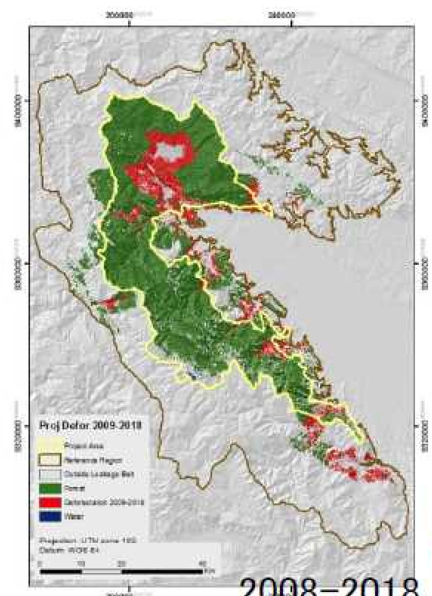
….



2017



2018



2008−2018

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Japan

森林タイプ毎の森林減少面積予測

Area deforested per forest class *icl* within the project area				Total baseline deforestation in the project area	
IDicl>	1	2	3		
Name >	pre-montane forest	cloud forest	dwarf forest	*ABSLPA$_t$* annual	*ABSLPA* cumulative
Project year *t*	ha	ha	ha	ha	ha
2009	40	1,806	0	1,846	1,846
2010	14	1,965	0	1,979	3,825
2011	8	2,108	0	2,116	5,941
2012	3	2,013	0	2,016	7,957
2013	2	1,986	0	1,987	9,944
2014	1	2,140	0	2,141	12,085
2015	2	2,076	0	2,078	14,163
2016	2	2,053	0	2,055	16,218
2017	1	2,120	0	2,121	18,339
2018	0	2,145	0	2,145	20,484

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森林炭素蓄積量

Estratos (Tipos de bosque)	Sub Estratos (Pisos altitudinales)	Superficie	Parcelas
Bosque de Neblina	1000 - 2500	170,056.1	97
Bosque Pre-Montano	500 - 1000	9,328.7	10
Bosque Enano	2500 - 3300	35,675.1	12
Purma	500 - 1000	6,729.3	9
Cultivos de café	500 - 1000	19,171.5	26
Pastos	500 - 1000	41,486.7	12
Pajonal	+ 2000	51,381.3	9
Nubes	-	52,505.5	-
Sombras	-	34,112.0	-
Lagos	-	306.6	-
Ríos	-	4,219.5	-
Infraestructura	-	433.4	-
Total		**425,405.6**	**175**

LU/LC class		Average carbon stock per hectare ± 90% CI					
		Cab_{cl}		Cbb_{cl}		$Ctot_{cl}$	
		average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI
ID_{cl}	Name	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
1	pre-montane forest	427.34	67.92	113.15	17.39	540.5	85.2
2	cloud forest	457.12	34.34	117.25	8.7	574.4	42.9
3	dwarf forest	184.95	61.83	46.34	16.23	231.3	78.0
4	non-forest	72.75	20.1	17.53	3.95	87.7	19.5

ベースラインの推定結果

Project year t	Baseline carbon stock changes: annual $\Delta CBSLPA_t$ (tCO₂-e)	Baseline carbon stock changes: cumulative $\Delta CBSLPA$ (tCO₂-e)	*Ex ante* project carbon stock changes: annual $\Delta CPSPA_t$ (tCO₂-e)	*Ex ante* project carbon stock changes: cumulative $\Delta CPSPA$ (tCO₂-e)	*Ex ante* leakage carbon stock changes: annual ΔCLK_t (tCO₂-e)	*Ex ante* leakage carbon stock changes: cumulative ΔCLK (tCO₂-e)	*Ex ante* net anthropogenic GHG emission reductions: annual $\Delta REDD_t$ (tCO₂-e)	*Ex ante* net anthropogenic GHG emission reductions: cumulative $\Delta REDD$ (tCO₂-e)	*Ex ante* VCUs tradable: annual VCU_t (tCO₂-e)	*Ex ante* VCUs tradable: cumulative VCU (tCO₂-e)
2009	861,442	861,442	(430,721)	(430,721)	(43,072)	(43,072)	387,649	387,649	344,577	344,577
2010	924,263	1,785,706	(462,132)	(892,853)	(46,213)	(89,285)	415,919	803,568	369,705	714,282
2011	988,339	2,774,045	(494,169)	(1,387,022)	(49,417)	(138,702)	444,753	1,248,320	395,336	1,109,618
2012	941,398	3,715,443	(423,629)	(1,810,651)	(37,656)	(176,358)	480,113	1,728,433	428,336	1,537,954
2013	928,040	4,643,483	(417,618)	(2,228,270)	(37,122)	(213,480)	473,301	2,201,734	422,258	1,960,212
2014	999,960	5,643,443	(399,984)	(2,628,253)	(29,999)	(243,479)	569,977	2,771,711	509,979	2,470,192
2015	970,589	6,614,032	(339,706)	(2,967,960)	(29,118)	(272,596)	601,765	3,373,476	538,677	3,008,869
2016	959,721	7,573,752	(287,916)	(3,255,876)	(19,194)	(291,791)	652,610	4,026,086	585,430	3,594,298
2017	990,999	8,564,751	(198,200)	(3,454,075)	(9,910)	(301,701)	782,889	4,808,975	703,609	4,297,907
2018	1,002,311	9,567,062	(100,231)	(3,554,307)	0	(301,701)	902,080	5,711,054	811,872	5,109,779

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ValidationとVerification

Validation用書類

- PD、77ページ
- 方法論関係の別添、99ページ
- 補助的資料
  - ドライバー分析、35ページ
  - 機会コスト分析、128ページ
  - 歴史的土地被覆変化分析、8ページ
  - 炭素蓄積、99ページ

Verification用書類

- モニタリングレポート (2008-2012) 、32ページ

Project year *t*	Baseline carbon stock changes		*Ex post* project carbon stock changes		*Ex post* net carbon stock changes		*Ex post* leakage carbon stock changes		*Ex post* net anthropogenic GHG emission reductions		*Ex post buffer credits**		*Ex post* VCUs tradable	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cum.ve	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CBSLPA_t$	$\Delta CBSLPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	ΔCLK_t	ΔCLK	$\Delta REDD_t$	$\Delta REDD$	VBC_t	VBC	VCU_t	VCU
	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2009	1,017,246	1,017,246	138,401	138,401	878,845	878,845	0	0	878,845	878,845	87,885	87,885	790,961	790,960
2010	964,620	1,981,866	138,401	276,803	826,219	1,705,064	0	0	826,219	1,705,064	82,622	170,506	743,597	1,534,557
2011	886,810	2,868,677	138,401	415,204	748,409	2,453,473	0	0	748,409	2,453,473	74,841	245,347	673,568	2,208,126
2012	843,650	3,712,327	138,401	553,605	705,249	3,158,722	0	0	705,249	3,158,722	70,525	315,873	634,724	2,842,849

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*Ex-post buffer credits are calculated based on a 10% Risk Factor (RF) attributed to the project based on the VCS non-permanence risk tool

5. Jurisdictional Nested REDD+

自然を守ることは、人間を守ること。

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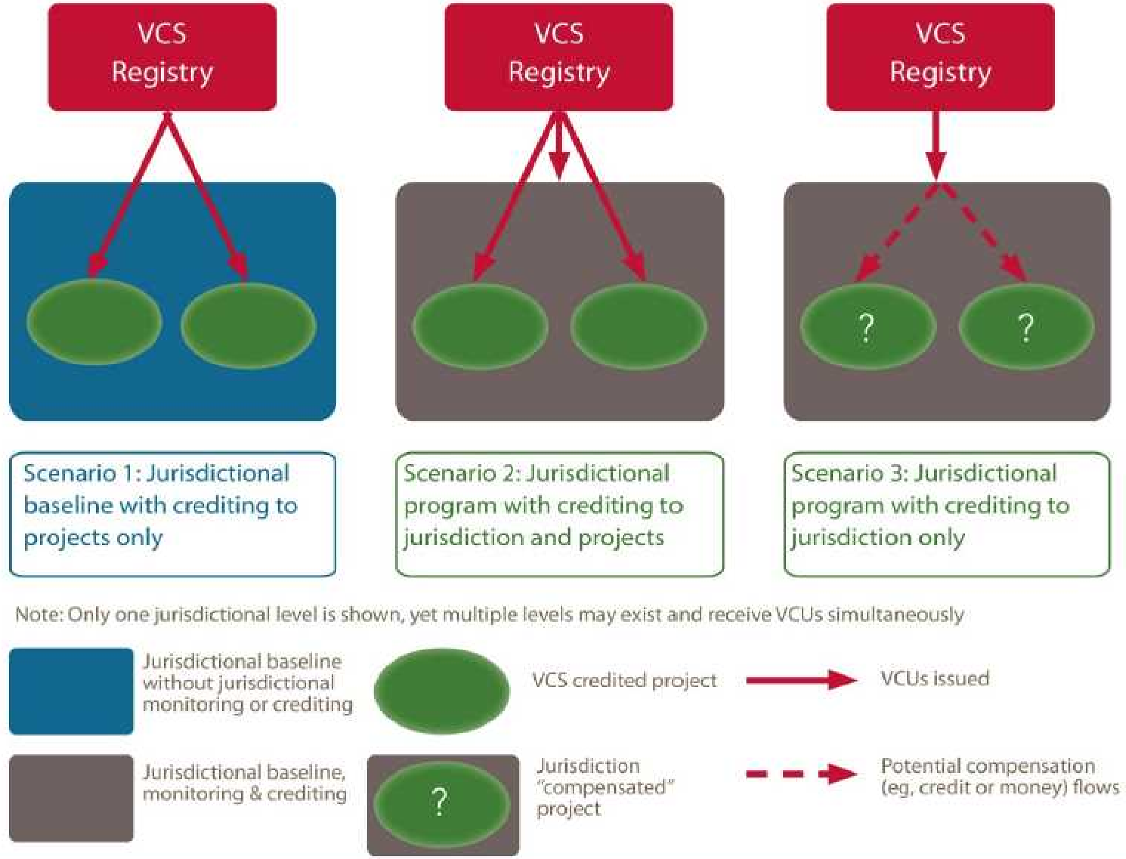
Jurisdictional and Nested REDD+

（管轄の／行政区の）（入れ子の）

- 背景
  - 将来的には、国レベルでの勘定の必要となる
  - 様々な林地（管轄、目的、現状）が存在し、対応するREDD+のスケールにも幅が生じる
  - 現地政府への移管を念頭に、能力開発や制度設計と同時に政府の関与・権限を拡大したい
  - 複数プロジェクトが同じ州内に存在する場合もあり、整合性を保つための仕組みが必要
  - プロジェクトー準国（州等）ー国を入れ子状に扱うための技術的・制度的な検討が進められている＝JNR
- 経過
  - 2011年開始
  - 2011/10 Technical Recommendationsの公表→ピアレビュー
  - 2012/5 draft VCS Requirementsの公表→パブコメ
  - 2012/10 Final VCS Requirementsの公表
  - 2013/10 各種ツール等の公表
  - パイロット実施中（アクレ州、コスタリカ、ペルー、DRC、チリ等）

JNR Scenarios



VCS VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

JNR Requirementsの項目

- □ プログラム開始日、プログラム期間
- □ バウンダリーの定義（地理、活動）
- □ 権利、他のGHGプログラムとの関係
- □ セーフガード
- □ 追加性と適格性
- □ ベースライン（レベル間をネスト）
- □ 先行する下位レベル（例、プロジェクト）から上位レベル（例、州・国）への移行期間
- □ リーケージ（プロジェクトから州、州間等）
- □ モニタリング（レベル間の一貫性の確保、精度）
- □ クレジット発行、支払い（ダブルカウンティングの防止を含む）
- □ 予期せぬ森林消失に対する対応
- □ 他

5. Validationの経験談

自然を守ることは、人間を守ること。

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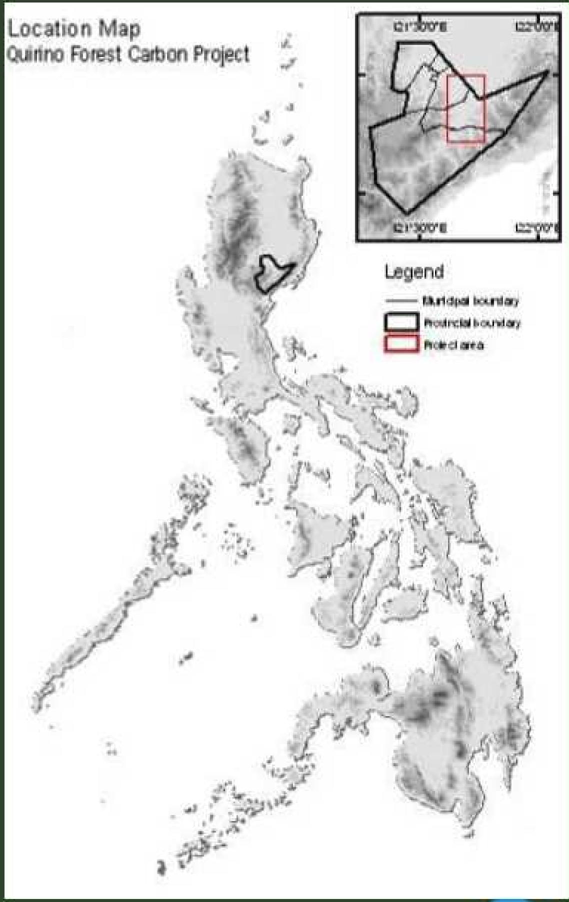
フィリピン・キリノ森林炭素プロジェクト

プロジェクトの概要(1/2)

- □ 対象地の重要性
  - □ フィリピンに残された貴重な森林を有するシエラマドレ生物多様性コリドー
  - □ 重要な水源地
  - □ 約半数の世帯が年間1,000ドル～2,000ドルで生活
- □ 目的
  - □ 代替生計手段の創出
  - □ 野性生物の生息地環境の保全・改善
  - □ 水源地の安定化
- □ プロジェクトバウンダリー
  - □ 草地及び農地(主にバナナ)
  - □ 177 ha(108区画)
  - □ 使用権の与えられた国有地
    - Integrated Social Forestry



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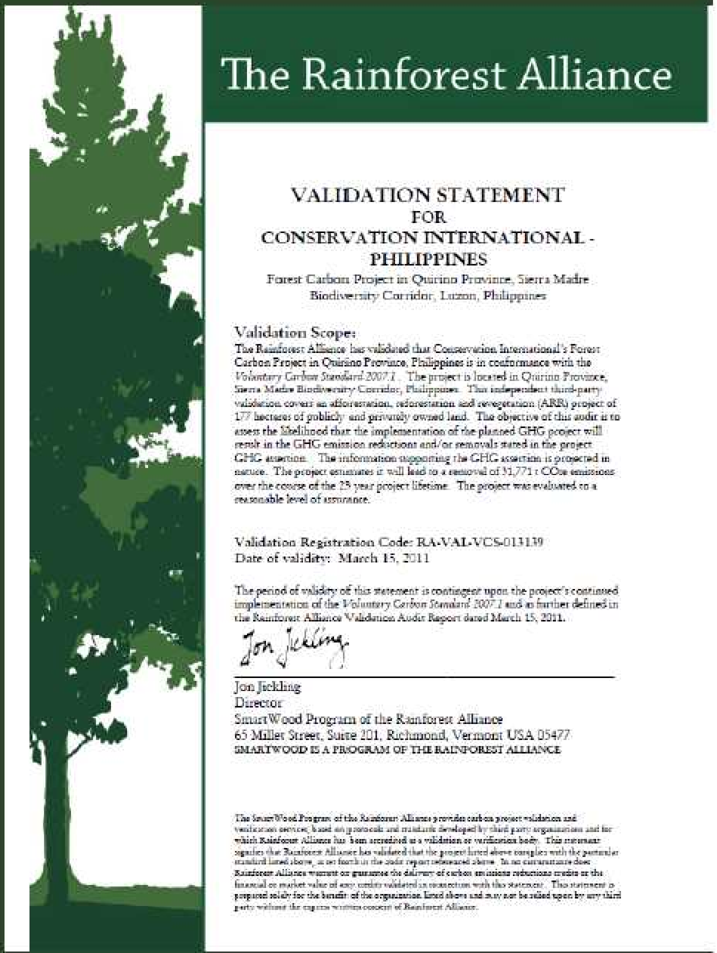
プロジェクトの概要(2/2)

- □ 活動
  - □ 自生種による森林再生：155 ha
  - □ アグロフォレストリー：22.2 ha
- □ 期間と資金
  - □ 2007年～2029年
  - □ moreTreesによる全面的支援
- □ Standard
  - □ 2010.6：CCBSゴールド
  - □ 2011.3：VCS

アジア初のVCS/CCBSダブル有効化プロジェクト



The Rainforest Alliance

VALIDATION STATEMENT
FOR
CONSERVATION INTERNATIONAL - PHILIPPINES

Forest Carbon Project in Quirino Province, Sierra Madre Biodiversity Corridor, Luzon, Philippines

Validation Scope:
The Rainforest Alliance has validated that Conservation International's Forest Carbon Project in Quirino Province, Philippines is in conformance with the *Voluntary Carbon Standard 2007.1*. The project is located in Quirino Province, Sierra Madre Biodiversity Corridor, Philippines. This independent third-party validation covers an afforestation, reforestation and revegetation (ARR) project of 177 hectares of publicly and privately owned land. The objective of this audit is to assess the likelihood that the implementation of the planned GHG project will result in the GHG emission reductions and/or removals stated in the project GHG assertion. The information supporting the GHG assertion is projected in nature. The project estimates it will lead to a removal of 31,771 t CO_2e emissions over the course of the 25 year project lifetime. The project was evaluated to a reasonable level of assurance.

Validation Registration Code: RA-VAL-VCS-013139
Date of validity: March 15, 2011

The period of validity of this statement is contingent upon the project's continued implementation of the *Voluntary Carbon Standard 2007.1* and as further defined in the Rainforest Alliance Validation Audit Report dated March 15, 2011.

Jon Jickling

Jon Jickling
Director
SmartWood Program of the Rainforest Alliance
65 Millet Street, Suite 201, Richmond, Vermont USA 05477
SMARTWOOD IS A PROGRAM OF THE RAINFOREST ALLIANCE

VCSバリデーション

- バリデーター
  - Rainforest Alliance
- 審査スケジュールとCAR(Corrective Action Request)

レビュー期間	CLOSE	NEW	OPEN
2009/7/22-25	--	13	13
2009/11/8-10	10	8	11
2010/7/12-16	7	1re-open	5
2011/2/16-17、3/2-3	5	0	0

Final report

- VCSのルール変更、CDM方法論の新規登録や改訂
- VCS(Voluntary Carbon Standards -> Verified Carbon Standards)の歴史
  - 2006: 第1版 -> 2007 改訂版
  - 2008 Agriculture, Forestry and Other Land Use (AFOLU)を含む ver.2007.1
  - 2011: 大々的な改訂 ver. 3, Jurisdictional and Nested REDD

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バリデーションで苦労した点と教訓

- 苦労した点
  - 使用するパラメータが保守的であることの論証
  - 植林プロジェクトの場合のプロジェクト期間の考え方がVCSのルール上あいまいであった(ver.3では明確化)ため、解釈が定まらず、土地所有者とのAgreementの修正が必要となった
  - クレジット販売からの収益を想定した設計のファイナンシャルリスクが高いと判断され、ドナーとの契約を変更した

- 教訓
  - バリデーターやVCS事務局とのコミュニケーションを有効に行う
    - ルールの解釈については、バリデーターやVCS事務局に確認する。
    - VCS事務局は、現場の経験に基づく助言を歓迎しているので、納得できないルールや記載については、真意を問い合わせ、改善案を提案すると良い。
  - 現地の担当者の理解度を上げ、また工夫して、一緒に作業できる環境をつくる
  - 可能な限り短時間でPDを完成させる
  - (常識は捨て、バリデーターが評価できる材料と論理を整えることに専念する)



ありがとうございました

CONSERVATION INTERNATIONAL



第３章

GHGプロジェクトの審査と REDDプロジェクト

留意点ならびに課題点の共有

イー・アール・エム日本株式会社
仲尾 強

REDDプラスに係る森林技術者講習会
GHGプロジェクトの審査とREDD+プロジェクト

～留意点ならびに課題点の共有～

2014年1月14日
イー・アール・エム日本株式会社
サステナビリティ マネジメントチーム
仲尾　強

ERM

The world's leading sustainability consultancy

講師

仲尾　強
ERM日本　サステナビリティマネジメントチーム　リーダー

- 1985年から日本鋼管(現JFEエンジニアリング)環境エンジニアリング本部にて、大型廃棄物処理プラントなどの環境関連設備に関するエンジニアリング業務や研究、開発に従事。
- 2002年からは外資系第三者機関にてCDM/JIプロジェクトの第三者審査手法の開発・実施に関わり、CDMの国連登録第1号案件であるノバジェララランドフィルプロジェクト(ブラジル)のバリデーションを行う。以来50件以上の温室効果ガス排出量削減プロジェクトの評価業務のプロジェクトリーダーを務める。
- 2009年からERM日本にて、気候変動やCSRに関わる様々なコンサルティング業務に従事。プロジェクトには経済産業省「地球温暖化対策技術普及等推進事業」において、インドネシアでのREDDに関するF/Sプロジェクト(2010年度)や、メキシコやモンゴルでの省エネ、ベトナムでの風力発電に関するJCMのためのF/Sプロジェクト(2011年、2012年、2013年度)でのMRVの開発やPDD(プロジェクト設計書)の作成を含む。
- その他、国内CO2削減プロジェクト検討委員会委員(経済産業省、2006-7)、J-VER制度方法論パネル委員会(環境省、2009-2012)、J―クレジット制度森林吸収小委員会(環境省、現在)、J-MRV(GREEN)アドバイザリーコミッティ(JBIC、2009-現在)など、温室効果ガス排出抑制に関する様々な制度作りのための委員を務める。

内容

GHGプロジェクトの審査

削減量の信頼性の確保

説明責任 MRV

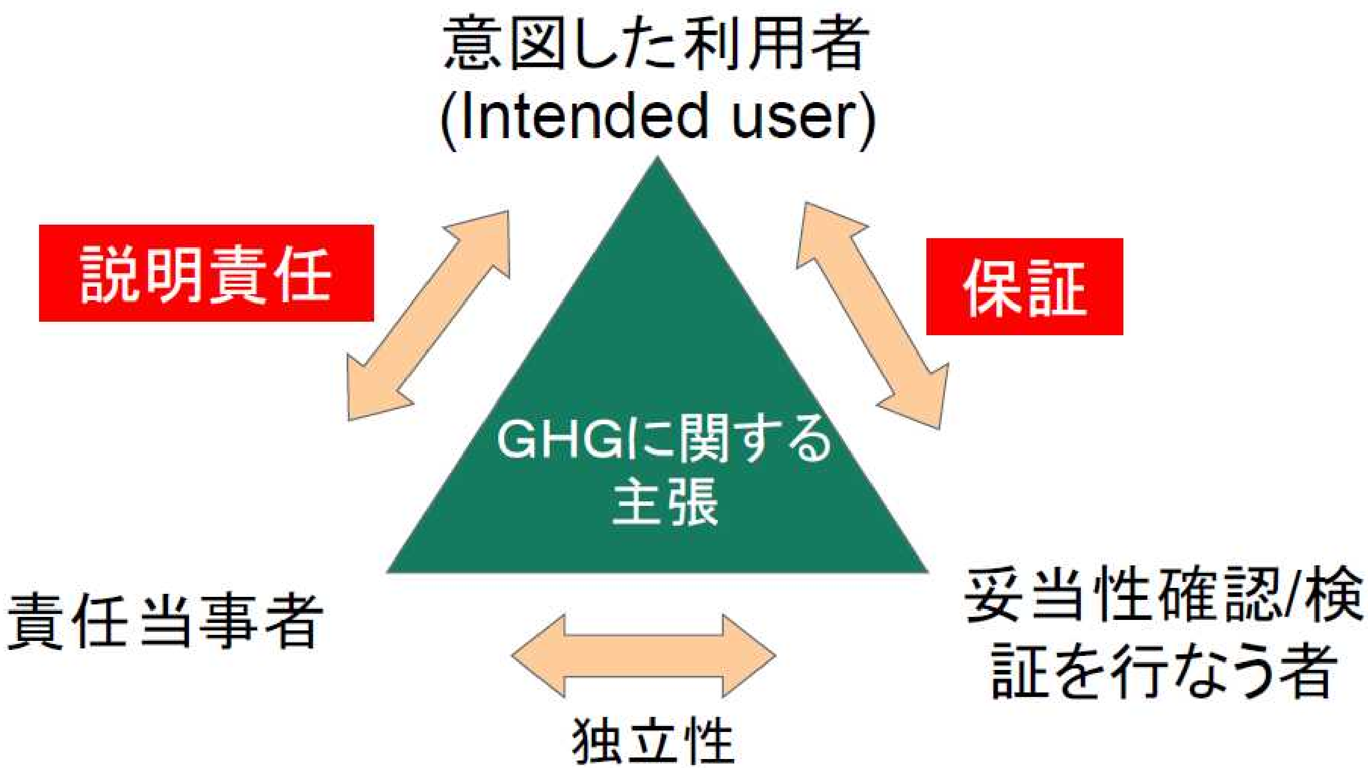
定量化と報告に対する要求

保証 MRV

審査に対する要求

(妥当性確認、検証)

削減量の信頼性の確保



ISO14064-3、図A．1

審査とは？

参照基準 → **評価** → **報告**

参照基準

- ISO
- ASME
- EU 指令
- 社内規定、標準、手順書

評価

- システム
- プロジェクト
- 製品
- データ
- その他

報告

- 意見書
- 保証書
- 認証書
- CE マーク
- 検査報告書

GHG プロジェクトの審査とは？

MRV

温室効果ガス削減プロジェクトの審査 ⇒通常二種類

- □ プロジェクト実施前：バリデーション
- □ プロジェクト実施後：ベリフィケーション

CDM、VCSで実施。

ISO14064では望ましいとされている。

GHG プロジェクトの審査とは？

バリデーション

プロジェクト設計書の、独立した第三者機関による評価.

- 評価の実施はEx-ante (プロジェクト活動開始前)

  : 将来の予測に基づく

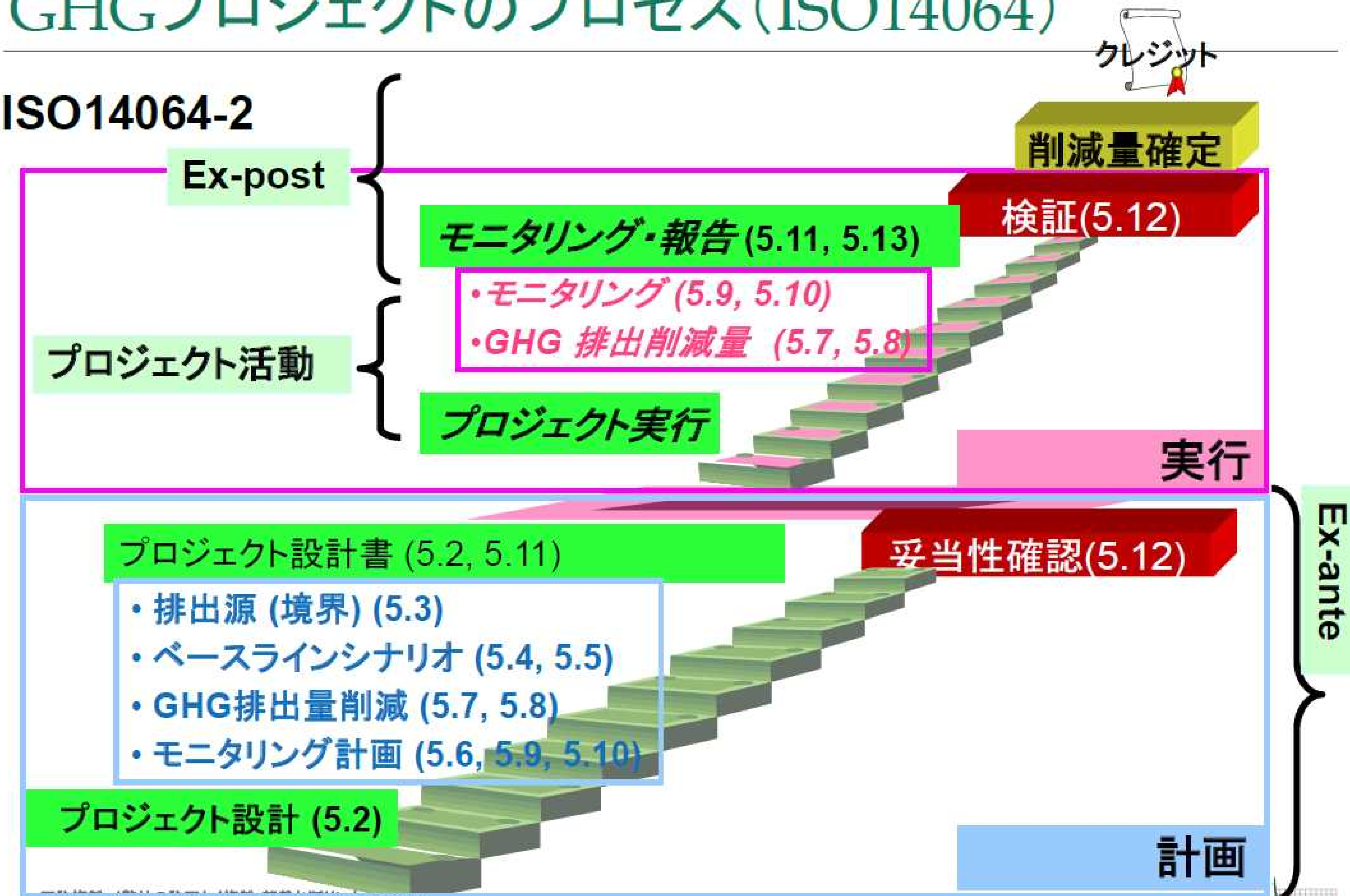
ベリフィケーション

プロジェクト実施によるパフォーマンスと削減量のレビューと確認

- 評価の実施はEx-post (プロジェクト活動開始後)

  : 実際のデータに基づく – 検証可能な情報

GHGプロジェクトのプロセス(ISO14064)



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GHGプロジェクトのプロセス(JCM, CDM)

JCM	<各プロセスにおける主な活動主体>	CDM
プロジェクト参加者 / 各国政府 また合同委員会により開発可能	提案方法論の提出	プロジェクト参加者
合同委員会	提案された方法論の承認	CDM理事会
プロジェクト参加者	PDDの作成	プロジェクト参加者
第三者機関(TPEs)	妥当性確認	指定運営機関(DOEs)
合同委員会	登録	CDM理事会
プロジェクト参加者	モニタリング	プロジェクト参加者
第三者機関(TPEs)	検証	指定運営機関(DOEs)
合同委員会が発行量を決定 各国政府がクレジットを発行	クレジット発行	CDM理事会

二国間クレジット制度 (Joint Crediting Mechanism (JCM))の最新動向、日本政府資料、2013年10月 11

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バリデーション

GHG プロジェクトの計画書における
GHGに関する主張(**2.11**)を評価する
体系的で、独立し、かつ、文書化されたプロセス。

(ISO14064-3, 2.32)

合意された妥当性確認の基準(2.33)に照らして

(ISO14064-3, 2.32)

バリデーション

参照基準 → **評価** → **報告**

- スキームのルール
- 方法論
- その他

- PDD

- バリデーション報告書

ベリフィケーション

GHG に関する主張を評価する，
体系的で，独立し，かつ，文書化されたプロセス

合意された検証の基準(2.32)に照らして

ISO14064-1，2 用語及び定義

ベリフィケーション

参照基準

- スキームのルール
- 方法論
- PDD
- その他

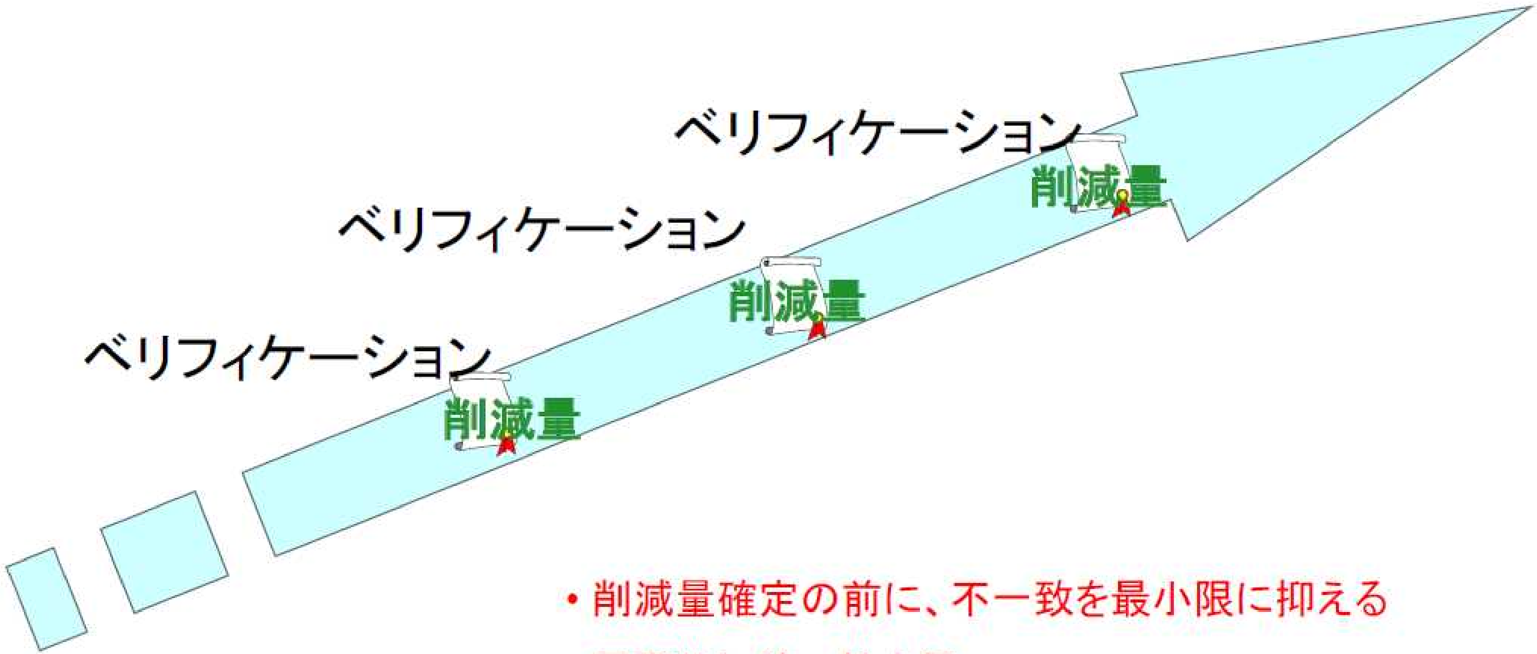
評価

- モニタリング報告書

報告

- ベリフィケーション報告書
- （認証書）

ベリフィケーション



- 削減量確定の前に、不一致を最小限に抑える
- 国際的に統一性を保つ

バリデーションとベリフィケーション

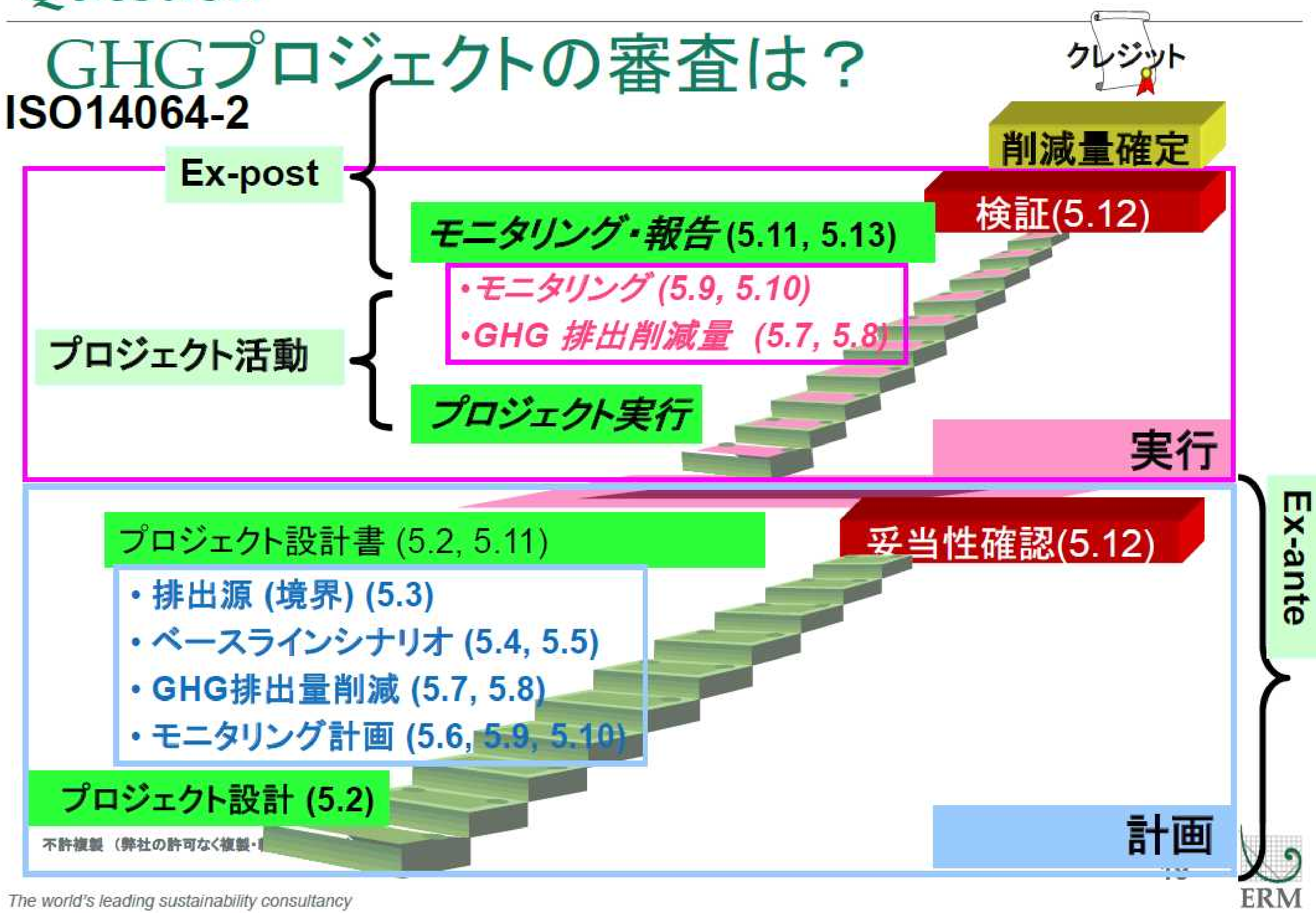
- バリデーション:
  - どちらかというと定性的な情報、推定、正当性などを評価。
  - ステークホルダーに対するインタビューを通して、結論に必要な多くの証拠を得る。
- ベリフィケーション:
  - どちらかというと定量的な情報、モニタリングの記録などを評価。
  - PDDやプロジェクト計画に沿って実施されていることを、確認する。

Question

審査とは？

参照基準	評価	報告
• ISO • ASME • EU 指令 • 社内規定、標準、手順書	• システム • プロジェクト • 製品 • データ • その他	• 意見書 • 保証書 • 認証書 • CE マーク • 検査報告書

Question


GHGプロジェクトの審査は？
ISO14064-2
クレジット
削減量確定
Ex-post
検証(5.12)
モニタリング・報告 (5.11, 5.13)
・モニタリング (5.9, 5.10)
・GHG 排出削減量　(5.7, 5.8)
プロジェクト活動
プロジェクト実行
実行
Ex-ante
プロジェクト設計書 (5.2, 5.11)
妥当性確認(5.12)
・排出源 (境界) (5.3)
・ベースラインシナリオ (5.4, 5.5)
・GHG排出量削減 (5.7, 5.8)
・モニタリング計画 (5.6, 5.9, 5.10)
プロジェクト設計 (5.2)
計画
不許複製（弊社の許可なく複製・
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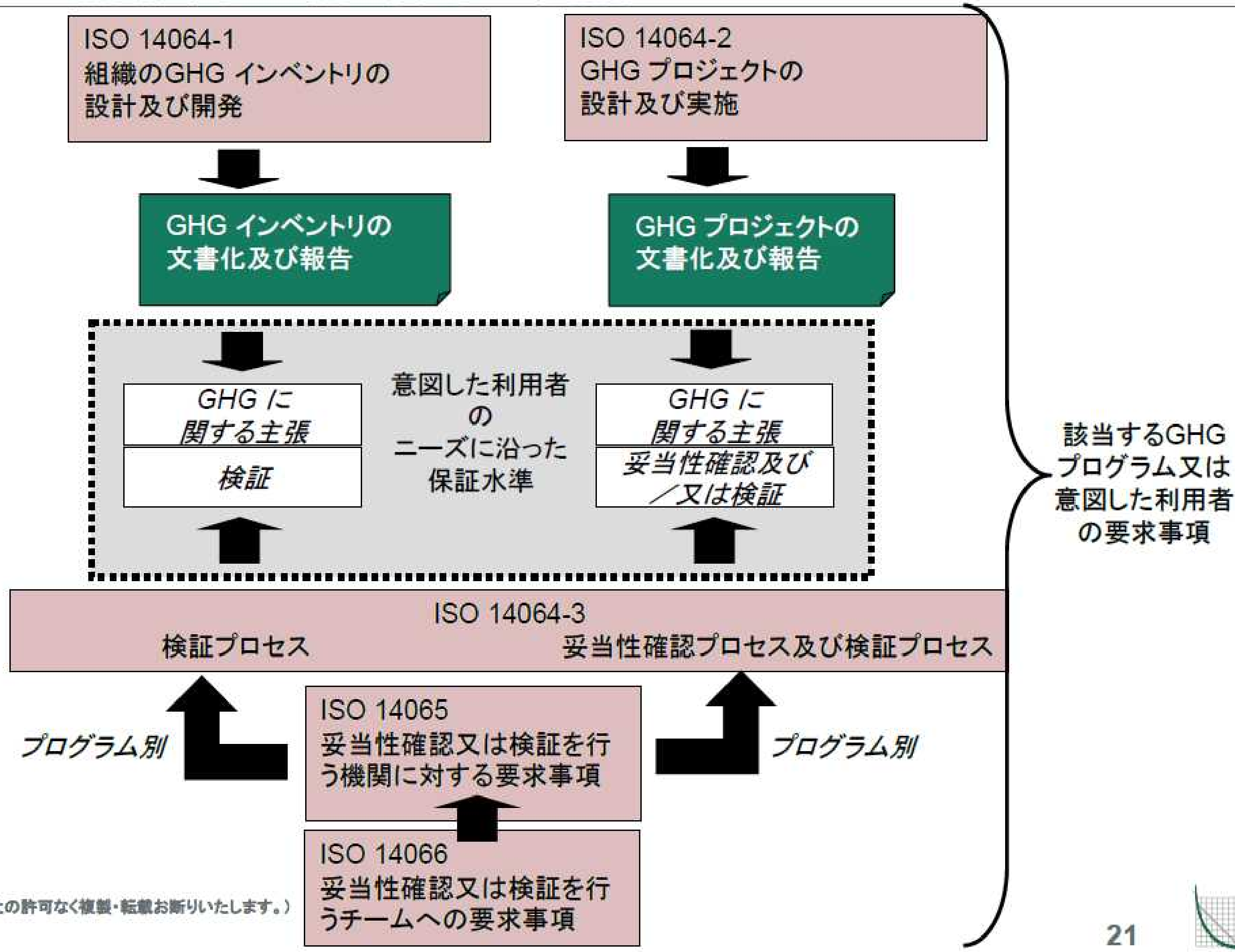
GHG削減プロジェクトの審査の原則

14064 規格群の各部間の関係



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ISO14064と他の規格

GHG算定・報告　検証報告

XX検証ガイドライン　算定ガイドライン

XXガイドライン　IPCC　VCS

ISO14064シリーズ

ISO14064-2：原則

適切性

- 意図した利用者のニーズに適したGHG の排出源，GHG の吸収源，GHG 貯蔵庫，データ及び方法論を選択する。

完全性

- 適切なGHG の排出量及び吸収量の全てを含める。基準及び手順を支える全ての適切な情報を含める。

一貫性

- GHG 関連の情報について，有意義な比較を可能にする。

ISO14064-2：原則

正確性
- 実行可能な限りバイアス及び不確かさを減らす。

透明性
- 意図した利用者が合理的な確信をもって判断を下せるように，十分かつ適切なGHG 関連の情報を開示する。

保守性
- GHG の排出量の削減又は吸収量の増加が過大に評価されないことを確実にするように，保守的な仮定，数値及び手順を使用する。

審査での判断：6原則

適切性, 完全性, 一貫性, 正確性, 透明性

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

リスクを減らす

情報の追加　　**保守性の原則**

審査での判断：重要性（Materiality）

適切性、完全性、一貫性
正確性、透明性、保守性

主張する際の原則

＋

重要性

保証を行なう際

ISO14064

審査での判断：重要性（Materiality）

誤り，脱漏，不実表示

影響を及ぼすか？？

- GHG に関する主張
- 意図した利用者

許容可能な重要性

妥当性確認を行う者，検証を行う者又はGHGプログラムが決定

閾値：5%
(JCM、VCS)

5%超える不一致　：不適合

審査での判断：重要性（Materiality）

重要性の判断
- ・定量的な側面 ⇒閾値で対応
- ・定性的な側面 ⇒専門家としての判断

定性的な判断が要求される項目の例
- 保全活動の有効性
- 温暖化以外へのインパクト
- セーフガードの確認

Question

6原則とは？

**適切性, 完全性, 一貫性,
正確性, 透明性**

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

リスクを減らす

情報の追加

保守性の原則

Question

重要性とは？

重要性の判断
- ・定量的な側面 ⇒閾値で対応
- ・定性的な側面 ⇒専門家としての判断

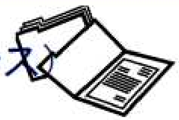
定性的な判断が要求される項目の例
- 保全活動の有効性
- 温暖化以外へのインパクト
- セーフガードの確認

バリデーションのアプローチ

リスクベースアプローチ

ステークホルダー
NGOs

プロジェクト設計
ベースライン(レファレンス)
モニタリング計画
排出削減量
環境影響評価
ローカルステークホルダーコミュニケーション


PDD

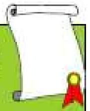
リスクの明確化:
推定・仮定
情報源

適切性?
完全性?
一貫性?
正確性?
保守性?
透明性?

現地訪問

重要な不確実性:
詳細な調査

バリデーション報告書
意見書



PDDのリスクとは？

1. ルール違反
2. 削減量に関する誤った報告の可能性
3. 報告原則に反する可能性
   - □適切性
   - □完全性
   - □一貫性
   - □正確性
   - □透明性
   - □保守性

バリデーション

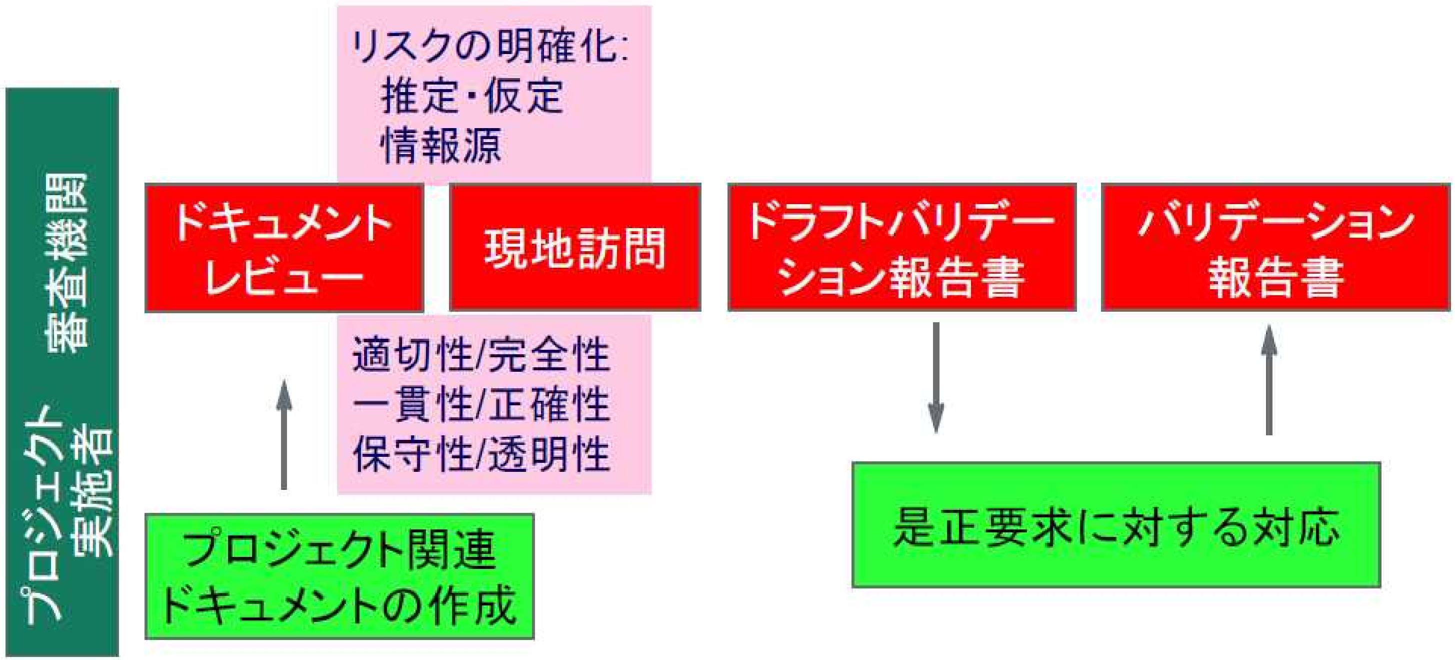
コンプライアンス

- PDDの記述内容が、スキームのルールに従っていること確認。
- 採用している方法論の適合性を評価。

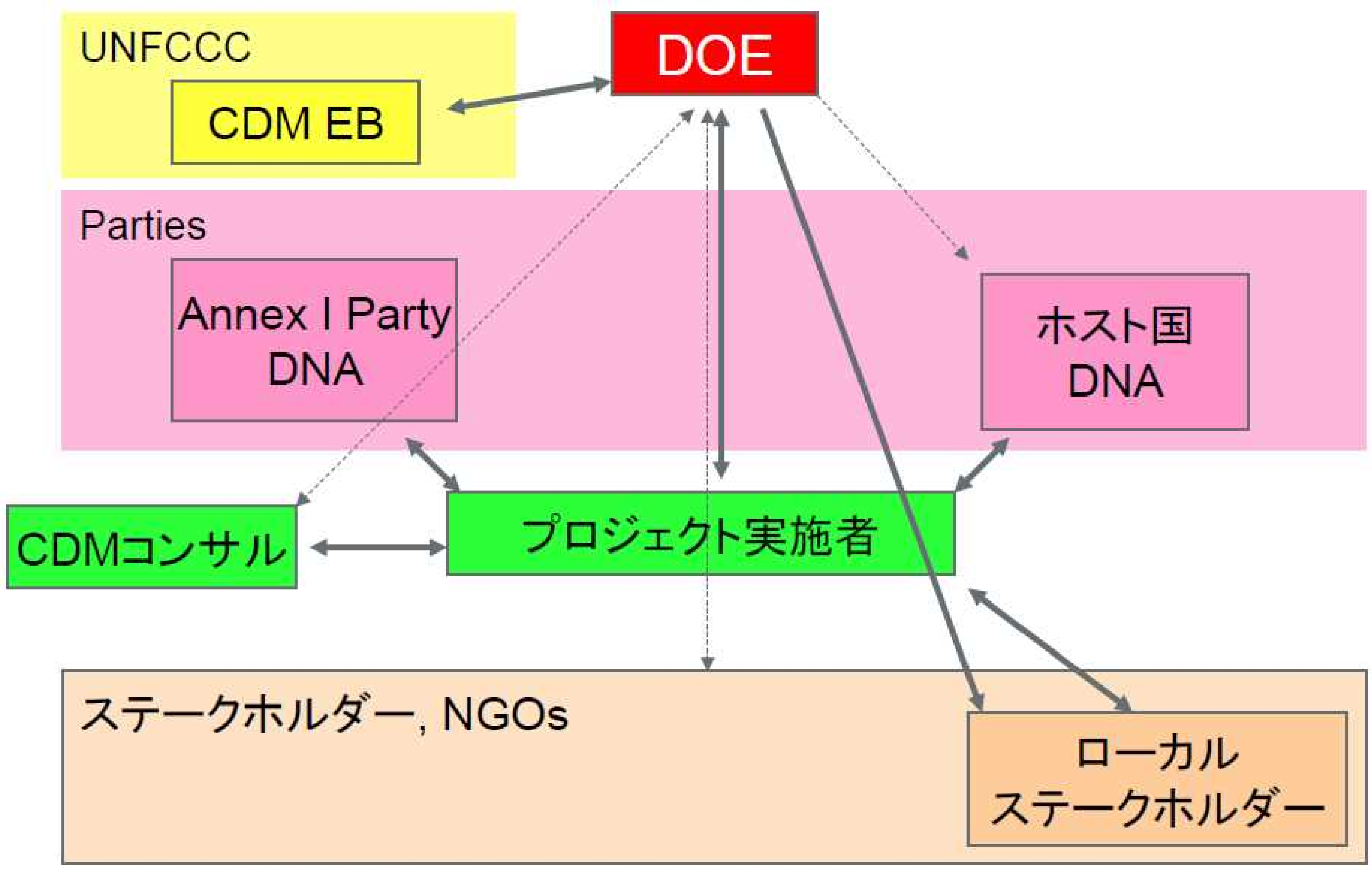
情報の評価

- PDDに示されている情報の適切性、完全性、一貫性、正確性、透明性及び様々な推定に対する保守性を、証拠に基づいて評価。

バリデーションのプロセス



バリデーションの関係者（CDMの例）



CDMの場合

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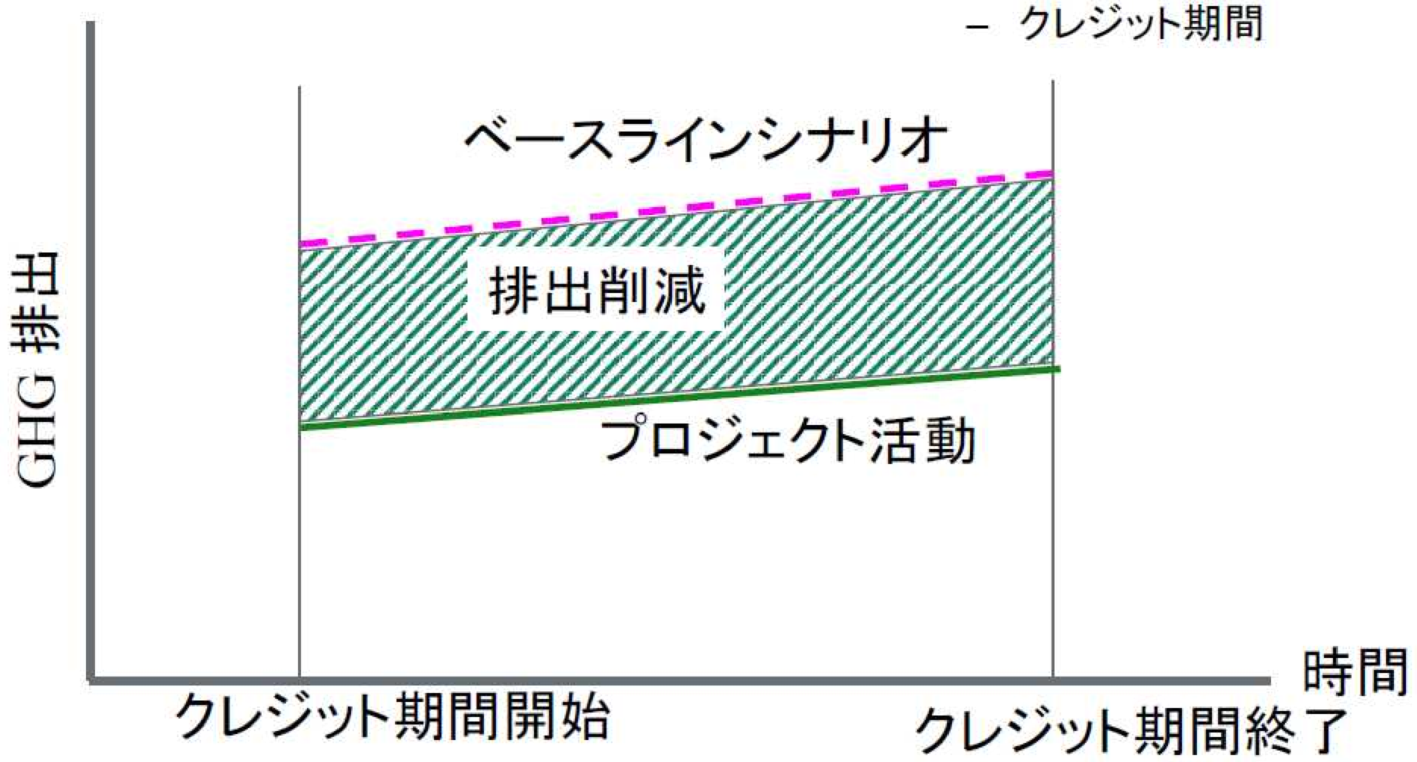
バリデーションの検討項目の例：ベースラインと追加性

排出削減は以下の二つで決定;
- ベースラインレベル
- クレジット期間



バリデーションの検討項目の例：ベースラインと追加性

ISO14064-2, 5.4

プロジェクトの推進者は，プロジェクトが，ベースラインシナリオで生じると仮定されるものに追加されている（additional）GHG の排出量の削減又は吸収量の増加をもたらすことを実証するための基準及び手順を選択するか又は確立し，正当な根拠を示し，かつ，適用しなければならない。

- ベースライン方法論
- 追加性

バリデーションの検討項目の例：ベースラインと追加性

- シナリオの想定
  - BAU
  - ホスト国の政策、法律、経済、環境、社会を考慮
  - エネルギーセクターへの影響を考慮
  - 代替技術/燃料の選択
  - ベースライン/プロジェクトの時間的なものを考慮
- 最も経済的なものを選択
- プロジェクトが無い場合とある場合の比較

従う → **ベースライン方法論**

むなしい議論を避ける

バリデーションの検討項目の例：ベースラインと追加性

保守性の適用

適切性, 完全性, 一貫性, 正確性, 透明性

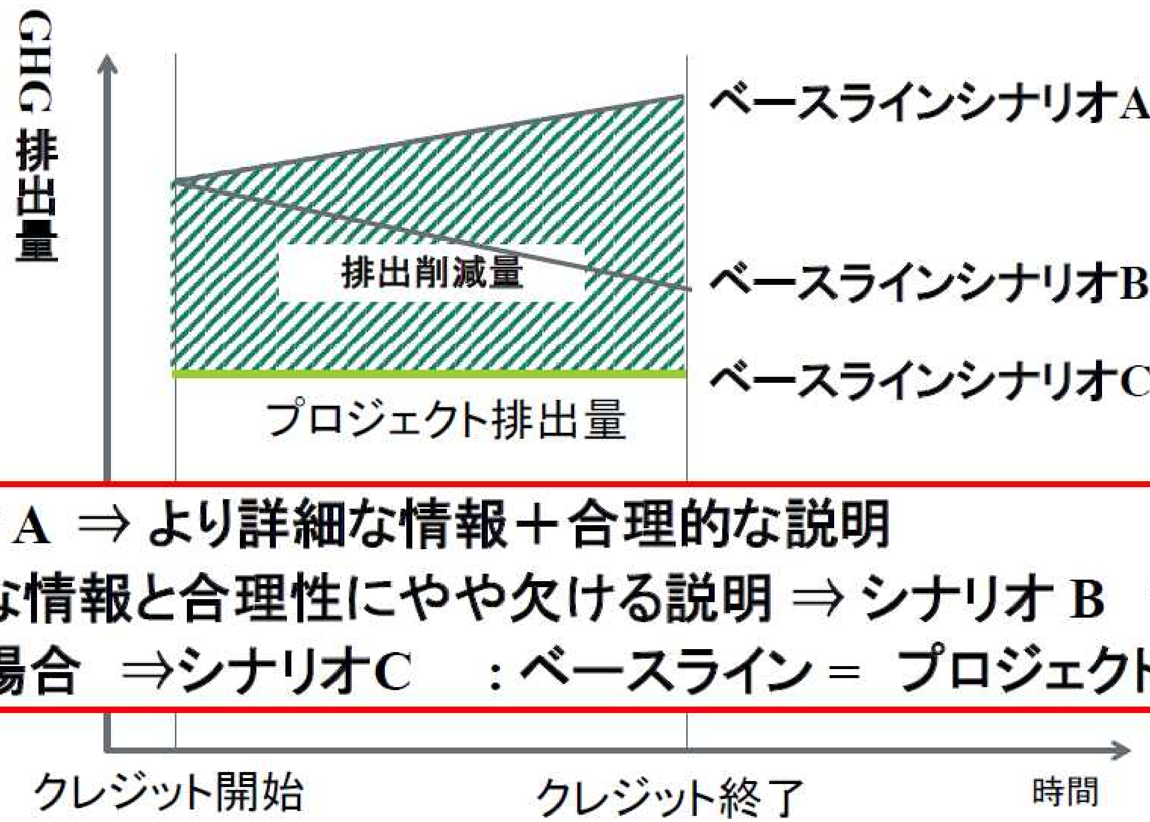
1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

リスクを減らす

情報の追加　　**保守性の原則**

バリデーションの検討項目の例：ベースラインと追加性

ベースラインスタディ



- シナリオ A ⇒ より詳細な情報＋合理的な説明
- 大雑把な情報と合理性にやや欠ける説明 ⇒ シナリオ B ？
- 最悪の場合 ⇒シナリオC ：ベースライン＝ プロジェクト

バリデーションの検討項目の例：削減量の算定の評価

GHG排出削減量の算定

方法論に従う

一般に

GHG排出量 ＝ **活動量** × **排出係数**

- 出典が明確
- GHG排出源、吸収源に対して適切
- 最新情報
- 不確実性を考慮し、正確で再現性のある方法で計算
- 他の係数との一貫性

バリデーションの検討項目の例：削減量の算定の評価

不確実性の高いデータや情報が使用されている場合、過度な排出削減量にならないように配慮する。

↓

保守性の原則

バリデーションの検討項目の例：削減量の算定の評価

不確実性の高いデータや情報が使用されている場合、過度な排出削減量にならないように配慮する。

適切性, 完全性, 一貫性, 正確性, 透明性

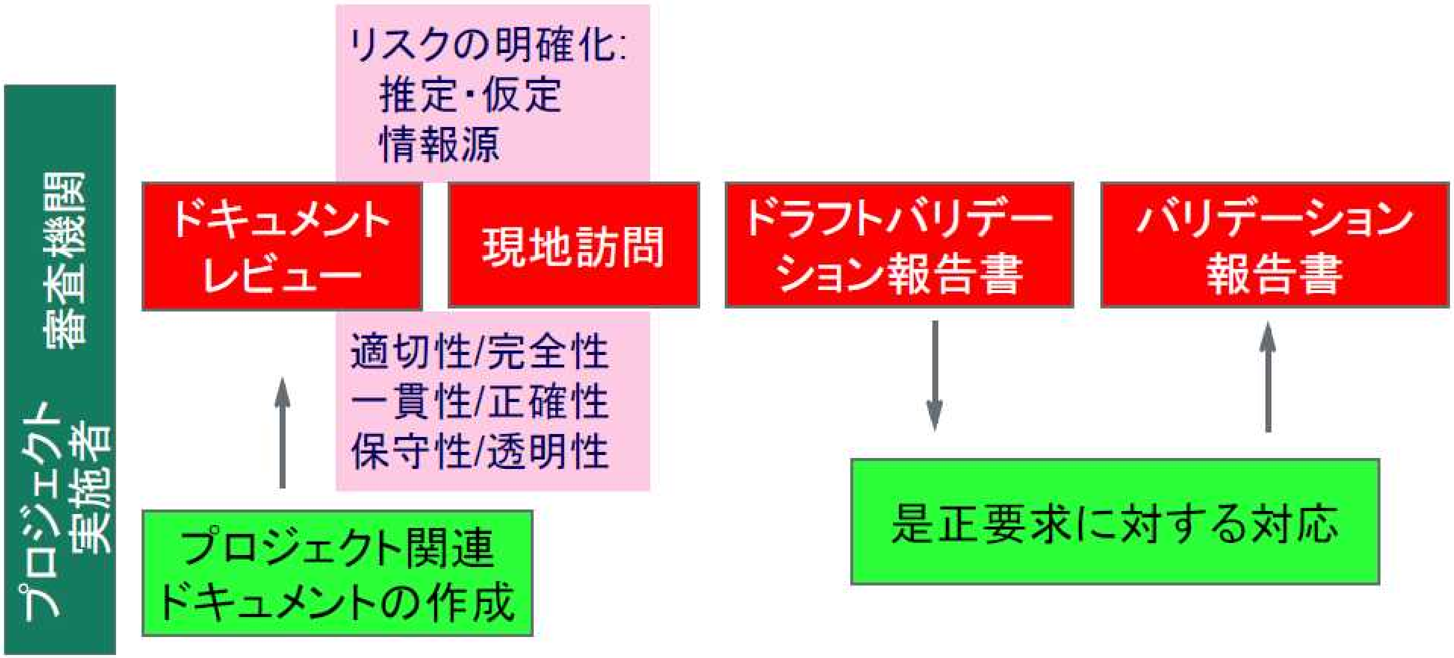
1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

リスクを減らす

情報の追加　　**保守性の原則**

Question

バリデーションのプロセスは？



Question

リスクアプローチとは？

1. ルール違反
2. 削減量に関する誤った報告の可能性
3. 報告原則に反する可能性
   - □適切性
   - □完全性
   - □一貫性
   - □正確性
   - □透明性
   - □保守性

ベリフィケーションのアプローチ

ベリフィケーションのアプローチ

情報の評価

モニタリング報告書		スキームオーナーへの開示 一般公開
算定記録	削減量計算 他の分析、計算	情報は開示されない
活動記録	電力の請求書 燃料消費記録 ラボテスト記録 生産記録 他の記録類	情報は開示されない

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ベリフィケーションのアプローチ

プロジェクト実施者

- 量的な情報
- 質的な情報

モニタリング報告書

適切性	透明性
完全性	一貫性
保守性	正確性

審査チーム

1. コンプライアンス
2. 情報の質
3. データマネジメント

Risk Based Approach

4. 重要性

ステークホルダー

意見書

ベリフィケーションのアプローチ

コンプライアンス

- PDDに従ってプロジェクトが実施され、物理的特徴が記述通りであることを確認する。
- モニタリングシステムや方法が、モニタリングプラン（PDD）や承認された方法論に従っていることを確認する。

情報の評価

- モニタリング報告書やその補助文書類は完全であり検証可能であることを確認し、評価する。
- モニタリング計画で示されている記録や、補完されているデータを確認・評価する。

ベリフィケーションのプロセス

審査機関

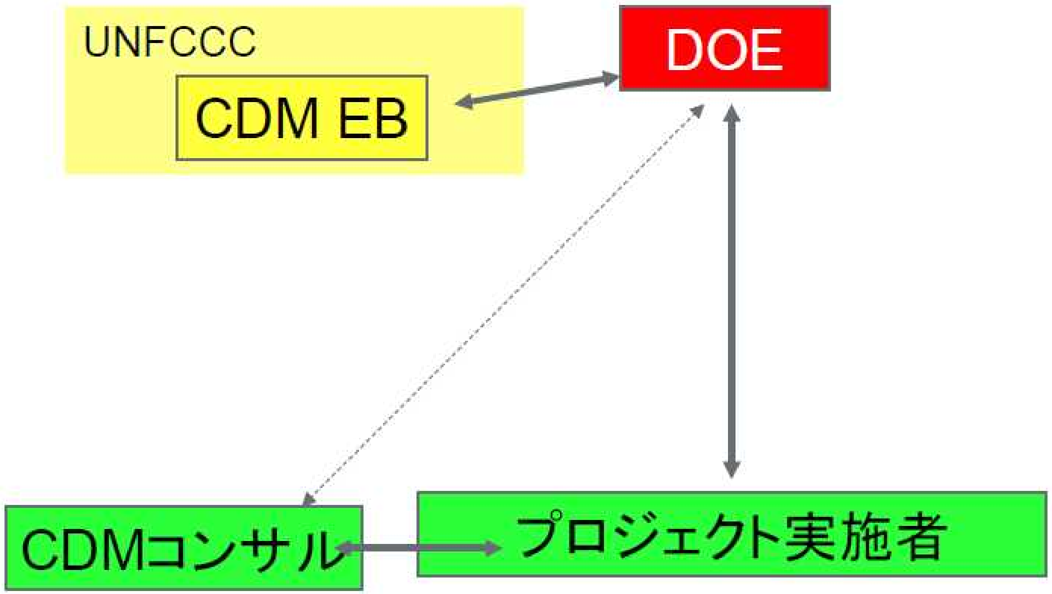
ドキュメントレビュー → 現地訪問 → ドラフトベリフィケーション報告書 → ベリフィケーション報告書

プロジェクト実施者

モニタリングレポート → ドキュメントレビュー

ドラフトベリフィケーション報告書 → 是正要求に対する対応 → ベリフィケーション報告書

ベリフィケーションの関係者（CDMの例）



ベリフィケーションのアプローチ

■ 情報の評価

証拠に基づき評価する。

証拠の質
審査証跡.
(a) 十分な証拠
(b) 情報源

潜在的な誤り、漏れや誤った報告の程度を評価。

リスク：潜在的な誤り、漏れや誤った報告

リスクベースアプローチ

固有リスクの評価の例

- プロジェクト活動の特質
- 排出源の特質(数、タイプなど)
- 適用方法論
- 情報
  - 合計した排出量に対する割合。
  - 前回の値との比較。大きな変化の有無。
  - 排出量の変化を示す別の指標。
(例えば、プロジェクト活動の変化など)

リスクベースアプローチ

リスクベースアプローチ

1. 固有リスクと統制リスクを評価
2. 高いリスク分野を重点的に審査

- 総ての情報の評価の実施は、非効率的。
- 審査の時間を有効に使用。
- 発見リスクを最小限に抑える。

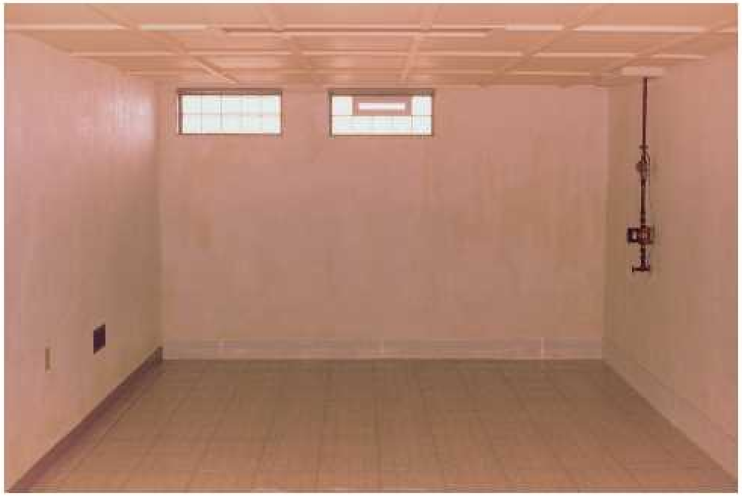
リスクベースアプローチ

固有リスクの評価の例

- プロジェクト活動の特質
- 排出源の特質(数、タイプなど)
- 適用方法論
- 情報
  - 合計した排出量に対する割合。
  - 前回の値との比較。大きな変化の有無。
  - 排出量の変化を示す別の指標。(例えば、プロジェクト活動の変化など)

リスクベースアプローチ

固有リスクの例



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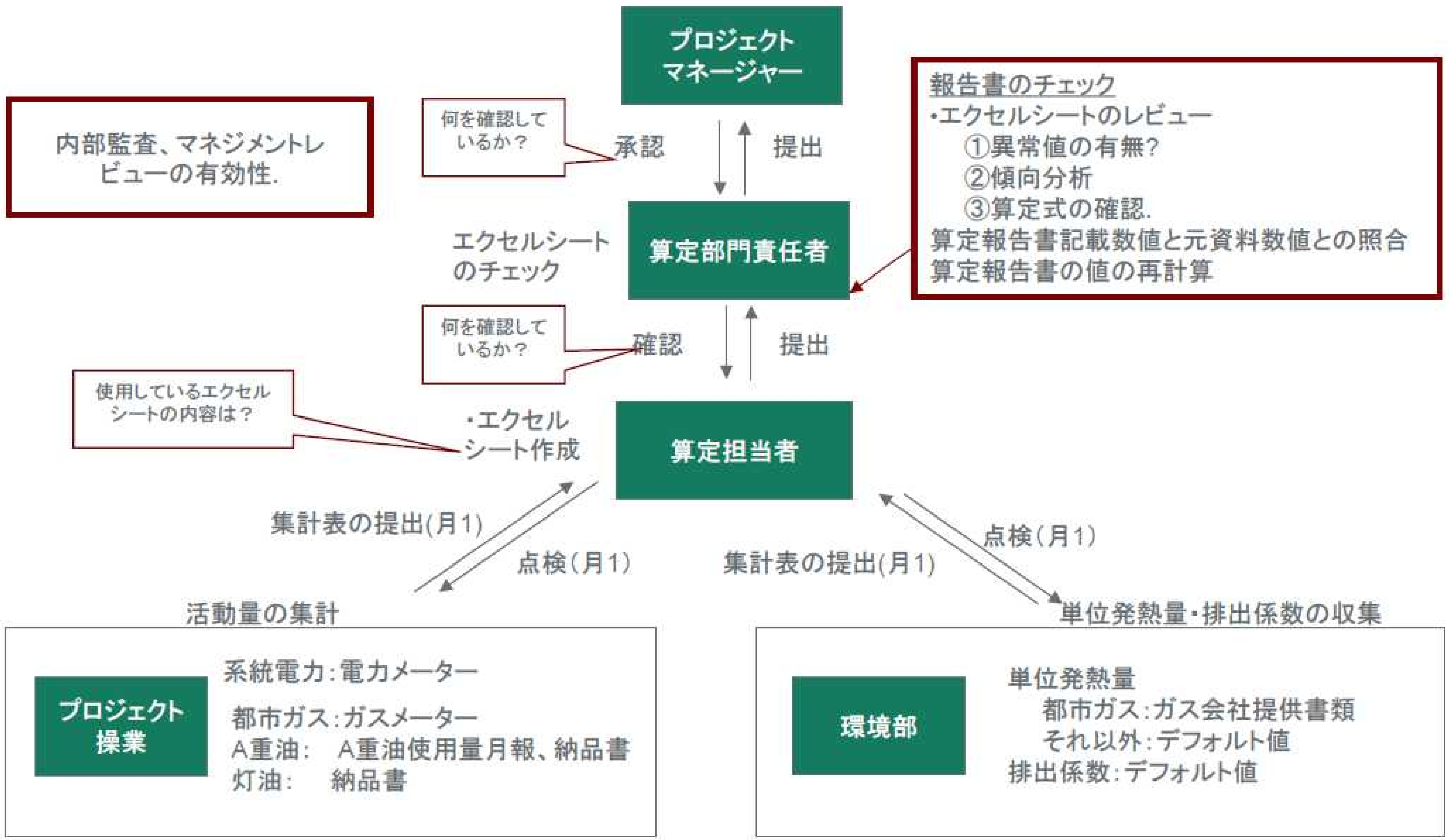
リスクベースアプローチ

統制リスクの評価の例

- データの収集、計算、報告のプロセル
- モニタリング機器のメンテナンス、キャリブレーション
- 重要な記録へのアクセス方法
- 情報のレビューや更新の方法
- 是正処置の方法
- 記録や文書類の管理方法
- 内部監査
- マネジメントレビュー

リスクベースアプローチ



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リスクベースアプローチ

6原則に従ってリスク評価を行う。

6 原則
- 適切性
- 完全性
- 一貫性
- 正確性
- 透明性
- 保守性

リスクベースアプローチ

6原則に従ったリスク評価の例

a) 完全性の欠如:

例えば, 重大な排出源の除外, 誤って設定された境界, リーケージの影響

b) 正確さの欠如:

例えば, ダブルカウント, 大量の主要なデータの手書きによる転記, 排出係数の不適切な使用;

c) 一貫性の欠如:

例えば, 前年まで用いていたGHG の排出量又は吸収量の算定方法から変更したことが報告されていない

(ISO14064-3, A.2.4.6.2)

Question

ベリフィケーションのプロセスは？

審査機関

ドキュメントレビュー

現地訪問

ドラフトベリフィケーション報告書

ベリフィケーション報告書

プロジェクト実施者

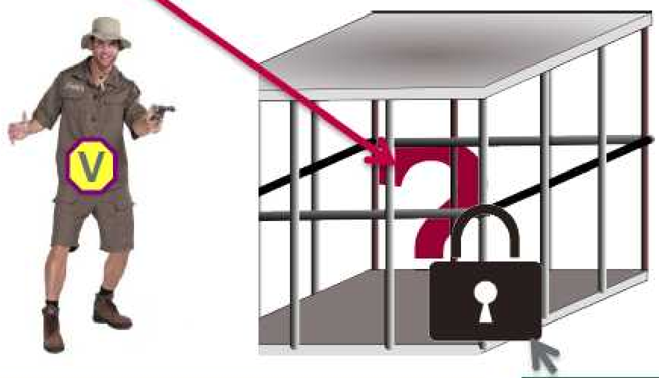
モニタリングレポート

是正要求に対する対応

Question　リスクアプローチとは？

固有リスク（Inherent Risk）
重大な不一致が発生するリスク

プロジェクトの複雑さ
排出源の特徴（タイプ，数など）



発見リスク（Detection Risk）

重大な不一致を，妥当性確認を行う者又は検証を行う者が発見できないリスク

ベリフィケーションの手法と関係
審査チーム内の専門化の有無

統制リスク（Internal control）
～管理上のリスク

GHG プロジェクトの管理策によって、重大な不一致を予防又は発見できないリスク

モニタリング機器の管理
データマネジメントシステム

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PDD (Project Description)のデスクレビューのポイント

Project Description (CDMではPDD)

VCSの場合

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

PDDのレビュー

参考とする文書類:

1. ガイドライン:　例えばVCSの場合
   - VCS Standard
   - Agriculture, Forestry and Other Land Use (AFOLU) Requirements V3.4
   - Jurisdictional and Nested REDD+ (JNR) Requirements V3.1
   - その他、VCSのプログラムドキュメント

2. 他の文書類
   - 適用する方法論
   - その他の文書類や情報。

PDDのレビュー

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

1.プロジェクトの内容

- 採用する技術、タイプ、スコープ
  - プロジェクト (何が行なわれるか?)
  - プロジェクト活動以前の既存シナリオ (今何が行なわれているか?)
  - 排出削減量
- 関係する国と参加者
- プロジェクト、クレジット期間
- ダブルカウント

PDDのレビュー

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

2. 方法論の適用

方法論の適用性.

- 登録済みの方法か？
- 適用条件(Applicability conditions)と正当性。
- 同じ方法論を採用した、別のプロジェクト。

PDDのレビュー

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

2. 方法論の適用

ベースライン

- プロジェクト境界 (排出源と温室効果ガス)
- ベースラインシナリオ
- ベースラインの決定
  - 追加性
  - 保守的で適切な決定

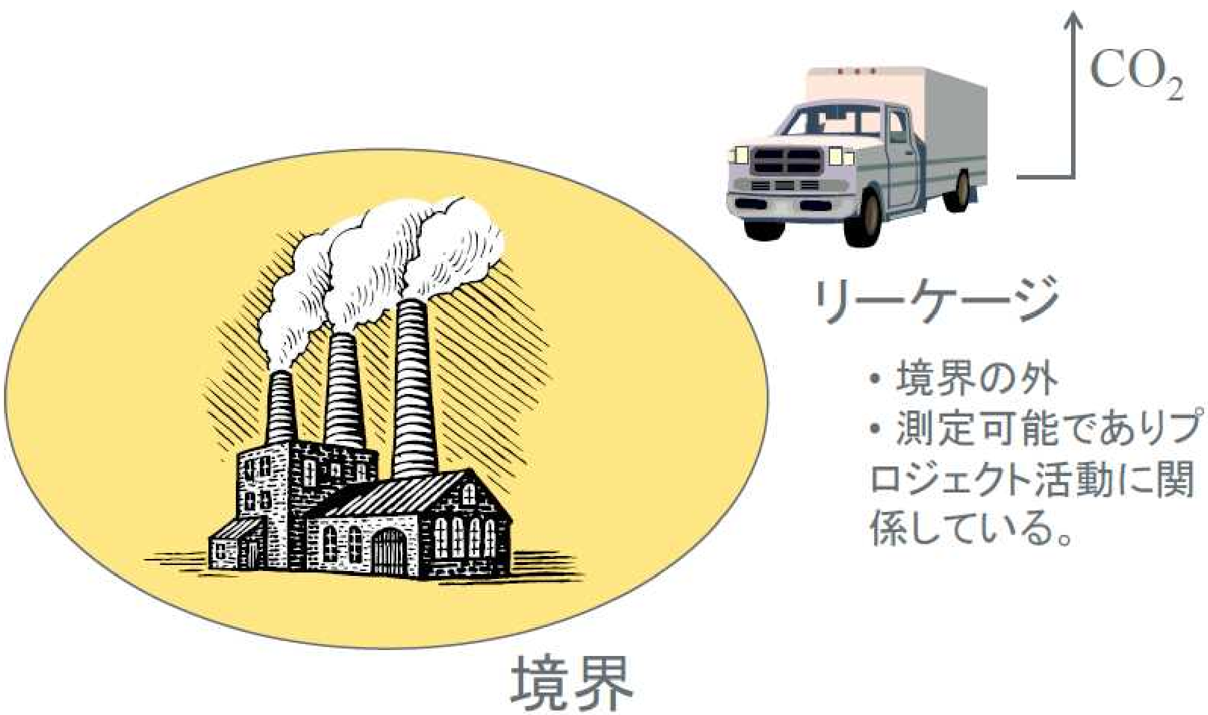
バウンダリー

全ての排出源を含むこと

- コントロールされている排出源
  影響を及ぼし、測定可能
- 重要かつﾌﾟﾛｼﾞｪｸﾄ活動に起因する。

Glossary of CDM terms

バウンダリー



PDDのレビュー

ベースラインスタディと追加性

追加性の正当性 :バリア(実施上の障壁)分析

- 投資上のバリア
- 技術上のバリア
- 習慣上のバリア
- 他のバリア:

方法論に従がっているか？

PDDのレビュー

3　排出削減量の算定

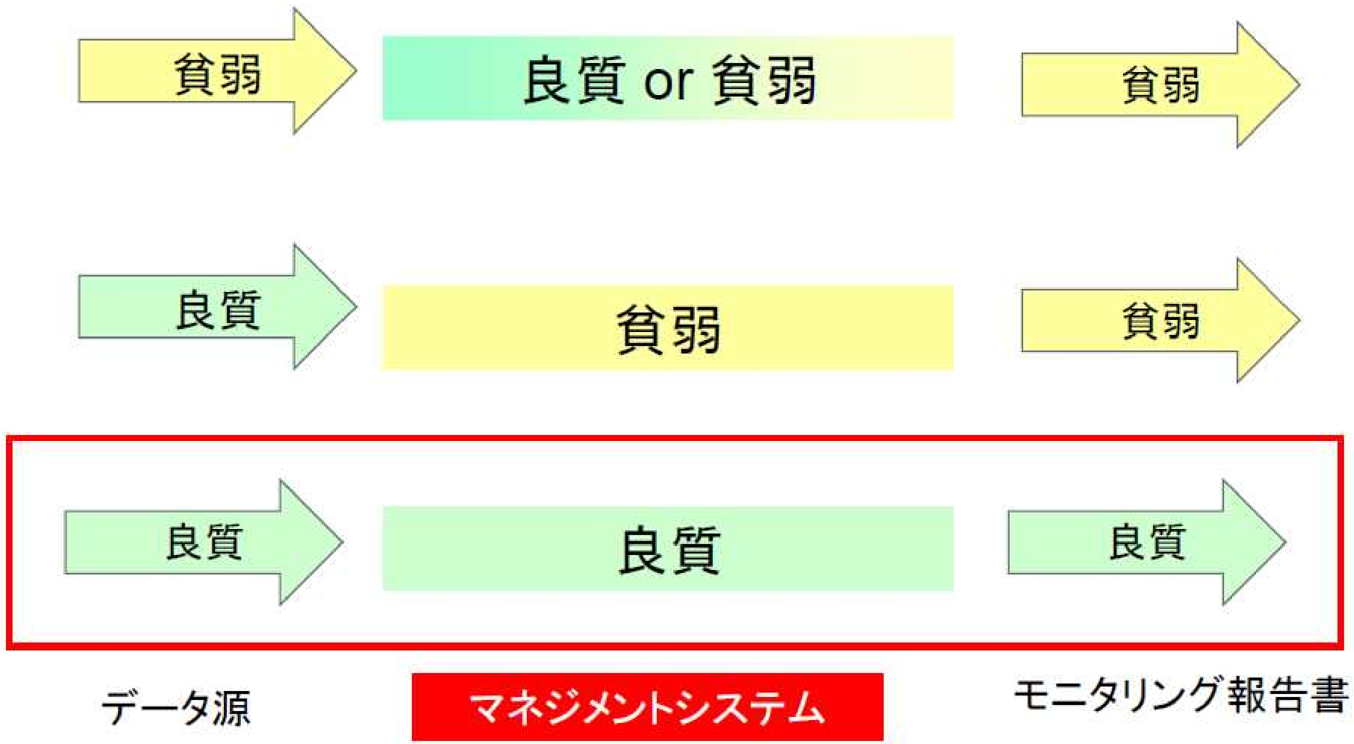
- 境界の設定は適切か?
- 全ての排出源は考慮されているか?
- 全ての6ガスを考慮しているか?
- リーケージは?
- 合理的で保守的な仮定の下で、全ての排出量は算定されているか?
- 現時点での削減量の推定("ex ante" の計算)

PDDのレビュー

4 モニタリング計画 (“*ex post*” での測定)

- クレジット獲得できる算定システムとなっているか。
- 選択した方法論に沿っていること。
- 排出量を導く
  - ベースライン排出量
  - プロジェクト活動排出量
- 適切なマネジメントシステム
- 実際のプロジェクトに沿っていること。

情報マネジメント



情報マネジメント

情報マネジメントシステム、確認事項の例

- プロジェクトマネジメントの責任・権限は明確か？
  （測定・計算・報告書作成・レビュー等）
- 要員の教育・訓練の手順は考慮されているか？
- 緊急時対策は考慮されているか？
- 測定機器の管理・校正の手順と妥当性は考慮されているか？
- 文書・記録類の取り扱い、維持の手順は考慮されているか？
- 内部監査・パフォーマンスレビューのしくみはあるか？
- 是正処置の手順は考慮されているか？

PDDは検証の際の参照資料となる

PDDのレビュー

1. Project Details
2. Application of Methodology
3. Quantification of GHG Emission Reductions and Removals
4. Monitoring
5. Environmental Impact
6. Stakeholder Comments

4. 環境影響

- EIAは必要か?
- 特定された潜在的な環境への影響?
- 越境する影響を含む

5. ステークホルダーのコメント

- 適切なステークホルダーが選定されているか?
- 適切なコミュニケーション手法がとられているか?

REDD+　審査の際の留意点

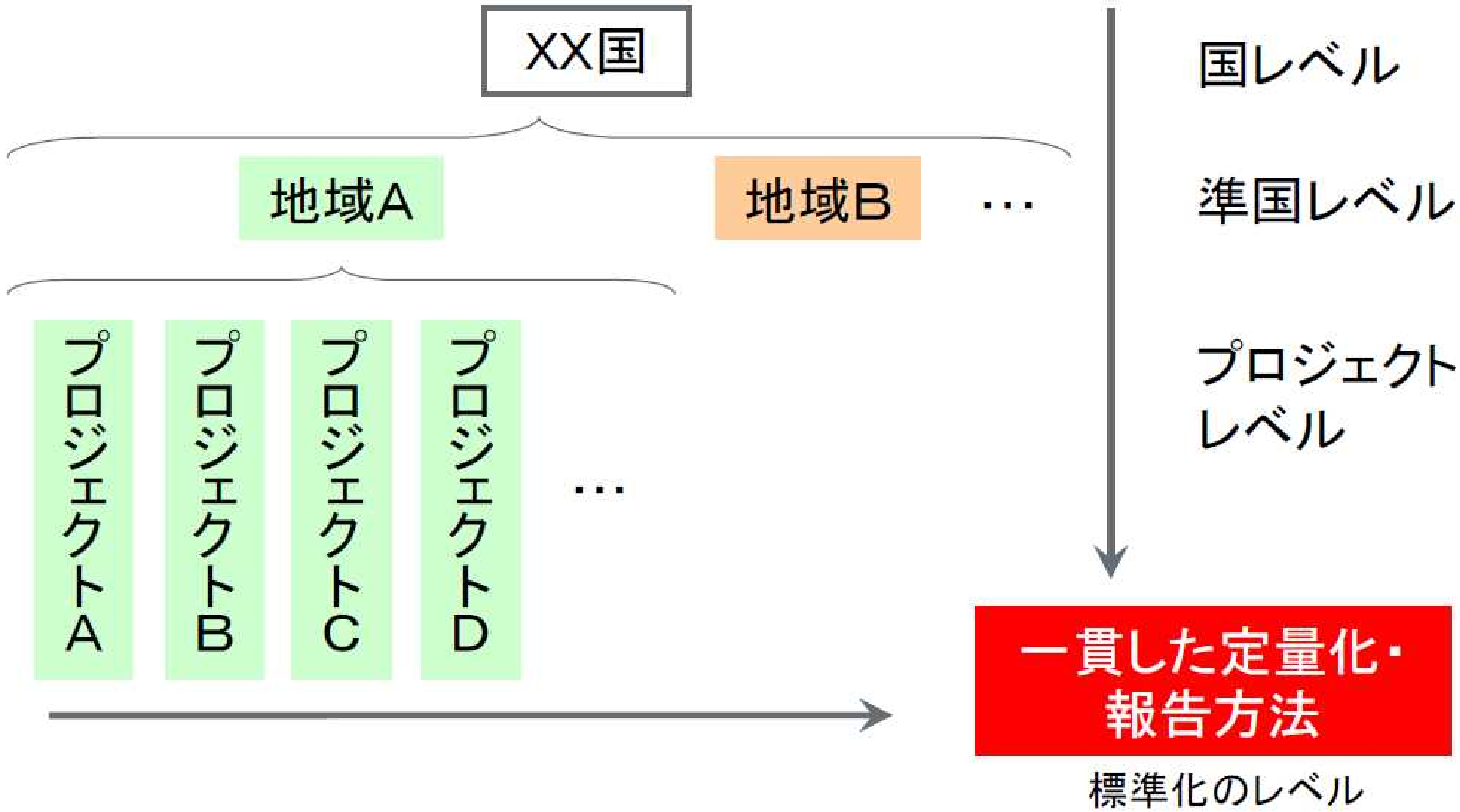
REDD+の留意点

- 削減プロジェクトのレベル
- バウンダリー
- 参照レベル
- 算定方法
- モニタリング体制
- 保全活動の有効性
- 温暖化以外へのインパクト
- セーフガード

どこまで審査で見るべきか？

判断基準は？

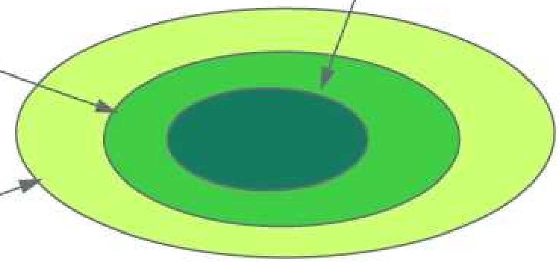
REDD+の留意点1:レベル



REDD+の留意点2：バウンダリー

通常三つのバウンダリー

- プロジェクトエリア：
  プロジェクト活動の境界
- リファレンスリージョン（参照エリア）：
  リファレンスレベル（ベースライン）を決定する際に用いるエリア
- リーケージベルト：
  リーケージを監視するエリア



REDD+の留意点2:バウンダリー

リモセンや公的データ(例えば行政区画など)で決定。

不確実性の評価(例えばリモセンの解像度など)。

REDD+の留意点2:バウンダリー

□ プロジェクトエリア

活動実行可能なバウンダリー設定か？
複数のサイトが点在しているときのサンプリングは？
衛星画像の解像度の判断は？
バウンダリー確認のためのサイトを、どのように回るか？

□ リファレンスリージョン

プロジェクトエリアより広く、類似性のある地域

- 森林へのアクセス/ 土地利用/ 森林減少の要因
- その他

□ リーケージベルト

森林削減活動が移転する可能性を分析し、エリアを特定

- 生産物の生産コスト/ 生産物の消費方法/ 輸送コスト
- その他

REDD+の留意点3:参照レベル

参照レベル(Reference revel)

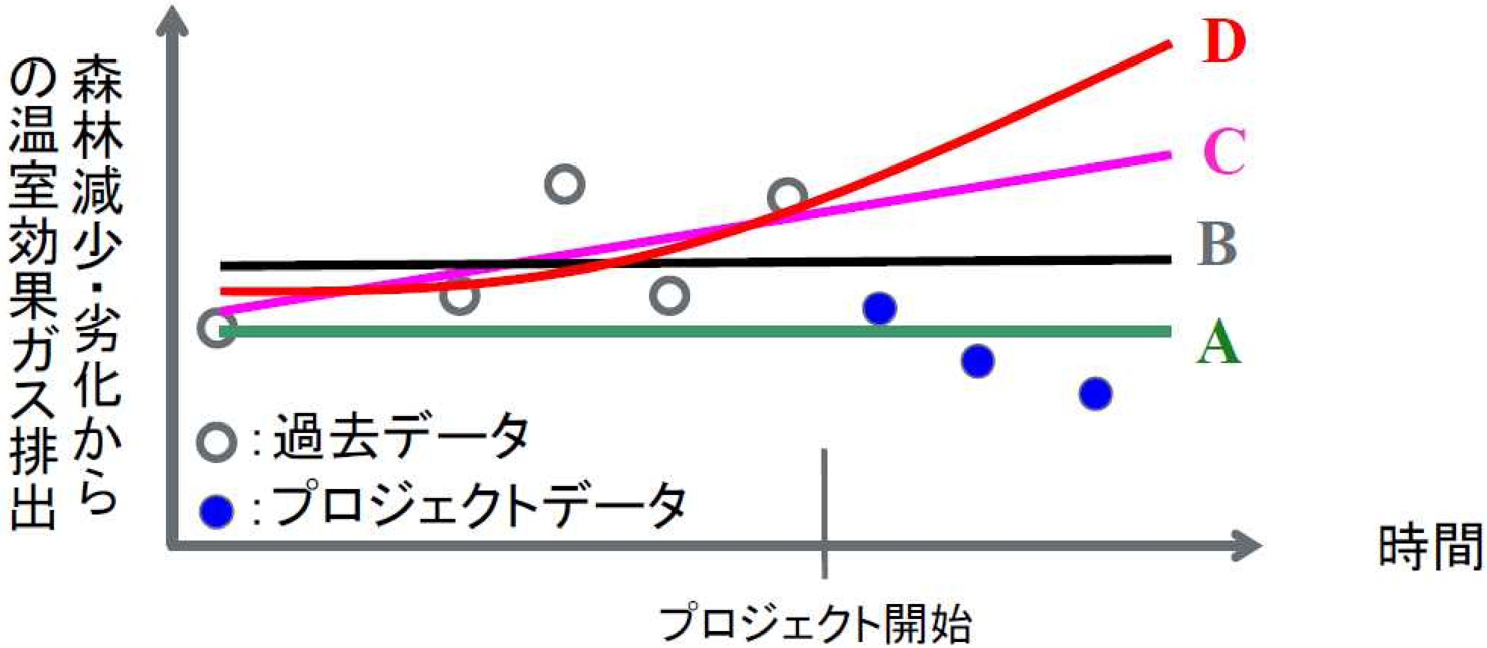
REDDプロジェクトが実施されない場合、GHGの排出はどうなるか。

これまでの森林伐採とGHG排出量の傾向からの推定。

GHG削減プロジェクトのベースライン

REDD+の留意点3:参照レベル

定量化、モニタリング、報告の原則を満たすシナリオの選択



国レベル、準国レベル、プロジェクト毎に設定？？

REDD+の留意点3:参照レベル

- □ 森林減少・劣化の原因の明確化と、選択したシナリオとの整合性。
- □ 対象国や地域の状況との整合性。
- □ 国、準国レベルとの整合性

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REDD+の留意点4:算定方法

$$E_{harvest,it} = \left(\frac{44}{12}\cdot\left(C_{BH,it}^{extracted} - C_{BH,it}^{woodproducts}\right)\right) + E_{BH,BiomassBurn,it}$$

$$R_{B,growth,it} = R_{ARB,it}\cdot A_{it}^{planted}\cdot\frac{44}{12}$$

$$\Delta C_{B,AG,it} = E_{timber,it} + E_{B,BiomassBurn,it} - R_{B,growth,it} + E_{harvest,it}$$

$$E_{B,drainage,it} = A_{B,drain,it}\cdot ME_{B,dd,it}$$

$$+ \quad E_{B,p,it} = E_{B,Drainage,it} + E_{B,PeatBurn,it}$$

$$E_{timber,it} = \left(C_{B,it}^{extracted} - C_{B,it}^{woodproducts}\right)\cdot\frac{44}{12}$$

$$E_{B,PeatBurn,it} = E_{B,PeatBurn,CO2,it} + E_{B,PeatBurn,CH4,it}$$

$$E_{B,BiomassBurn,it} = E_{B,BiomassBurn,CO2,it} + E_{B,BiomassBurn,N2O,it} + E_{B,BiomassBurn,CH4,it}$$

VM0004より抜粋

REDD+の留意点4:算定方法

- 多くの式と係数
- 様々なサンプリング手法
- サンプリング結果からの推定方法
- ････　方法論との整合性。
- 基本はIPCCのはず。

REDD+の留意点4:算定方法

保守性の適用

**適切性, 完全性, 一貫性,
正確性, 透明性**

A. General description of project activity
B. Application of a baseline and monitoring methodology
C. Duration of the project activity / Crediting period
D. Environmental impacts
E. Stakeholders' comments

リスクを減らす

情報の追加　　**保守性の原則**

REDD+の留意点5:モニタリング体制

モニタリングに現地の住民の参加?

有効なモニタリング体制の構築

REDD特有の留意点6:保全活動の有効性

- 森林火災防止活動
- ステークホルダーへの啓蒙
- 農業支援活動
- 森林パトロール
- その他、様々な保全活動

➡ 活動の有効性は考慮せず、カーボンストックの変化のみをモニター、検証？

REDD特有の留意点7：温暖化以外へのインパクト

- □ 生物多様性やエコシステムへの影響
- □ 社会経済的影響
- □ 環境への影響
- □ プロジェクトバウンダリー外への上記の影響

CDM-VVM（v1.2）パラ159-161

社会経済的影響、生物多様性や自然エコシステムを含む環境への影響、プロジェクト境界外への影響の分析に関して、DOEは確認すること。

REDD特有の留意点8:セーフガードの確認

例えば以下のような事態への予防処置

- 天然林の人工林への転換
- 先住民族や地域住民への悪影響

REDD特有の留意点8：セーフガードの確認

セーフガードの項目（COP16, Annex I Para2）：

(a) 国家森林プログラムや関連する国際条約・国際合意を補完し、整合性を保った活動;
(b) ホスト国の法令・主権を踏まえ、透明かつ効果的な国家森林ガバナンスを促進・支援;
(c) 先住民や地域住民の知見や権利の尊重;
(d) 先住民・地域コミュニティなど、関係するステークホルダーの参加;

(e) 天然林・生物多様性保全と整合性があり、社会・環境的便益の増強となる行動を促進・支援;
(f) 森林に蓄積された炭素の再放出予防の活動（非永続性）;
(g) 排出の移転（リーケッジ）予防の活動

REDD特有の留意点8：セーフガードの確認

セーフガードの情報提供システム（COP17）

セーフガードへの配慮、具体的にとられた措置についての情報を定期的に提供すること（全活動実施期間）。

バリデーション、ベリフィケーションにおいて、評価すべきか？？？

Question

バリデーションの留意点

削減プロジェクトのレベル

バウンダリー

参照レベル

算定方法

モニタリング体制

保全活動の有効性

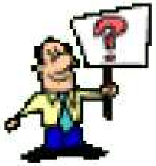
温暖化以外へのインパクト

セーフガード

どこまで審査で見るべきか？

判断基準は？

Any Questions?



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第 4 章

REDDプロジェクトPDDの作成に向けて③

三菱UFJリサーチ＆コンサルティング
平塚基志

平成25年度　REDDプラスに係る森林技術者講習　応用講習（b）
-REDDプロジェクト開始に必要なプロジェクト設計書（PDD）の作成実習-

PDD作成に係る留意点

平塚 基志（三菱UFJリサーチ＆コンサルティング）
hiratsuka@murc.jp

Mitsubishi UFJ Research and Consulting

Project Design Document（PDD）とは？

- □ **PDDとは何か？**
  - □ CDMでは『Project Design Document（PDD）』
  - □ VCSでは『Project Description（PD）』
  - □ オフセット・クレジット（J-VER）制度では『プロジェクト計画書
    （参考資料として配布）

<u>⇒ 名前は異なっても、記載する内容に大差はない。</u>

VCS | VERIFIED CARBON STANDARD　CCB Standards　PROJECT DESCRIPTION
VCS Version 3, CCB Standards Second Edition

<u>*VCS+CCB Project Description Template*</u>

<u>*Instructions for completing the template:*</u>

TITLE PAGE: All items in the box at the bottom of the title page must be completed using Arial 10pt, black, regular (non-italic) font. This box must appear on the title page of the final document. Project descriptions may also feature the project title and preparers' name, logo and contact information more prominently on the title page, using the format below (Arial 24pt and Arial 11pt, black, regular font).

PROJECT DESCRIPTION/DESIGN DOCUMENTATION: The project description is a detailed description of the project and the ways in which it meets the required and optional criteria of the Verified Carbon Standard (VCS) and Climate, Community & Biodiversity (CCB) Standards.

Instructions for completing this joint VCS & CCB Standards template can be found under each section heading in blue or green italicized text. The blue text represents guidance for the carbon component of the project description that must follow VCS project-level requirements and the applied VCS methodology. The green text represents guidance for the community and biodiversity components of the project description that must follow CCB Standards requirements and includes a cross reference to the relevant CCB Standards criteria. It should be noted that the instructions provided in this document are meant to help and aid the user in completing the template and the instructions do not represent the VCS or CCB Standards requirements. All requirements are found in the relevant VCS program and CCB Standards documents and these documents should be consulted before completing this template.

All sections must be completed using Arial 10pt, black, regular (non-italic) font. Sections which are not applicable may be left blank but should NOT be deleted from the final document. All instructions, including this introductory text, should be deleted from the final document.

PROJECT TITLE

Logo (optional)

Document Prepared By (individual or entity)

Contact Information (optional)

Project Title	*Name of project*
Version	*Version number of this document*
Date of Issue	*DD-Month-YYYY this version of the document issued*
Prepared By	*Individual or entity that prepared the document*
Contact	*Physical address, telephone, email, website*

v3.0　1

VCS及びCCBS認証に申請する際のPD様式

1

Mitsubishi UFJ Research and Consulting

クレジット発行までの作業におけるPDDの位置付け-1

全体の流れ	プロジェクト実施者（ラオス政府もしくはNGO）	第三者検証機関（適切な機関：選択可能）	VCS事務局
プロジェクト申請書の作成	【申請書の作成】 方法論に基づき、プロジェクト申請書を作成する。申請書には、GHG排出削減・吸収を実現するにあたっての多量の情報が必要になる。	VCSガイドライン基づき有効化審査を実施	VCSではCDMのDOE、ISO14065審査機関、及びその他VCSの指定を受けた第三者検証機関を指定
プロジェクト有効化審査		【有効化審査】 対象プロジェクトとして適格か、また排出削減量・吸収増大量の算定が正しいか等を評価・判断する。	
プロジェクト登録			【プロジェクトの登録】

REDDプラスプロジェクトの登録のために必要となる計画書

クレジット発行までの作業におけるPDDの位置付け-2

全体の流れ	プロジェクト実施者（ラオス政府もしくはNGO）	第三者検証機関（適切な機関：選択可能）	VCS事務局
モニタリング	【モニタリング】プロジェクト実施者は計画に従いモニタリングを実施（モニタリング報告書の作成）		VCSではCDMのDOE、ISO14065審査機関、及びその他VCSの指定を受けた第三者検証機関を指定
クレジット検証	VCSガイドラインに基づき実施	【クレジット検証】検証機関はプロジェクト実施者からのモニタリング報告書について検証報告書を作成	
クレジット認証			【クレジット認証】VCS事務局が検証機関からの報告書が完全かどうかを決定し、クレジットを認証
クレジット発行・登録・管理			【クレジット発行・登録・管理】VCS事務局がクレジットを発行

REDDプラスプロジェクトからのクレジット量の定量化のために必要となる報告書

Mitsubishi UFJ Research and Consulting

3

PDDには何を記述するのか-1

□ **PDDには何を書くのか？**

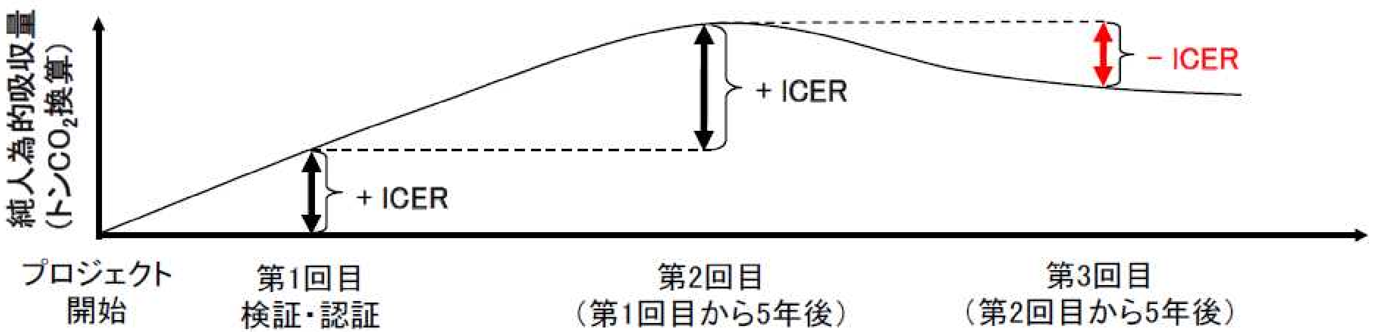
⇒ プロジェクト実施にあたっての計画書であり、誰が、どこで、いつ、どのようにプロジェクトを実施し、どの程度のGHG排出削減・吸収量が見込まれるかを示すものである。

⇒ GHG排出削減・吸収量は「事前推計」の結果であり、仮の値である。

□ **省エネ等のプロジェクトとの相違点は何か？**

⇒ 森林吸収源には「特有の課題」があり、それら課題への対処方法を丁寧に説明することが求められる。CDMではプロジェクトタイプの結果から「非永続性」への対処方法が異なっている（以下）。

ICER発行：前回の認証時以降達成された純人為的吸収量に相当するICERが発行される。純人為的吸収量が減少した場合は、補填しなければならない。



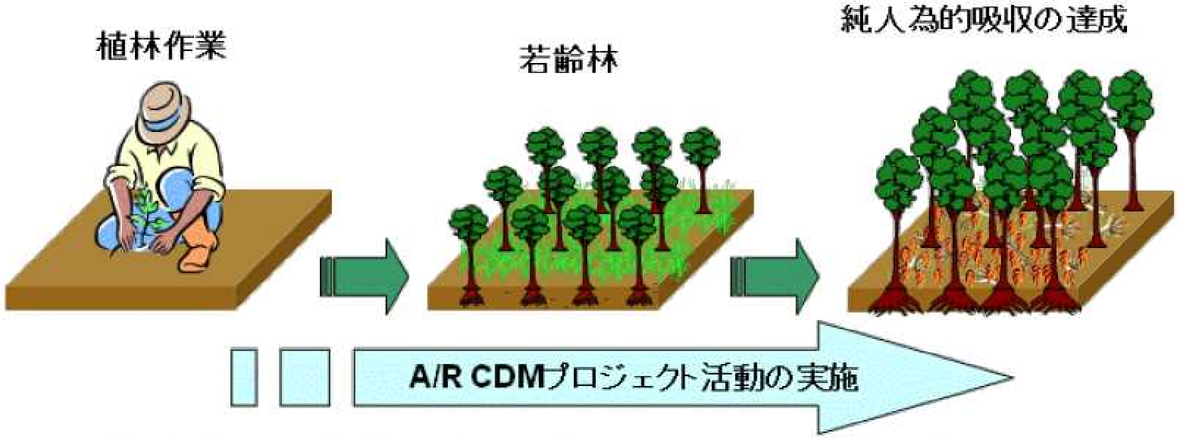
A/R CDMでの非永続性への対処として導入された期限付きクレジットの考え方

PDDには何を記述するのか-2

□ **A/R CDMとREDDプラスの違いは何か？**

⇒ 非森林地から森林への土地利用変化（土地転用）分を定量化することになるが、土地利用変化のあった面積は比較的算定しやすい。

⇒ 植林活動は分かりやすい。植林された森林の成長量を算定するのであり、森林の成長に関する研究成果に基づくことができる。



A/R CDMでの吸収量の位置付け（非森林から森林への土地転用）

Verified Carbon Standard（VCS）におけるPDの目次

1 Project Details

Verified Carbon Standard(VCS)におけるPDの目次(つづき)

方法論の選択

☐The project applied "VM0015 "Methodology for Avoided Unplanned Deforestation"".

Applicability Conditions of VM0015	Reasons for justifications
a) Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities as long as the category is unplanned deforestation according to the most recent VCS AFOLU requirements.	The project promotes activities that avoid deforestation and forest degradation in the *HK-VC which is not under planned activities.* Therefore, it is categorized as the Avoided Unplanned Deforestation and/or Degradation (AUDD) of REDD.
b) Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology.	Baseline activities include deforestation and forest degradation in natural and secondary forests by pioneer shifting cultivation and other human activities including expansion of grazing area and so on. Therefore, the project is categorized as the Avoided Unplanned Deforestation and/or Degradation (AUDD).
c) The project area can include different types of forest, such as, but not limited to, old-growth forest, degraded forest, secondary forests, planted forests and agro-forestry systems meeting the definition of "forest".	Although there is not an official definition of forest under REDD+ activities in Lao PDR, the Lao PDR's Government has adopted parameters to define forest under Forestry Strategy 2020 and forest classification.
d) At project commencement, the project area shall include only land qualifying as "forest" for a minimum of 10 years prior to the project start date.	From results of satellite imagery analysis from 1994 to 2004, we confirmed that land use of the project area is categorized as "forest".
e) The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable.	The forest land located within the project boundary is characterized by seasonal tropical forest, therefore no forested wetland is found within the project area.

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PDD作成に係る留意点（UNFCCCでの議論とも関係）

【REL/RL】
堅牢かつ高い透明性を確保したREL/RLの設定が求められる。

プロジェクト実施しなかった場合 ≒ 参照レベル
※過去のトレンドに加えて、国の状況（National Circumstances）の反映が大きな課題となっている。

【MRVシステム】
REDDプラス活動で得られたGHG排出削減・吸収量の算定には、十分なMRVシステムの適用が必要になる。

画像解析及び地上調査で定量化した複数時点のGHG排出量

【国家森林モニタリングシステム】
国もしくは準国ベースで森林面積や森林炭素ストック量の定量化にあたっては、国家森林モニタリングシステムの整備・運営を欠かすことができない。

GHG排出削減量・GHG吸収量
※REDDプラス活動により、「活動による効果」をGHG排出削減量として定量化する必要がある。

プロジェクト実施によるGHG排出・吸収量
※REDDプラス実施で、GHG排出量が減少する。

【ドライバー特定】
REDDプラス実施後のGHG排出量を試算/算定するためには、森林減少・劣化のドライバーを特定し、それらへの対処を行った際の効果を定量化する必要がある。

過去の森林減少・劣化によりGHG排出量の算定（トレンド解析）

過去のトレンド及びNational Circumstancesに基づきGHG排出量を推定

【セーフガード】
REDDプラス実施でGHG排出削減・吸収量を獲得できても、他に負の影響がでないよう配慮する必要がある

9

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PDD作成に係る留意点

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1. **MRVシステム及び国家森林モニタリングシステムとの関係**

   ⇒ 森林劣化とは「森林としての土地利用のまま炭素ストック量が変化すること」であり、そのモニタリング技術が求められる。算定にあたり一定水準の精度が求められる。

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   ⇒ 参照レベルの設定方法で発行されるクレジット量の大小が大きく変化する。基本的には将来予測に基づき設定するものなので、完全な正解はない。重要なのは設定の際の透明性の高さになる。

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1. MRVシステム及び国家森林モニタリングシステムとの関係

- 森林炭素ストック量（GHG排出・吸収量）の算定にあたっては。森林面積（活動量）をリモートセンシング、排出/吸収係数（面積あたりの炭素ストック量）を現地調査で特定することとなる。

森林面積（ha） × 排出/吸収係数（炭素ストック量/ha） ＝ 炭素ストック量の算定（GHG排出・吸収量の算定）

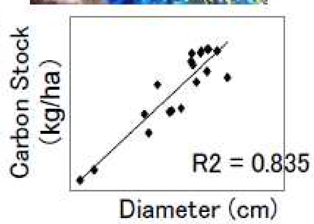
リモートセンシング

Integration

地上調査による補正

地上調査

Develop volume table



炭素ストック量の算定
（GHG排出・吸収量の算定）

1. MRVシステム及び国家森林モニタリングシステムとの関係

【画像解析の精度に関する考え方】

- 画像解析の精度評価のためのグランドトゥルースの抽出方法には、単純無作為抽出と層化抽出の2つの方法がある。
- 単純無作為抽出では、分類結果によらず無作為にグランドトゥルースを抽出するので、森林タイプ区分ごとの抽出確率が実際の面積比に比例すると期待される。国家森林資源調査など大規模な系統抽出も代用可能である。サンプル数が少ない場合、面積比の小さな森林タイプ区分に大きな誤差が生じる可能性がある。
- 層化抽出では、森林タイプ区分ごとに任意にサンプル数を割り振って、森林タイプ区分 ごとに無作為に抽出する。調査資源を効率的に配置できるため、リモートセンシングプロジェクトではこのようにサンプルを抽出することが多い。

出典：森林総合研究所「REDD-plus COOKBOOK」

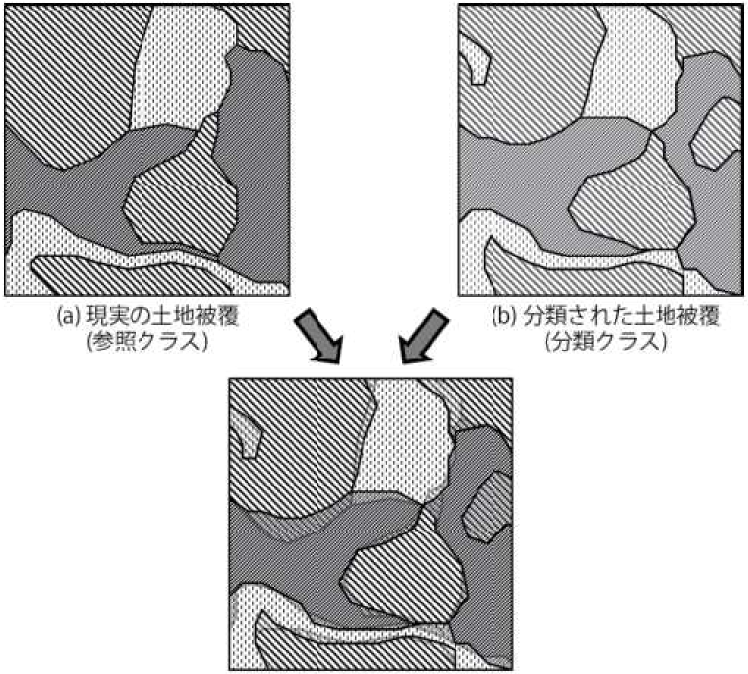


図　現実の世界と衛星画像から分類された地図の土地被覆

実際には(a)を特定することができず、画像解析により求められる(b) しか得られない。このため、サンプル(グランドトゥルース) を地図上で抽出して(a) と(b) を比較し、地図の精度とバイアスを推定しなければならない。

1. MRVシステム及び国家森林モニタリングシステムとの関係

【画像解析の精度に関する考え方】

□ SOURCEBOOKでは中解像度の画像解析により森林/非森林の解析精度として**「80～95%は達成可能」**としている。

□ VCSでは複数の方法論で具体的に解析精度の要求水準を定めている(以下)。

方法論	活動タイプ	対象地域		精度の要求水準		プロジェクト例
		対象地域	対象森林	森林／非森林区分	森林タイプ区分	
VM0004	計画された森林減少の抑制	東南アジア熱帯地域	熱帯泥炭林であること、また居住地を含んではならない	80%	―	□土地利用区分は、①泥炭湿地林(劣化度:小)、②泥炭湿地林(劣化度:大)、③泥炭低木地(樹冠率20%未満)、④ケランガス林、⑤ケランガス開放低木地、⑥季節的浸水地、⑦開水面　の7区分としている。 □インドネシアの事例では、判読精度は81.3%と記されている
VM0006	モザイク状の森林減少・劣化の抑制	全世界	全森林	70%	70%	□土地利用区分は、①常緑林、②落葉樹林・混交林、③非森林の3区分としている。 □カンボジアの事例では、判読精度は94%以上と記されている。
VM0015	計画外の森林減少の抑制	全世界	泥炭林は対象外	90%	80%	□土地利用区分は、①常緑樹林、②季節林、③非森林、④水域の4区分としている。 □CIジャパンのFS事業(カンボジア)では、判読精度(正しく分類された点数／正しい点数)は、常緑樹林80%、季節林85%、非森林72%、水域100%で、全体で81%と記されている。

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1. MRVシステム及び国家森林モニタリングシステムとの関係

【VCS方法論0015 における地上調査の概要】

- □ **サンプリングの骨格**
  - □ 地上調査については、サンプルサイズ、プロットサイズ、プロットの形状、プロットの位置をプロジェクト計画書に明記する必要がある。
  - □ プロットについては、プロジェクト対象地もしくは参照エリア内に設置することとし、設置方法としては一時的なプロット(Temporary Plot)でも永久プロット(Permanent Plot)でも構わない。
- □ **プロットサイズ及びプロット数**
  - □ プロットサイズはプロット数と大きく関係する。一般的にプロットサイズは100m^2～1,000m^{2}のプロットとなり、それに基づきプロット設置数を計算することとなる。
  - □ プロジェクト実施前にプロットサイズ及びそれによる算定精度を特定するのは困難である。既存文献から対象地の森林タイプ区分における炭素ストック量の変動係数、もしくはプロジェクト実施前に取得する各森林タイプ区分における炭素ストック量の標準偏差に基づき特定する方法が紹介されている。
- □ **プロット配置**
  - □ 恣意的なプロット配置を避けるため、システマティックサンプリングが望ましい。<u>ただし、道路状況等でアクセス困難な位置にプロットを配置するのは現実的ではない。その際は、透明性及び保守性に留意しつつ、道路沿いや川沿い等にバッファー(林縁効果を避けるためのエリア)を確保して、プロットを配置する。</u>
  - □ 上述した通り、プロジェクト実施前にプロット数を特定することは困難であるが、プロット数の特定にあたっては周辺地域を対象に含む森林インベントリ等を活用する方法がある。

PDD作成に係る留意点（再掲）

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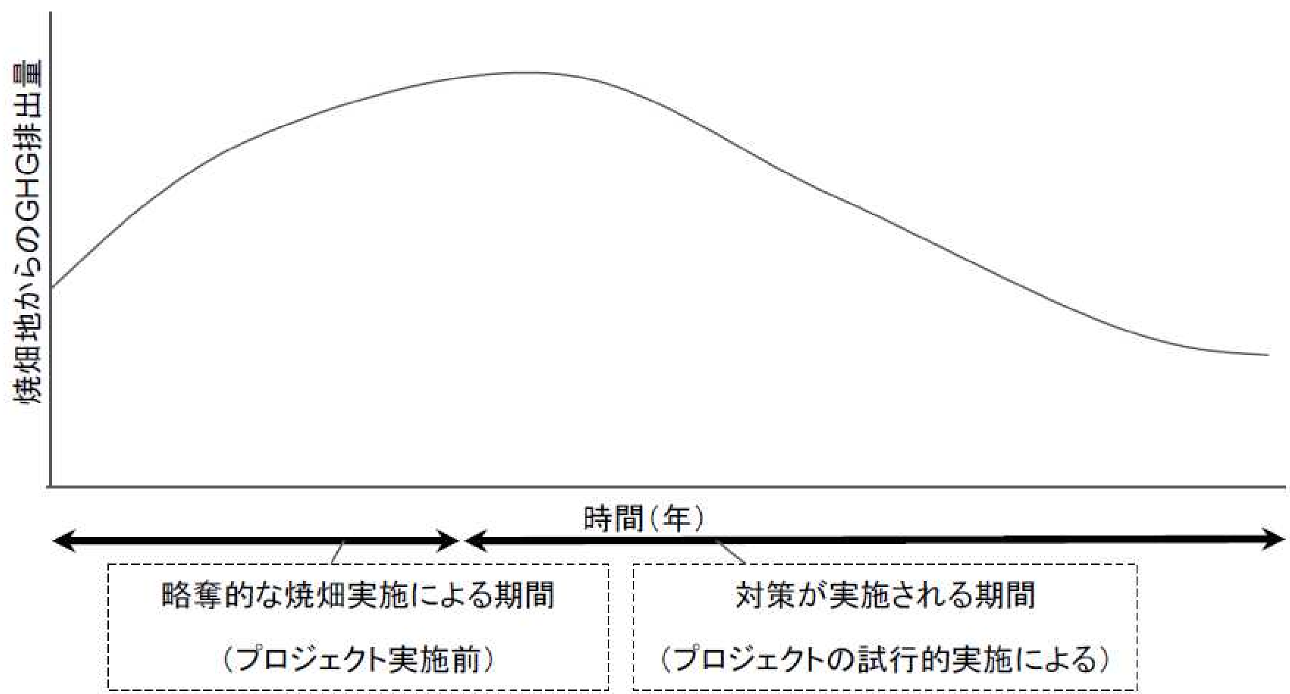
- 例えば、森林減少・劣化のドライバが略奪的な焼畑地の拡大である場合、それへの対策として持続的な焼畑農業の導入や焼畑以外の生計手段の導入を行う。このことで、実施に得られる森林減少・劣化の面積・炭素ストック量から、GHG排出削減・吸収量を試算する。



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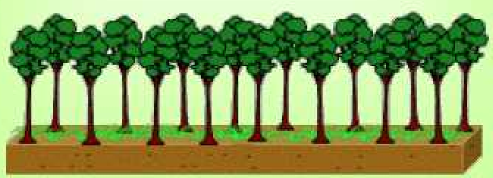
3. セーフガードへの配慮

□ セーフガード（社会経済面）への配慮に欠けた例（イメージ）

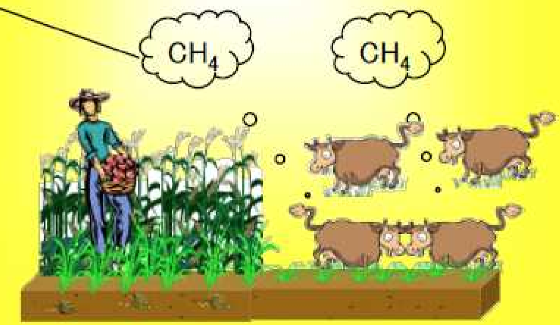
1. プロジェクト実施前、プロジェクト境界内では、林内放牧が行われていた。

2. プロジェクト活動により、住民の活動が強制的に制限された。



3. プロジェクトに起因し、プロジェクト境界外に放牧地が移動した。それに伴い、プロジェクト境界外で温室効果ガス（CH_4など）の排出が増大した。

ウシ1頭あたりのCH_4排出量は80-120kg/年 [GPG LULUCF]



3. セーフガードへの配慮

□ セーフガード（生物多様性面）への配慮の方向性（ラオスの例）

National Biodiversity and Action Plan　12の原則
1. Biodiversity is a national heritage and must presently be used in a sustainable manner and be conserved and protected for future generations.
2. The NBSAP must be fully consistent with the Socio-economic Development Strategy up to the years 2010 and 2020 and with efforts to attract foreign investment.
3. The NBSAP must be based on an analysis of the present status of the environment, but must also take into account the emerging trends of industrialization and modernization.
4. The national development process must reflect ecological, economic, social, cultural and spiritual values of the local people.
5. The sustainable use of biodiversity is a key element of livelihood strategies.
6. The knowledge, innovations and practices of local people should be respected and their use and maintenance of biodiversity carried out with the support and involvement of their people.
7. Biodiversity is best conserved in-situ.
8. The conservation and sustainable use of biodiversity resources require co-operation at all levels, namely local, national, regional and global and also a sharing of knowledge, costs and benefits.
9. The NBSAP should address biodiversity depletion, improve the data and information status and provide a link between biodiversity and economic development.
10. The formulation and implementation of policies and the establishment of a legal framework are necessary as effective measures against biodiversity depletion.
11. Education and the raising of public awareness are essential in ensuring the conservation and sustainable use of biodiversity resources.
12. The integration of conservation and development is one form of sustainable PA management.

政府の政策・戦略面への対応	ラオスの国内法、各郡で作成される開発計画、各種統計資料等に基づき、現状と今後の動向分析を行い、ラオス政府の戦略・計画に反しないよう計画の作成・実施を進める。
現地住民（現地資源）への対応	現地ローカルコンサルタントやプロジェクトカウンターパートを介したワークショップやヒアリング等に基づき、地域住民の知見や意見、現地の実情等を把握し、計画・実施に反映する。
実施プロセスへの対応	プロジェクト対象地における実施プロセスはFPIC等の原則に基づき、様々なステイクホルダーが参加し、各々の享受している便益の把握、及び活動実施による費用やベネフィットの共有を図るとともに、REDDプラス活動を進める。

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4. 参照レベルの設定（案）

1.過去の複数時点の森林面積及び炭素ストック量から、トレンドを解析

一般に途上国における森林減少・劣化はエルニーニョ等の自然現象や経済状況に大きく影響を受け年により変動が大きい。このため、過去の森林減少・劣化の動態を解析するにあたっては、参照する過去の時点数が少ないとトレンド把握が困難になる。一方、過去の時点数を多くすることは、労力及びコスト面で大きな負担になる。

※ 上記課題は以下のTier 1からTier 3まで共通である。

2-1.過去のGHG排出量の平均値から設定する方法（Tier 1：精度低）⇒（29頁）

2-2.過去からのトレンドに基づく回帰式で設定するする方法（Tier 2：精度中）⇒（30頁）

2-3.森林減少・劣化のドライバーの分析結果及び経済動向等のNational Circumstancesを反映して設定する方法（Tier 3：精度高）⇒（31頁）

3.必要に応じて参照レベルを適宜更新する。

森林減少・劣化のドライバーが事業実施後に変化することも考えられる。このため、必要に応じて参照レベルを更新していくことを検討する。更新方法にあたっては、UNFCCCにおける先進国の森林吸収源に関するルールや今後の動向に留意する必要がある。

4. 参照レベルの設定（案）-参照レベル設定の作業ステップ（Tier 1）-

2-1.過去のGHG排出量の平均値から設定する方法（Tier 1：精度低）

⇒（方向性）過去のGHG排出量の平均値を算定するにあたり、最低限の時点数として[3] [4] [5] 時点に基づくこととする。また、そのうち1つは最低でもプロジェクト実施時より[5] [7]年以上前、そして、うち1つは直近[5] [3] [2]年以内とする。

⇒（方向性）過去に大規模な森林火災等があり、GHG排出量が大きく年変動している場合は、保守的なGHG排出削減・吸収量となるよう[証明する] [説明する]必要がある。

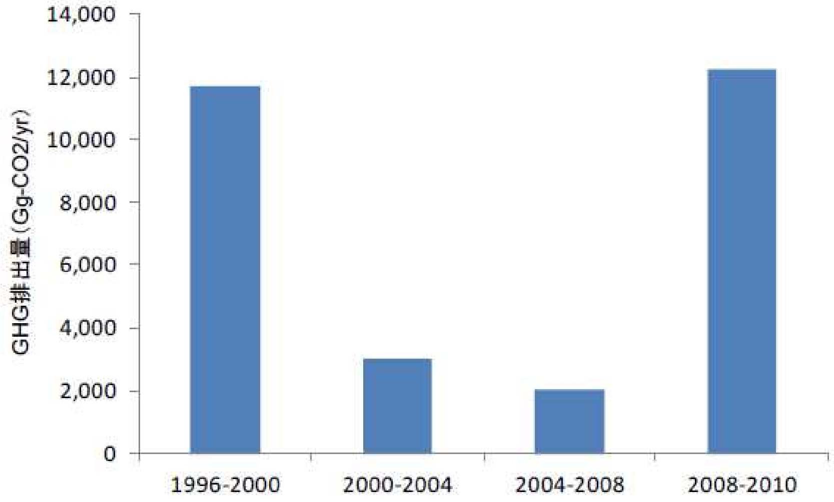


図 過去5時点のGHG炭素ストック量から求めた4期間におけるGHG排出量（中央カリマンタンの例）

※年平均のGHG排出量は7,248Gg-CO2、標準偏差は±5,498Gg-CO2、最大値は12,257Gg-CO2、最小値は2,019Gg-CO2

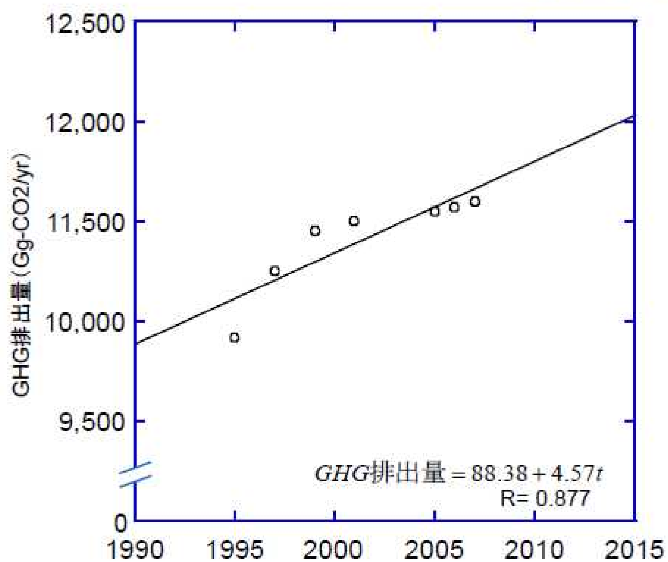
4. 参照レベルの設定(案) -参照レベル設定の作業ステップ(Tier 2)-

2-2.過去からのトレンドに基づく回帰式で設定するする方法(Tier 2: 精度中)

⇒(方向性)過去からのトレンドに基づくにあたり、最低限の時点数として[3] [4] [5] 時点に基づくこととする。また、そのうち1つは最低でもプロジェクト実施時より[5] [7]年以上前、そして、うち1つは直近[5] [3] [2]年以内とする。

⇒(方向性)過去に大規模な森林火災等があり、GHG排出量が大きく年変動している場合は、保守的なGHG排出削減・吸収量となるよう[証明する] [説明する]必要がある。

⇒(方向性)適用する回帰式の選択にあたっては、直線回帰ではなくゴンペルツ曲線のような曲線が望ましく、GHG排出削減・吸収量を保守的に算定するようにする。



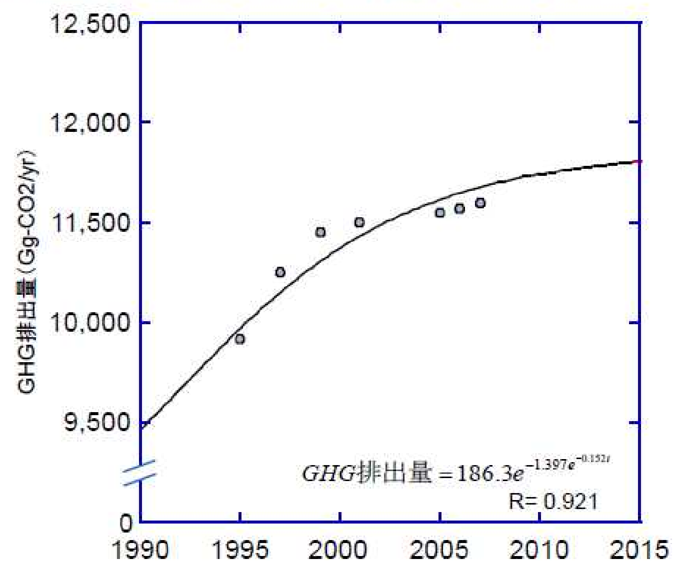


図 直線回帰とゴンペルツ曲線から設定した参照レベル(イメージ図)

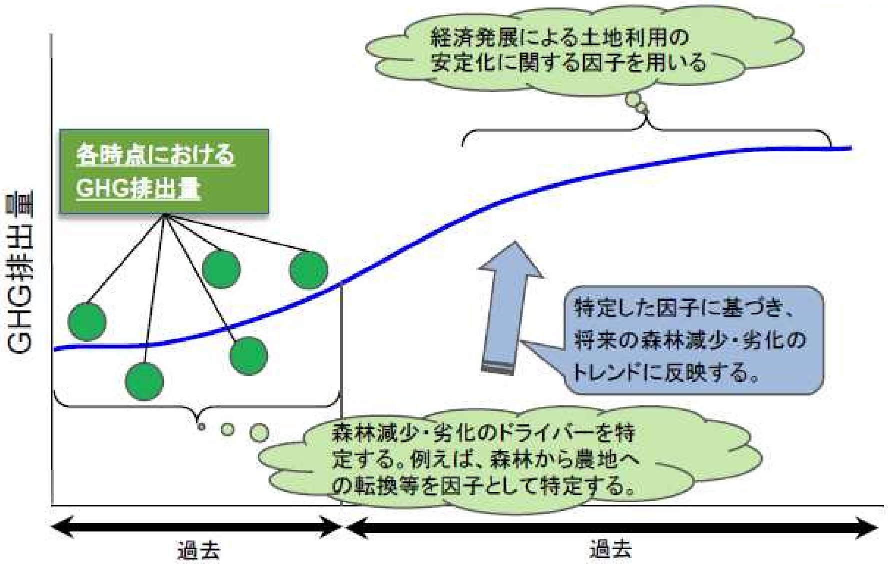
4. 参照レベルの設定（案） -参照レベル設定の作業ステップ（Tier 3）-

2-3.森林減少・劣化のドライバーの分析結果、及び将来に向けた森林・林業政策等のNational Circumstancesを反映して設定する方法（Tier 3：精度高）

森林減少・劣化のドライバーとしては、人為影響（人口、国内総生産（GDP）、道路総延長等）、及び自然影響（旱魃等）が考えられる。森林減少・劣化を抑制するためには、そのドライバーを適格に把握する必要がある。

⇒（方向性）過去のトレンドから、森林面積/炭素ストック量とドライバーの関係を明確化する。ドライバーの年傾向を把握するにあたっては、ホスト国の統計資料等、入手可能な情報に活用する。また、保守的な参照レベルであることを[証明する] [説明する]必要がある。

⇒（方向性）参照レベルの設定にあたり、National Circumstances（NC）を反映させる。その際も、保守的に適用したことを[証明する] [説明する]必要がある。



※NCとして反映する情報について、例えばプロジェクト実施前にドライバーとしてオイルパーム農園の増加を選択しても、実際にプロジェクト実施後に政策変更等でオイルパーム農園の増加が起こらない可能性もあり、その場合は反映した情報を実際の値に修正することが求められる可能性がある。その場合、オイルパーム農園の情報（統計情報）が継続的に入手可能かを考慮する必要がある。

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Mitsubishi UFJ Research and Consulting

PDD作成に係る留意点（再掲）

□ REDDプラス特有の課題とは何か？

1. MRVシステム及び国家森林モニタリングシステムとの関係

   ⇒ 森林劣化とは「森林としての土地利用のまま炭素ストック量が変化すること」であり、そのモニタリング技術が求められる。算定にあたり一定水準の精度が求められる。

   ⇒ REDDプラスを実施する国（ホスト国）の森林インベントリとの一貫性が求められる。

2. REDDプラス活動の妥当性（森林減少・劣化のドライバー特定及びドライバーへの効果的な対策の実施）

   ⇒森林減少・劣化への対策として、何が効果的なのか特定しにくく、その対策への評価も難しい。

3. セーフガード

   ⇒ 従来からの懸念事項が明確化され、その対策が必要になった。重要であるが、具体的に何を実施すればよいか判断しにくい。

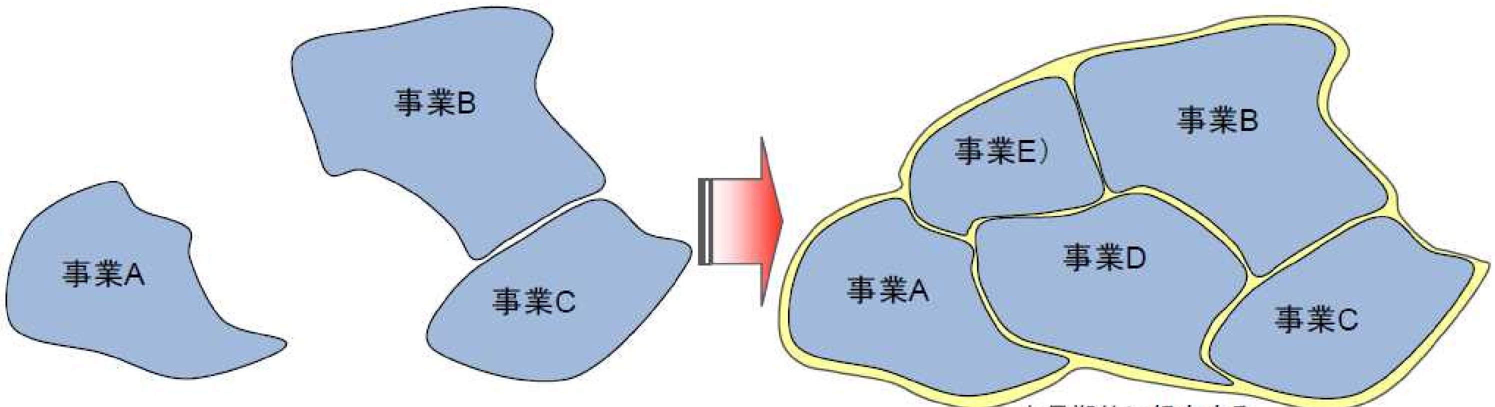
4. 参照レベルの設定

   ⇒ 参照レベルの設定方法で発行されるクレジット量の大小が大きく変化する。基本的には将来予測に基づき設定するものなので、完全な正解はない。重要なのは設定の際の透明性の高さになる。

5. **スケールの相違への対処**

   ⇒ プロジェクトベースの取組はホスト国における準国もしくは国ベースの取組の1部と位置付けられるため、一貫性が重要になる。

4. スケールの相違への対処 -スケールの考え方-



短期的にプロジェクトベースでのREDDプラス

中長期的に想定する
準国ベースでのREDDプラス

第５章

VCSの概要について

一般社団法人　日本森林技術協会
宗像 和規

VCSとは

Verified Carbon Standard (VCS)

・自主的炭素市場における温室効果ガス排出量削減・吸収プロジェクト活動から発生するクレジットについて、しっかりとした品質を保証するための基準を提供することを目的とする。

・2005年に、NPO等によって設立された。
The International Emissions Trading Association（IETA）
World Economic Forum
The World Business Council for Sustainable Development（WBCSD）
The Climate Group

VCS の組織構成

VCS協会
（VCS Association）

VCS事務局
（VCS Secretariat）

レジストリ（登記）の管理・
運営等を担当

VCS委員会
（VCS Board）

認証基準の改定などを
議論する場

AFOLUグループ
（Agriculture,Forestry and
Other Land Use）

農業・森林・その他の土地利用について技術的に支援

PDDからクレジット発行までの流れ

プロジェクト設計書の作成(PDD)	VCSの様式に基づきプロジェクト設計書を作成(PDD)を作成する。 また、GHG排出量の定量化を行うため、VCSで承認された方法論を選択する。
↓	
プロジェクトの妥当性確認(Validation)	第三者検証機関等により、プロジェクト設計書の妥当性確認　を行う。
↓	
プロジェクトの登録	第三者検証機関による審査を終え、VCS事務局にプロジェクトの登録を行う。
↓	
モニタリング報告書の作成	プロジェクト設計書の計画に従いモニタリングを実施する。 VCSの様式に基づきモニタリング報告書を作成する。
↓	
モニタリングの検証(Velification)	第三者検証機関等により、モニタリング報告書の検証を行う。
↓	
クレジットの発行･登録･管理	第三者検証機関による審査を終え、VCS事務局がクレジットの発行を行う。 クレジットは、VCS Program RegistryでVCS事務局が登録･管理を行う。

VCS のプログラム

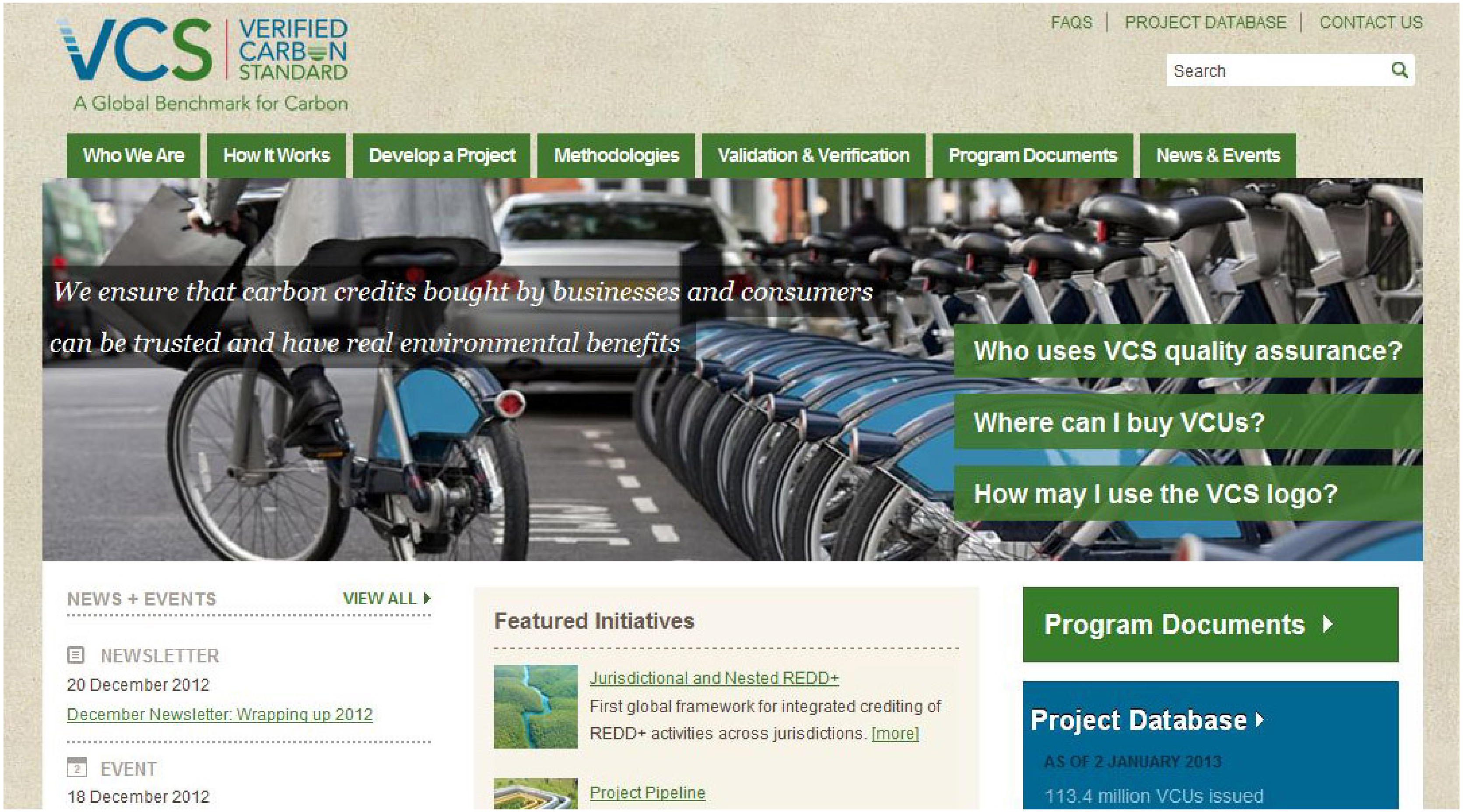
・VCSのプログラムには、認証された温室効果ガスの排出量削減とクレジットを発行するため、プロジェクト開発を行う手順、規則、要件などが示されている。

・プロジェクトの実施者は、プログラム文書に記載され、（実施するプロジェクトに）該当する全ての規則と要件を満たさなければならない。

・プログラム文書は、VCSのWebサイトから入手できる。

http://www.v-c-s.org/

VCS のホームページ



VCSのホームページより

VCSのプログラム文書

掲載されているプログラム文書の例

VCSプログラムガイドV3.5	包括的なVCSプログラムのドキュメント。 プロジェクトの登録、方法論、認証、検証機関の認定要件、レジストリシステムの機能など、VCSプログラムのルールと要件を記載。
VCSスタンダードV3.4	方法論、検証、モニタリング手法など、プロジェクトを実施する上での要件を記載。また、AFOLU(農業、林業及びその他の土地利用)やODS(オゾン層破壊物質）など、方法論の要件を踏まえた特定の側面から詳しく解説。
AFOLUの要件V3.4	AFOLU分野における方法論を開発するための詳細な要件を記載。
AFOLU非永続リスクツールV3.2	非永続リスクを評価するためのツール。プロジェクト実施者や、認証・検証機関が実施すべき具体的な手順を記載。
プロジェクトの説明V3.2	プロジェクトの説明（PD)のテンプレート
モニタリング報告書V3.3	モニタリング報告書のテンプレート
妥当性確認報告書V3.3	妥当性確認（Validation）報告書のテンプレート
検証報告書V3.3	検証報告書（Verification）報告書のテンプレート

VCS のプログラム文書

VCS VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

FAQS | PROJECT DATABASE | CONTACT US

Search

Who We Are | How It Works | Generate VCUs | Methodologies | Validation & Verification | Program Documents | Press Room

- Find a Program Document
- Find a Guidance Document
- Program Development
- Previous Versions

Stay Informed!

Enter your email address below to receive VCS updates:

Email Address

All Program Documents

All VCS requirements are included in the Version 3 documents below.

Documents are updated periodically. Please check this page to be sure you are using the latest version of a given document.

For a running catalogue of all updates, see the Updates to VCS Version 3.

Having trouble finding the correct VCS document online? Send feedback to secretariat@v-c-s.org

REQUIREMENTS

VCS Program Guide, v3.5	**Current Version**: v3.5 **Issued:** 8 October 2013 The VCS Program Guide is the overarching VCS Program document. It sets out all rules and requirements governing the VCS Program, including the project

VCSのホームページより

VCS のプログラム文書

「プロジェクトの説明」
文書(テンプレート)
データ

PROJECT TEMPLATES & FORMS

Project Description, v3.2	**Current Version**: v3.2 **Issued:** 8 October 2013 Project description template
Monitoring Report, v3.3	**Current Version**: v3.3 **Issued:** 8 October 2013 Monitoring report template
Registration Representation, v3.2	**Current Version**: v3.2 **Issued:** 8 October 2013 Deed of representation issued in respect of the project
Registration Representation (multiple PPs), v3.2	**Current Version**: v3.2 **Issued:** 8 October 2013 Deed of representation issued in respect of the project with multiple project proponents
Issuance Representation, v3.3	**Current Version**: v3.3 **Issued:** 8 October 2013 Deed of representation issued in respect of GHG emission reductions or removals
Issuance Representation (multiple PPs), v3.3	**Current Version**: v3.3 **Issued:** 8 October 2013 Deed of representation issued in respect of GHG emission reductions or removals from projects with multiple project proponents
Listing Representation, v3.1	**Current Version**: v3.1 **Issued**: 4 October 2012

VCSのホームページより

VCS のプログラム文書

「プロジェクトの説明」文書（テンプレート）

VCS | VERIFIED CARBON STANDARD　PROJECT DESCRIPTION: VCS Version 3

PROJECT TITLE

Logo (optional)

Document Prepared By (individual or entity)

Contact Information (optional)

Project Title	*Name of project.*
Version	*Version number of this document.*
Date of Issue	*DD-Month-YYYY this version of the document issued.*
Prepared By	*Individual or entity that prepared this document.*
Contact	*Physical address, telephone, email, website.*

v3.2　2

VCSのプログラム文書

「プロジェクトの説明」(PROJECT DESCRIPTION v3.2)目次

VCS のプログラム文書

「VCS Standard」
文書


VCS | VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

VCS Standard

VCS Version 3
Requirements Document
8 October 2013, v3.4

VCS のプログラム文書

「VCS　Standard　v3.4」 目次

VCS プロジェクトの適用範囲

・VCSの対象となるプロジェクトは、鉱業、製造業、産業廃棄物処理、森林保全から再生可能エネルギーなどの多岐にわたる。

VCSの分野別の適用範囲

1. エネルギー産業(再生可能/不可) 2. エネルギー輸送 3. エネルギー需要 4. 製造業 5. 化学工業 6. 建設 7. 運輸 8. 鉱業・鉱物生産	9. 金属の生産 10. 燃料からの漏えい 11. 産業ガスからの漏えい 12. 溶剤使用 13. 廃棄物の処理・処分 (AFOLU) 14. 農業、林業および他の土地利用 15. 家畜と肥料の管理

AFOLUプロジェクトの分類

・農業、林業および他の土地利用(AFOLU)プロジェクトは、以下のカテゴリーに分類される。

・植林、再植林及び緑化(ARR)
・農地管理(ALM)
・改善された森林管理(IFM)
・森林減少と森林劣化に由来する排出の削減(REDD)
・草原や潅木林への変換の防止(ACoGS)
・湿地の保全と再生(WRC)

AFOLUの要件

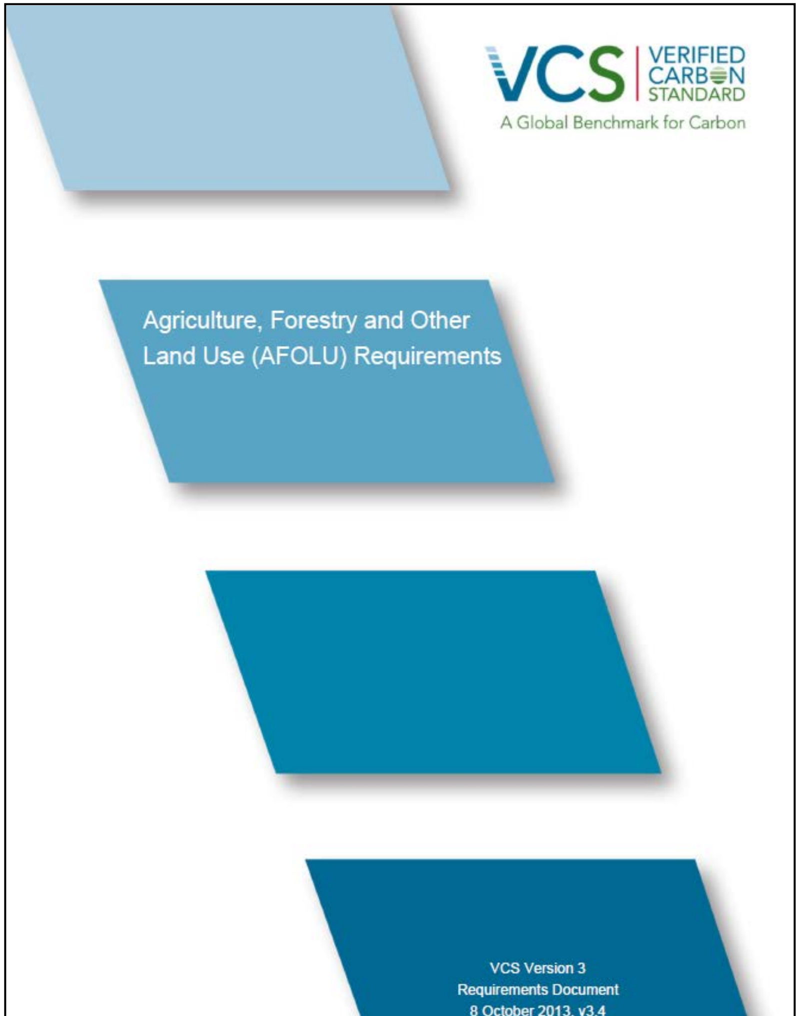
・VCSのAFOLU（Agriculture, Forestry and Other Land Use、農業・森林・その他の土地利用）プロジェクトが対象となる。

・VCSのプログラム文書、「AFOLU Requirements」として取り纏められ、AFOLUグループで定めた基準と定義について記載されている。

・プロジェクトは、原則的にプログラム文書の「VCS Standard」に沿って実施するが、AFOULで定めた基準（外部基準含）を踏まえて実施する。

「グッドプラクティスガイダンス」（IPCC 2003）
→炭素貯蔵量、GHG吸排出量の定量化
「ナショナルGHGインベントリー ガイドライン」（IPCC 2006）
→炭素プールの吸収量の定量化手順

AFOLUの要件



VCSのホームページより入手可

AFOLUの要件
〔 Agriculture, Forestry and Other Land Use (AFOLU) Requirements 〕

AFOLUの要件

「AFOLUの要件」(AFOLU Requirements v3.4)

目次

AFOLU 非永続リスクツール

・このツールは、AFOLU（Agriculture, Forestry and Other Land Use、農業・森林・その他の土地利用）プロジェクトに必要な非永続性のリスク分析およびバッファ決定を行うための手順を提供する。また、このツールは、リスクを評価し、適切なリスク評価を決定するために、プロジェクト実施主体や検証機関等に対する要求事項を定めている。

・評価されるリスクのカテゴリーは、「内部リスク」、「外部リスク」、「自然リスク」の3つに大別される。

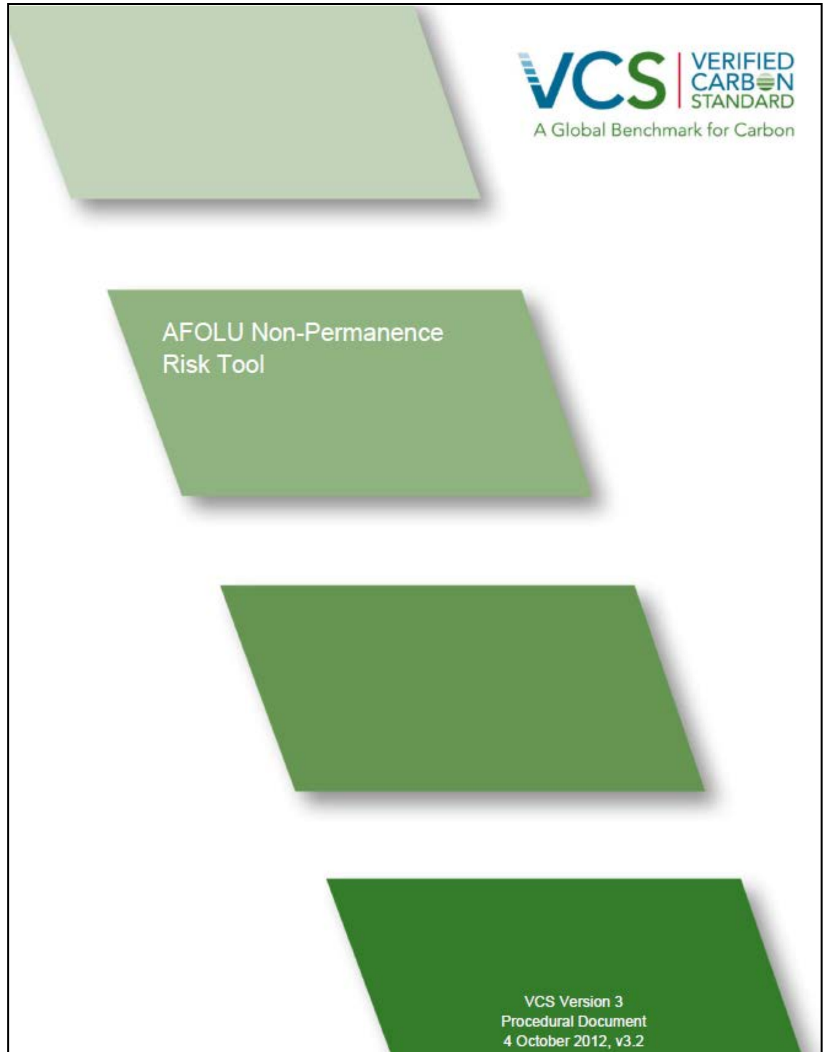
・それぞれのカテゴリーでリスクが点数化され、総合評点によりプロジェクトの全リスク評価を決定する。これにより非永続リスクのバッファークレジットが徴収される。

内部リスク	外部リスク	自然リスク
プロジェクト管理 財政的実行可能性 機会コスト※ プロジェクト寿命	土地保有 コミュニティ関与 政治的リスク	火災 病害虫の発生 極端な気象 その他の自然リスク

※プロジェクトを実施しなかった場合に得られる利益。

AFOLU 非永続リスクツール

「AFOLU Non-Permanence Risk Tool 」文書



AFOLU 非永続リスクツール

「AFOLU Non-Permanence Risk Tool v3.2」 目次

VCSにおけるISOの規定

・VCSは、ISO14064-2:2006、ISO14064-3:2006及びISO14065:2007に規定された要件に基づいて実施されている。

ISO14064-2 :2006	【温室効果ガス−第2部：プロジェクトにおける温室効果ガスの排出削減・吸収量の定量化、モニタリング及び報告のための規格並びに手引】 ・温室効果ガス排出削減・吸収のためのプロジェクトに焦点 ・プロジェクトのベースラインを決定するための要求事項等が規定
ISO14064-3 :2006	【温室効果ガス−第3部：温室効果ガスに関する主張の妥当性確認及び検証のための規格並びに手引】 ・検証の計画、評価手順及び温室効果ガス報告書の評価の要求事項が規定 ・独立第三者機関が温室効果ガス報告書の検証する際に用いられる。
ISO14065 :2007	【温室効果ガス：認定及びその他の承認形式で試用するための温室効果ガスの妥当性確認及び検証機関に対する要求事項】 ・温室効果ガスの妥当性確認及び検証を行う機関に対する要求事項を規定

VCSの検証体制

・VCSでは、プロジェクトと独立した検証体制が品質保証の核

・VCS事務局は直接検証作業を行わない。VCS協会に認定された第三者検証機関が実施する。全てのプロジェクトは、検証を受ける必要がある。

・VCSの検証機関は、CDM理事会に認定されたDOE（CDMプロジェクトで検証を行う第三者検査機関）、ISO14065の審査機関、及びVCS事務局から認定された第三者検査機関が実施する。

「プロジェクトの説明」→妥当性確認（Validation）→プロジェクト登録
「モニタリング報告書」→検証（Verification）→クレジット発行

方法論について

・VCSの方法論は、それぞれのプロジェクトにおける温室効果ガス削減効果を定量化するため、詳細な要件を設定したものであり、実際の温室効果ガスの削減効果を定量化するための手順や方程式が示されている。

・プロジェクトの実施者は、温室効果ガスの削減量を定量化するために、VCSで承認された方法論を選択して使用するとともに、選択した方法論に完全に従わなければならない。

・新たなプロジェクト開発において、既存の方法論がニーズを満たしていない場合、VCS協会に提案し、新たな方法論を開発することができる。

方法論について

・VCSのサイト上には、分野別に方法論が掲載されており、AFOULプロジェクトについては、5つのREDDの方法論が示されている。
【方法論ID】
VM0004、VM0006、VM0007、VM009、VM0015

・また、各方法論を補完するために、モジュールとツールが掲載されている。

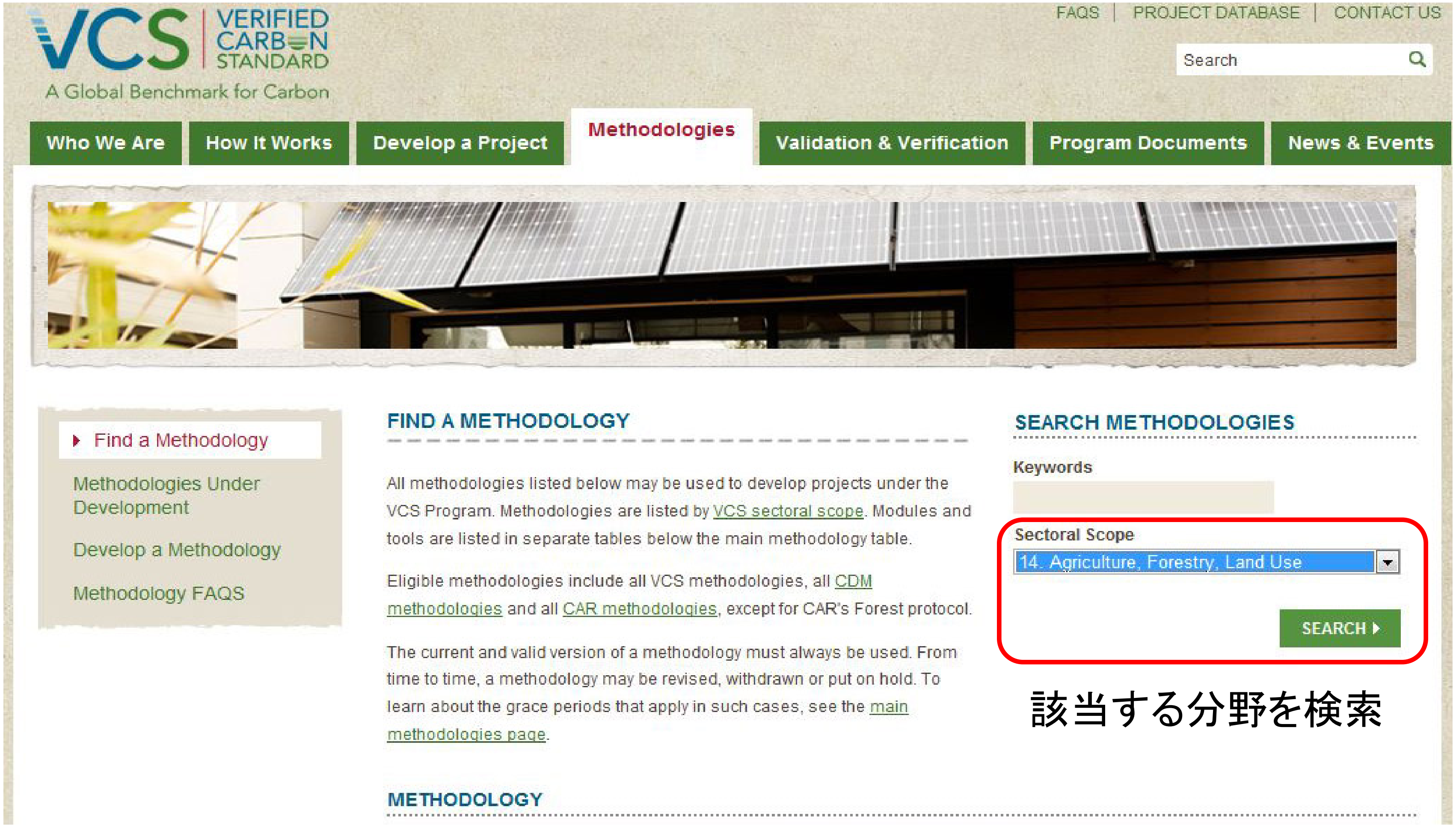
モジュール	特定のタスクを実行するために適用できる方法論の構成要素
ツール	解析を行ったり、モジュールや方法論を選択・使用するためのガイドラインや手順

方法論について

・REDDプロジェクトに係る方法論

方法論		概　要
VM0004	Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests	東南アジアの泥炭湿地林における計画的な土地利用転換を避ける保全プロジェクトのための方法論を示す。
VM0006	Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation	計画外の人為的なモザイク状森林伐採と劣化を減少させることを目的とする活動のための条件と炭素量計算方法を示す。
VM0007	REDD Methodology Modules	モジュール方式のREDD方法論であり、計画的な森林伐採、計画外の森林伐採、森林劣化というベースラインの状況に応じて適用させるモジュールを選択
VM0009	Methodology for Avoided Mosaic Deforestation of Tropical Forests	熱帯林におけるモザイク森林伐採を防ぐ活動からの排出削減量を求めるための方法論
VM00015	Methodology for Avoided Unplanned Deforestation	無計画な森林破壊を避けるための方法論を示す。モザイク状と面的な伐採の両方に適応可能。

方法論について

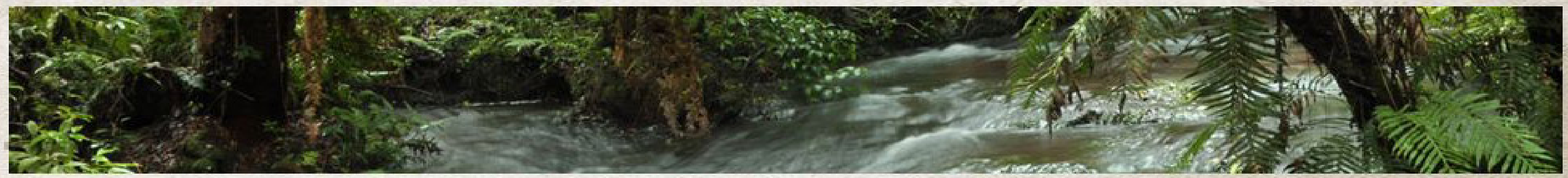


該当する分野を検索

VCSのホームページより

方法論について

Who We Are | How It Works | Develop a Project | Methodologies | Validation & Verification | Program Documents | News & Events



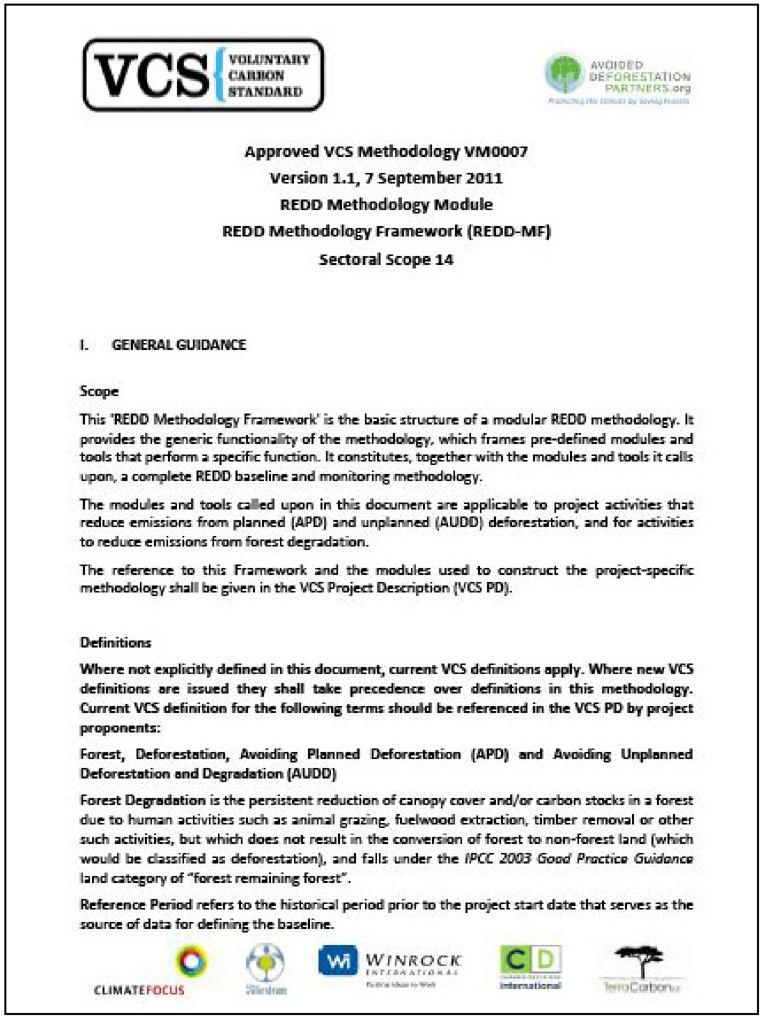
Find a Methodology

METHODOLOGY

Sectoral Scope	ID	Available Methodologies
14. Agriculture, Forestry, Land Use	VM0003	Methodology for Improved Forest Management through Extension of Rotation Age, v1.0
14. Agriculture, Forestry, Land Use	VM0004	Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1.0
14. Agriculture, Forestry, Land Use	VM0005	Methodology for Conversion of Low-productive Forest to High-productive Forest, v1.1
14. Agriculture, Forestry, Land Use	VM0006	Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation, v1.0
14. Agriculture, Forestry, Land Use	VM0007	REDD Methodology Modules (REDD-MF), v1.1
14. Agriculture, Forestry, Land Use	VM0009	Methodology for Avoided Mosaic Deforestation of Tropical Forests, v1.1
14. Agriculture, Forestry, Land Use	VM0010	Methodology for Improved Forest Management: Conversion from Logged to Protected Forest, v1.1
14. Agriculture, Forestry, Land Use	VM0011	Methodology for Calculating GHG Benefits from Preventing Planned Degradation, v1.0

VCSのホームページより

方法論について



VCS VOLUNTARY CARBON STANDARD

AVOIDED DEFORESTATION PARTNERS.org

Approved VCS Methodology VM0007
Version 1.1, 7 September 2011
REDD Methodology Module
REDD Methodology Framework (REDD-MF)
Sectoral Scope 14

I. GENERAL GUIDANCE

Scope

This 'REDD Methodology Framework' is the basic structure of a modular REDD methodology. It provides the generic functionality of the methodology, which frames pre-defined modules and tools that perform a specific function. It constitutes, together with the modules and tools it calls upon, a complete REDD baseline and monitoring methodology.

The modules and tools called upon in this document are applicable to project activities that reduce emissions from planned (APD) and unplanned (AUDD) deforestation, and for activities to reduce emissions from forest degradation.

The reference to this Framework and the modules used to construct the project-specific methodology shall be given in the VCS Project Description (VCS PD).

Definitions

Where not explicitly defined in this document, current VCS definitions apply. Where new VCS definitions are issued they shall take precedence over definitions in this methodology. Current VCS definition for the following terms should be referenced in the VCS PD by project proponents:

Forest, Deforestation, Avoiding Planned Deforestation (APD) and Avoiding Unplanned Deforestation and Degradation (AUDD)

Forest Degradation is the persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuelwood 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 falls under the *IPCC 2003 Good Practice Guidance* land category of "forest remaining forest".

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

CLIMATEFOCUS　WINROCK INTERNATIONAL　CD International　TerraCarbon

VCSのホームページより入手可

方法論：　VM0007
（REDD Methodology Modules）

方法論について

モジュール
ツール

対応表

E-FFC "VMD0014 Estimation of emissions from fossil fuel combustion"

E-NA CDM tool "Estimation of direct N_2O emissions from nitrogen application"

Monitoring Module:

M-MON "VMD0015 Methods for monitoring of greenhouse gas emissions and removals"

Miscellaneous Modules:

X-STR "VMD0016 Methods for stratification of the project area"

X-UNC "VMD0017 Estimation of uncertainty for REDD project activities"

Tools:

T-SIG CDM tool "Tool for testing significance of GHG emissions in A/R CDM project activities"

T-ADD "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities"

T-BAR "Tool for AFOLU non-permanence risk analysis and buffer determination"

REDD projects under the Methodology Framework are divided between three broad activity types: unplanned deforestation, planned deforestation and forest degradation through collection of wood for fuel and production of charcoal. A single project may include one, two or all three of these activity types. In table 1 the modules and tools are listed and it is indicated when use of modules/tools is mandatory under each activity type. The tool T-SIG should be used to justify the omission of carbon pools and emission sources.

Table 1. List of modules/tools and determination of when module/tool use is mandatory (M) or optional (O).

		Unplanned Deforestation	Planned Deforestation	Degradation (Fuelwood / Charcoal)
Always Mandatory	REDD-MF	M	M	M
	M-MON	M	M	M
	T-ADD	M	M	M
	T-BAR	M	M	M
	X-UNC	M	M	M
	X-STR	M	M	M
Baselines	BL-UP	M	-	-
	BL-PL	-	M	-
	BL-DFW	-	-	M

Leakage	LK-ASU	M	-	-
	LK-ASP	-	M	-
	LK-DFW	-	-	M
	LK-ME	(m)[1]	(m)[1]	(m)[2]
Pools*	CP-AB	M	M	M
	CP-D	(m)[3]	(m)[3]	(m)[3]
	CP-L	O	O	O
	CP-S	O	O	O
	CP-W	(m)[1]	(m)[1]	-
Emissions*	E-BB	M	M	M
	E-FCC	O	O	O
	E-NA	(m)[4]	O	O

M Modules marked with an M are fully mandatory: the indicated modules and tools must be used

O Modules marked with an O are fully optional: the indicated pools and sources can be included or excluded as decided by the project but if included in the baseline they must also be included in the with-project scenario

(m)[1] Mandatory where the process of deforestation involves timber harvesting for commercial markets

(m)[2] Mandatory where fuelwood or charcoal is harvested for commercial markets

(m)[3] Mandatory if this carbon pool is greater in baseline (post-deforestation/degradation) than project scenario and significant; otherwise can be conservatively omitted

(m)[4] Mandatory where leakage prevention activities include increases in the use of fertilizers

* VCS requirements and the tool T-SIG shall be used to justify the omission of carbon pools and emission sources

Applicability Conditions

This REDD Methodology Framework is a compilation of modules and tools that together define the project activity and necessary methodological steps. By choosing the appropriate modules, a project-specific methodology can be constructed. The justification of the choice of modules and why they are applicable to the proposed project activity shall be given in the VCS PD.

Specific applicability conditions exist for each module and must be met for the module to be used.

方法論：　VM0007

方法論について

方法論：VM0007　目次

目　次	概　　要
Ⅰ. 一般的ガイダンス	
適用範囲	方法論のフレームワークと適用範囲
定義	用語の定義
モジュールとツール	適用するモジュールとツールの概説
適用条件	「すべての活動タイプ」、「計画外の森林伐採」、「計画的な森林伐採」、「劣化」の適用条件
Ⅱ. 純温室効果ガス排出量削減の評価	
ST0. 最適なVCS活動の識別	ディシジョンツリーによる最適な活動タイプの識別
ST1. プロジェクト境界の定義	地理的な境界、時間的な境界、炭素プール、温室効果ガスの排出源、リーケージの原因
ST2. 追加性の実証	プロジェクトシナリオにおける追加性の実証
ST3. モニタリング計画の開発	モニタリング計画の策定方法の概説
ST4. ベースラインの炭素ストックの変化と温室効果ガス排出量の推計	推計手法に対応したモジュール
ST5. 純温室効果ガス排出削減量の総推計	VCSバッファーの計算、不確実性の解析、検証済み炭素単位の計算
Ⅲ. 事後モニタリング	
TS1. モニタリング計画に沿ったモニタリング	主なベースラインドライバ、炭素ストック変化と温室効果ガス排出量、リーケージ
TS2. 将来のクレジット期間のベースライン改訂	エージェント、ドライバの等の変化に伴いベースラインを改訂
IV. 他のモジュールのパラメータ	関連するパラメータ一覧

環境及び社会的基準の認証

- VCSは特定のプロジェクトの吸収量及び排出削減量を算出する手順を認証するものであり、環境及び社会面の認証には別の基準が必要となる。

- 一例として、CCB（Climate, Community and Biodiversity) Standardsは、土地利用プロジェクトの温室効果ガス削減の効果、地域コミュニティー支援および生態系の保護における効果などを評価するものである。排出削減量の算出方法を認証するものではないため、VCS等との併用が勧められている。VCS+CCBプロジェクトの説明テンプレート（VCS+CCB Project Description Template）が用意されている。

VCSプロジェクトデータベース

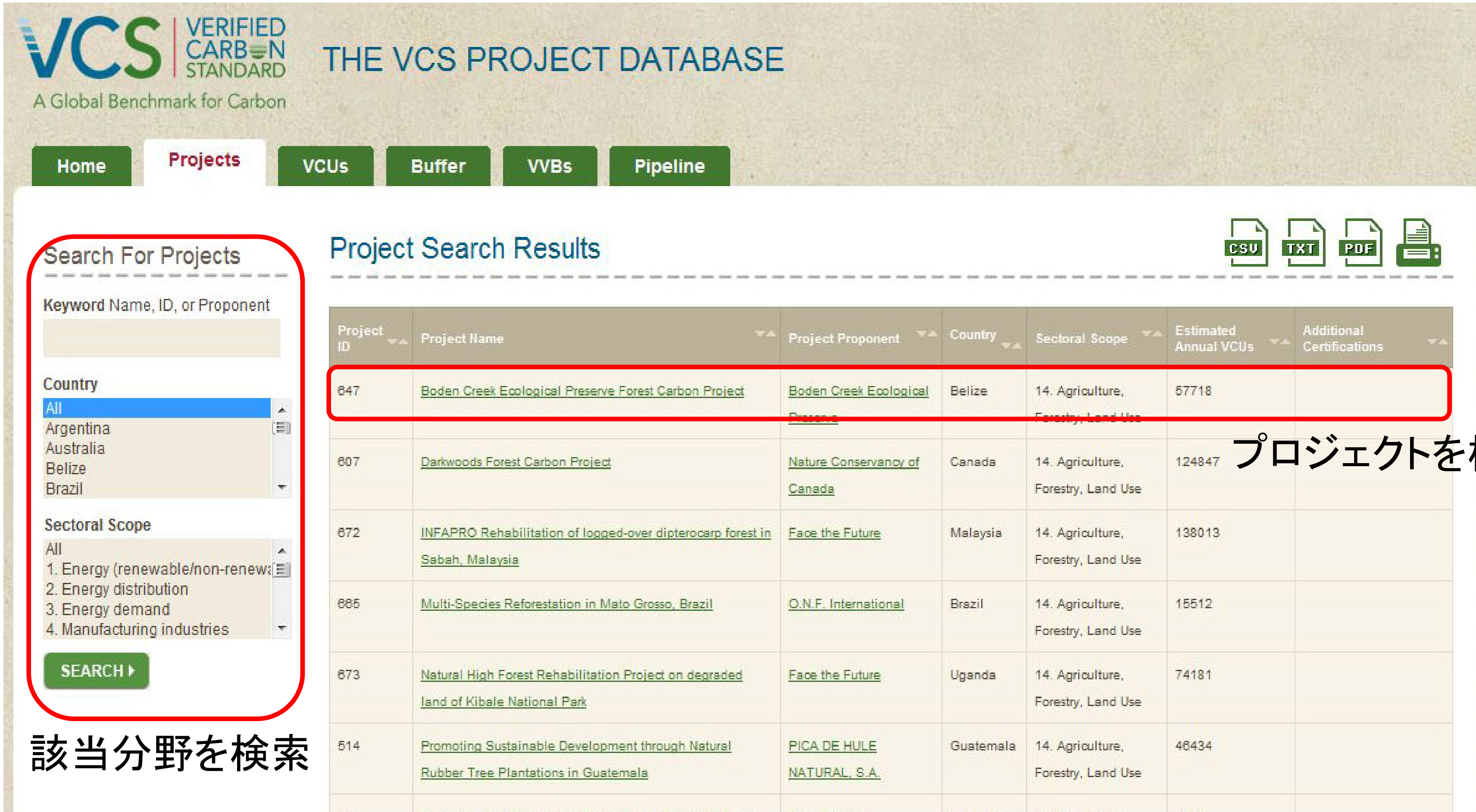
- VCSでは、認証が完了したプロジェクトは、VCSプロジェクトデータベースに掲載される。

- データベースには、プロジェクトに係る全ての情報が掲載されている。（クレジットの発行、プロジェクトの説明、モニタリング報告書、妥当性確認報告書、検証報告書など）

- VCSデータベースは、以下のアドレスでアクセスし、検索・閲覧が可能。

http://www.vcsprojectdatabase.org/

VCSプロジェクトデータベース



Project ID	Project Name	Project Proponent	Country	Sectoral Scope	Estimated Annual VCUs	Additional Certifications
647	Boden Creek Ecological Preserve Forest Carbon Project	Boden Creek Ecological Preserve	Belize	14. Agriculture, Forestry, Land Use	57718	
607	Darkwoods Forest Carbon Project	Nature Conservancy of Canada	Canada	14. Agriculture, Forestry, Land Use	124847	
672	INFAPRO Rehabilitation of logged-over dipterocarp forest in Sabah, Malaysia	Face the Future	Malaysia	14. Agriculture, Forestry, Land Use	138013	
665	Multi-Species Reforestation in Mato Grosso, Brazil	O.N.F. International	Brazil	14. Agriculture, Forestry, Land Use	15512	
673	Natural High Forest Rehabilitation Project on degraded land of Kibale National Park	Face the Future	Uganda	14. Agriculture, Forestry, Land Use	74181	
514	Promoting Sustainable Development through Natural Rubber Tree Plantations in Guatemala	PICA DE HULE NATURAL, S.A.	Guatemala	14. Agriculture, Forestry, Land Use	46434	
587	Protection of a Tasmanian Native Forest (Project 3: Peter	Peter Downie	Australia	14. Agriculture,	55549	

プロジェクトを検索

該当分野を検索

VCSのホームページより

VCSプロジェクトデータベース

Boden Creek Ecological Preserve Forest Carbon Project,
BELIZE

Back to Search Results

Google Earth map

Exact project location coordinates are visible in Google Earth. Google Map pinpoints may be approximations.

The core objective of this project is to commercialize the forest carbon offsets at the Boden Creek Ecological Preserve near Punta Gorda, Belize, Central America. This property has been the site of a groundbreaking effort to use ecotourism as a funding source for land preservation. Due to the global economic downturn it is imperative that additional funding sources be secured to stabilize the operation. This land is currently under immediate threat of land conversion for agriculture, and it contains documented populations of internationally protected biodiversity.

Project ID
647

Project Proponent
Boden Creek Ecological Preserve

Project Status
Registered - VCUs Issued
View Issuance Records
View Buffer Pool Records

Sectoral Scope
14. Agriculture, Forestry, Land Use

Project Methodology
VM0007

Project Validator
Scientific Certification Systems, Inc. (SCS)

Registry
Markit

Estimated Annual VCUs
57,718

選択したプロジェクトのページ

VCSのホームページより

VCSプロジェクトデータベース

immediate threat of land conversion for agriculture, and it contains documented populations of internationally protected biodiversity.

Estimated Annual VCUs
57,718

REGISTRATION DOCUMENTS

Document	Upload Date
Project Proponent Registration Representation	18 Jul 2011 19:29:49 GMT
Project Description	18 Jul 2011 19:28:16 GMT
Validation Report	18 Jul 2011 19:29:29 GMT
Validation Statement	18 Jul 2011 19:29:40 GMT

「プロジェクトの説明」文書

ISSUANCE DOCUMENTS

Type	Link	Upload Date
Monitoring Report	MONIT_REP_647_01JAN2005_31DEC2010.pdf	27 Jul 2011 21:10:53 GMT
Project Proponent Issuance Representation	PP_ISS_REP_647_01JAN2005_31DEC2010.pdf	27 Jul 2011 21:12:00 GMT
Verification Report	VERIF_REP_647_01JAN2005_31DEC2010.pdf	27 Jul 2011 21:11:07 GMT
Verification Statement	VERIF_STA_647_01JAN2005_31DEC2010.pdf	27 Jul 2011 21:11:49 GMT

VCSのホームページより

VCSプロジェクトデータベース

VCS VOLUNTARY CARBON STANDARD

Boden Creek Ecological Preserve
Forest Carbon Project
June 15, 2011

Forest Carbon Offsets LLC
600 Cameron Street
Alexandria, VA 22314, USA
Technical Contact: Jeff Waldon, Chief Technical Officer
Phone: +1 540-230-2854, Email: jeffwaldon@forestcarbonoffsets.net
Web: http://www.forestcarbonoffsets.net

Cover Photo: Station #6 Boden Creek Trail, April 3, 3008 03:47h, jaguar likely pair (Miller and Miller 2008).

「プロジェクトの説明」文章

VCS Project Description Template, v3.2

Project Title	プロジェクトのタイトル
Version	バージョン
Date of Issue	発行日
Prepared By	作成者
Contact	問い合わせ
Table of Contents	目次
1.Project Details	1. プロジェクトの詳細
1.1 Summary Description of the Project	1.1プロジェクトの概要説明
1.2 Sectoral Scope and Project Type	1.2分野別の適用範囲及びプロジェクトの種類
1.3 Project Proponent	1.3プロジェクトの提唱者
1.4 Other Entities Involved in the Project	1.4プロジェクトに関与する他の存在
1.5 Project Start Date	1.5プロジェクト開始日
1.6 Project Crediting Period	1.6プロジェクトのクレジット期間
1.7 Project Scale and Estimated GHG Emission Reductions or Removals	1.7プロジェクトの規模と温室効果ガス吸排出量の推定
1.8 Description of the Project Activity	1.8プロジェクト活動の説明
1.9 Project Location	1.9プロジェクトの場所
1.10 Conditions Prior to Project Initiation	1.10プロジェクト開始前の状況
1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks	1.11法律、法令及びその他の規制の枠組みへの準拠
1.12 Ownership and Other Programs	1.12所有権およびその他のプログラム
1.12.1Right of Use	1.12.1使用権
1.12.2 Emissions Trading Programs and Other Binding Limits	1.12.2排出権取引プログラムと他の拘束力のある制限
1.12.3 Other Forms of Environmental Credit	1.12.3環境クレジットの他のフォーム
1.12.4 Participation under Other GHG Programs	1.12.4その他の温室効果ガスプログラムへの参加
1.12.5 Projects Rejected by Other GHG Programs	1.12.5他の温室効果ガスプログラムによる拒否
1.13 Additional Information Relevant to the Project	1.12.6プロジェクトに関連する追加情報
Eligibility Criteria	的確性基準
Leakage Management	リーケージの管理
Commercially Sensitive Information	営利上の機密情報
Further Information	さらに詳しい情報
2. Application of Methodology	2.方法論の適用
2.1Title and Reference of Methodology	2.1タイトルと方法論の参照
2.2 Applicability of Methodology	2.2方法論の適用性
2.3 Project Boundary	2.3**プロジェクト境界**
2.4 Baseline Scenario	2.4**ベースラインシナリオ**
2.5 Additionality	2.5**追加性**
2.6 Methodology Deviations	2.6方法論の偏差
3. Quantification of GHG Emission Reductions and Removals	3.温室効果ガスの吸排出量の定量化
3.1 Baseline Emissions	3.1**ベースライン排出量**
3.2 Project Emissions	3.2**プロジェクト排出量**
3.3 Leakage	3.3**リーケージ**
3.4 Net GHG Emission Reductions and Removals	3.4温室効果ガスの純排出削減量と吸収量
4. Monitoring	4.モニタリング
4.1 Data and Parameters Available at Validation	4.1妥当性確認で使用可能なデータとパラメータ
4.2 Data and Parameters Monitored	4.2モニタリングのためのデータとパラメータ
4.3 Monitoring Plan	4.3モニタリング計画
5. Environmental Impact	5.環境への影響
6. Stakeholder Comments	6.利害関係者の意見

地理的境界
・プロジェクトエリア
・リーケージエリア（ベルト）
・参照エリア
炭素プール
GHG排出源

アクティビティ（活動）データ
排出係数

活動移動リーケージ
マーケットリーケージ

MRV
コンサバティブ
非永続性リスクとバッファークレジット
不確実性

VCS Project Description Template

This template is for the development of VCS projects.

Instructions for completing the project description:

TITLE PAGE: All items in the box at the bottom of the title page must be completed using Arial 10pt, black, regular (non-italic) font. This box must appear on the title page of the final document. Project descriptions may also feature the project title and preparers' name, logo and contact information more prominently on the title page, using the format below (Arial 24pt and Arial 11pt, black, regular font).

PROJECT DESCRIPTION: Instructions for completing the project description template are given under the section headings in this template. All instructions must be followed, as set out in the VCS Standard*. Instructions relate back to the rules and requirements set out in the* VCS Standard *and accompanying program documents. As such, this template must be completed in accordance with such documents, and the preparer will need to refer to the VCS program documents and the methodology in order to complete the template. It is also expected that relevant guidance, as it relates to the project and methodology, is followed. Note that the instructions in this template are intended to serve as a guide and do not necessarily represent an exhaustive list of the information the preparer should provide under each section of the template.*

All sections must be completed using Arial 10pt, black, regular (non-italic) font. Where a section is not applicable, same must be stated under the section (the section must not be deleted from the final document).

All instructions, including this introductory text, should be deleted from the final document.

PROJECT TITLE

Logo (optional)

Document Prepared By (individual or entity)

Contact Information (optional)

Project Title	*Name of project*
Version	*Version number of this document*
Date of Issue	*DD-Month-YYYY this version of the document issued*
Prepared By	*Individual or entity that prepared this document*
Contact	*Physical address, telephone, email, website*

Table of Contents

Insert table of contents

1 PROJECT DETAILS

1.1 Summary Description of the Project

Provide a summary description of the project to enable an understanding of the nature of the project and its implementation, including the following (no more than one page):

- *A summary description of the technologies/measures to be implemented by the project.*
- *The location of the project.*
- *An explanation of how the project is expected to generate GHG emission reductions or removals.*
- *A brief description of the scenario existing prior to the implementation of the project.*
- *An estimate of annual average and total GHG emission reductions and removals.*

1.2 Sectoral Scope and Project Type

Indicate the sectoral scope(s) applicable to the project, the AFOLU project category and activity type (if applicable), and whether the project is a grouped project.

1.3 Project Proponent

Provide contact information for the project proponent(s). Copy and paste the table as needed.

Organization name	
Contact person	
Title	
Address	
Telephone	
Email	

1.4 Other Entities Involved in the Project

Provide contact information and roles/responsibilities for any other entities involved in the development of the project. Copy and paste the table as needed.

Organization name	
Role in the project	
Contact person	
Title	
Address	

Telephone	
Email	

1.5 Project Start Date

Indicate, and provide justification for, the project start date, specifying the day, month and year.

1.6 Project Crediting Period

Indicate the project crediting period, specifying the day, month and year for the start and end dates and the total number of years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Indicate the scale of the project (project or large project) and the estimated annual GHG emission reductions or removals for the project crediting period.

Project Scale	
Project	
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year A (eg, 2014)	
Year B	
Year C	
Year...	
Total estimated ERs	
Total number of crediting years	
Average annual ERs	

1.8 Description of the Project Activity

Describe the project activity or activities (including the technologies or measures employed) and how it/they will achieve net GHG emission reductions or removals.

For non-AFOLU projects:

- *Include a list and the arrangement of the main manufacturing/production technologies, systems and equipment involved. Include in the description information about the age and average lifetime of the equipment based on manufacturer's specifications and* *industry standards, and existing and forecast installed capacities, load factors and efficiencies.*

- *Include the types and levels of services (normally in terms of mass or energy flows) provided by the systems and equipment that are being modified and/or installed and their relation, if any, to other manufacturing/production equipment and systems outside the project boundary. Clearly explain how the same types and levels of services provided by the project would have been provided in the baseline scenario.*
- *Where appropriate, provide a list of facilities, systems and equipment in operation under the existing scenario prior to the implementation of the project.*

For AFOLU projects:

- *For all measures listed, include information on any conservation, management or planting activities, including a description of how the various organizations, communities and other entities are involved.*
- *In the description of the project activity, state if the project is located within a jurisdiction covered by a jurisdictional REDD+ program.*

1.9 Project Location

Indicate the project location and geographic boundaries (if applicable) including a set of geodetic coordinates. For grouped and AFOLU projects, coordinates may be submitted separately as a KML file.

1.10 Conditions Prior to Project Initiation

Describe the conditions existing prior to project initiation and demonstrate that the project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

Where the baseline scenario is the same as the conditions existing prior to the project initiation, there is no need to repeat the description of the scenarios (rather, just state that this is the case and refer the reader to Section 2.4 (Baseline Scenario).

For AFOLU projects, include the present and prior environmental conditions of the project area, including as appropriate information on the climate, hydrology, topography, relevant historic conditions, soils, vegetation and ecosystems.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Identify and demonstrate compliance of the project with all and any relevant local, regional and national laws, statutes and regulatory frameworks.

1.12 Ownership and Other Programs

1.12.1 Right of Use

Provide evidence of right of use, in accordance with the VCS specifications on right of use.

1.12.2 Emissions Trading Programs and Other Binding Limits

Indicate whether the project reduces GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading, and include details about any such programs or mechanisms. Where applicable, demonstrate that GHG emission reductions and removals generated by the project will not be used for compliance under such programs or mechanisms. Examples of appropriate evidence are provided in the VCS Standard*.*

1.12.3 Other Forms of Environmental Credit

Indicate whether the project has sought or received another form of GHG-related environmental credit, including renewable energy certificates. Include all relevant information about the GHG-related environmental credit and the related program.

List all other programs under which the project is eligible to participate (to create another form of GHG-related environmental credit).

1.12.4 Participation under Other GHG Programs

Indicate whether the project has been registered, or is seeking registration under any other GHG programs. Where the project has been registered under any other GHG program, provide the registration number and details.

1.12.5 Projects Rejected by Other GHG Programs

Indicate whether the project has been rejected by any other GHG programs. Where the project has been rejected, provide the relevant information, including the reason(s) for the rejection and justification of eligibility under the VCS Program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

For grouped projects, specify the eligibility criteria for inclusion of new instances of each project activity.

Leakage Management

Where applicable, describe the leakage management plan and implementation of leakage and risk mitigation measures.

Commercially Sensitive Information

Indicate whether any commercially sensitive information has been excluded from the public version of the project description and briefly describe the items to which such information pertains.

Note - Information related to the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions and removals (including operational and capital expenditures) cannot be considered to be commercially sensitive and must be provided in the public versions of the project documents.

Further Information

Include any additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Provide the title, reference and version number of the methodology or methodologies applied to the project. Include also the title and version number of any tools applied by the project.

2.2 Applicability of Methodology

Demonstrate and justify how the project activity(s) meets each of the applicability conditions of the methodology(s), and tools (where applicable) applied by the project. Address each applicability condition separately.

2.3 Project Boundary

Define the project boundary and identify the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios (including leakage if applicable).

Source		Gas	Included?	Justification/Explanation
Baseline	Source 1	CO_2		
		CH_4		
		N_2O		
		Other		
	Source 2	CO_2		
		CH_4		
		N_2O		
		Other		

Source		Gas	Included?	Justification/Explanation
Project	Source 1	CO_2		
		CH_4		
		N_2O		
		Other		
	Source 2	CO_2		
		CH_4		
		N_2O		
		Other		

In addition to the table, provide a diagram or map of the project boundary, showing clearly the physical locations of the various installations or management activities taking place as part of the project activity based on the description provided in Section 1.8 (Description of the Project Activity) above.

For non-AFOLU projects, include in the diagram the equipment, systems and flows of mass and energy. Include the GHG emission sources identified in the project boundary.

For AFOLU projects, include in the diagram or map the locations of where the various measures are taking place, any reference areas and leakage belts.

2.4 Baseline Scenario

Identify and justify the baseline scenario, in accordance with the procedure set out in the applied methodology and any relevant tools. Where the procedure in the applied methodology involves several steps, describe how each step is applied and clearly document the outcome of each step.

Explain and justify key assumptions, rationale and methodological choices. Provide all relevant references.

2.5 Additionality

Demonstrate and assess the additionality of the project, in accordance with the applied methodology and any relevant tools, taking into account of the following:

- *Where a project method is applied to demonstrate additionality and the procedure in the applied methodology or tool involves several steps, describe how each step is applied and clearly document the outcome of each step. Indicate clearly the method selected to demonstrate additionality (eg, investment analysis or barrier analysis in the case of the CDM* Tool for the demonstration and assessment of additionality*). Where barrier analysis, or equivalent, is used to demonstrate additionality, only include the most relevant barriers. Justify the credibility of the barriers with key facts and/or assumptions and the rationale. Provide all relevant references.*

- *Where a performance method is applied to demonstrate additionality, demonstrate that performance can be achieved to a level at least equivalent to the performance benchmark metric.*
- *Where the methodology applies an activity method for the demonstration of additionality, use this section to demonstrate regulatory surplus (only) and include a statement that notes that conformance with the positive list is demonstrated in the Applicability of Methodology section above.*

Provide sufficient information (including all relevant data and parameters, with sources) so that a reader can reproduce the additionality analysis and obtain the same results.

2.6 Methodology Deviations

Describe and justify any methodology deviations. Include evidence to demonstrate the following:

- *The deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals.*
- *The deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.*

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Describe the procedure for quantification of baseline emissions and/or removals in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (eg, with respect to selection of emission factors and default values).

3.2 Project Emissions

Describe the procedure for quantification of project emissions and/or removals in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (eg, with respect to selection of emission factors and default values).

3.3 Leakage

Describe the procedure for quantification of leakage emissions in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (eg, with respect to selection of emission factors and default values).

3.4 Net GHG Emission Reductions and Removals

Describe the procedure for quantification of net GHG emission reductions and removals. Include all relevant equations. For AFOLU projects, include equations for the quantification of net change in carbon stocks.

Provide the ex-ante calculation (estimate) of baseline emissions/removals, project emissions/removals, leakage emissions and net GHG emission reductions and removals in the table below.

For data and parameters monitored, use estimates. Document how each equation is applied, in a manner that enables the reader to reproduce the calculation. Provide example calculations for all key equations, to allow the reader to reproduce the calculation of estimated net GHG emission reductions or removals.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year A				
Year B				
Year C				
Year...				
Total				

4 MONITORING

4.1 Data and Parameters Available at Validation

Complete the table below for all data and parameters that are determined or available at validation, and remain fixed throughout the project crediting period (copy the table as necessary for each data/parameter). Data and parameters monitored during the operation of the project are included in Section 4.2 (Data and Parameters Monitored) below.

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*
Source of data	*Indicate the source(s) of data*
Value applied:	*Provide the value applied*
Justification of choice of data or description of measurement methods and procedures applied	*Justify the choice of data source, providing references where applicable. Where values are based on measurement, include a description of the measurement methods and procedures applied (eg, what standards or protocols have been followed), indicate the responsible person/entity that undertook the measurement, the date of the measurement and the measurement results. More detailed information may be provided in an appendix.*
Purpose of Data	*Indicate one of the following:* • *Determination of baseline scenario (AFOLU projects only)*

	• *Calculation of baseline emissions* • *Calculation of project emissions* • *Calculation of leakage*
Comments	*Provide any additional comments*

4.2 Data and Parameters Monitored

Complete the table below for all data and parameters that will be monitored during the project crediting period (copy the table as necessary for each data/parameter). Data and parameters determined or available at validation are included in Section 4.1 (Data and Parameters Available at Validation) above.

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*
Source of data	*Indicate the source(s) of data*
Description of measurement methods and procedures to be applied	*Specify the measurement methods and procedures, any standards or protocols to be followed, and the person/entity responsible for the measurement. Include any relevant information regarding the accuracy of the measurements (eg, accuracy associated with meter equipment or laboratory tests).*
Frequency of monitoring/recording	*Specify measurement and recording frequency*
Value applied:	*Provide an estimated value for the data/parameter*
Monitoring equipment	*Identify equipment used to monitor the data/parameter including type, accuracy class, and serial number of equipment, as appropriate.*
QA/QC procedures to be applied	*Describe the quality assurance and quality control (QA/QC) procedures to be applied, including the calibration procedures where applicable.*
Purpose of data	*Indicate one of the following:* • *Calculation of baseline emissions* • *Calculation of project emissions* • *Calculation of leakage*
Calculation method	*Where relevant, provide the calculation method, including any equations, used to establish the data/parameter.*
Comments	*Provide any additional comments*

4.3 Monitoring Plan

Describe the process and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters set out in Section 4.2 (Data and Parameters Monitored) above. Include details on the following:

- *The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters. Where relevant, include the procedures for calibrating monitoring equipment.*
- *The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities.*
- *The policies for oversight and accountability of monitoring activities.*
- *The procedures for internal auditing and QA/QC.*
- *The procedures for handling non-conformances with the validated monitoring plan.*
- *Any sampling approaches used, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures.*

Where appropriate, include line diagrams to display the GHG data collection and management system.

5 ENVIRONMENTAL IMPACT

Summarize any environmental impact assessments carried out with respect to the project, where applicable.

6 STAKEHOLDER COMMENTS

Summarize relevant outcomes from any stakeholder consultations and mechanisms for on-going communication.

APPENDIX X: <TITLE OF APPENDIX>

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.

応用講習 b　グループ別実習の課題

【手順】

①　受講生をＡとＢ、２つのグループに分ける。

②　グループごとに、配布したベリーズとケニヤの PDD を読み、下表に示す項目ごとに、2 つのプロジェクトの概要を記載し、それぞれの違いについてコメントする（下表参照）。

③　グループ別実習終了までに、模造紙や付箋紙等を用いて、下表を取り纏める（下図参照）。

③　グループ別実習後の総合討論で、各グループの代表者が、取り纏め内容を発表する。

【課題表】

項　　　目	ベリーズ PDD	ケニヤ PDD	コメント欄
・プロジェクト概要			
・ベースライン・シナリオ			
・GHG 削減方策 （プロジェクト・アクティビティ）			
・モニタリング手法			
・その他			

※　「プロジェクト概要」については、PDD の「1. Project Description」の中から、面積、プロジェクト期間、クレジット期間と推定総排出量、森林の概要等、比較できる項目について概要を記載する。

※　「ベースライン・シナリオ」、「GHG 削減方策」、「モニタリング手法」については、記載されているページを探して概要を記載する。

※　「その他」については、時間が余った場合、項目を自由に選択して概要を記載する。

※　箇条書きで簡潔に記載すること（概要のみで OK）。

作業イメージ（H24 の実習より）

This Project Document is Dated January 25th, 2011, and conforms to the VCS PD Template dated 19th November 2007.

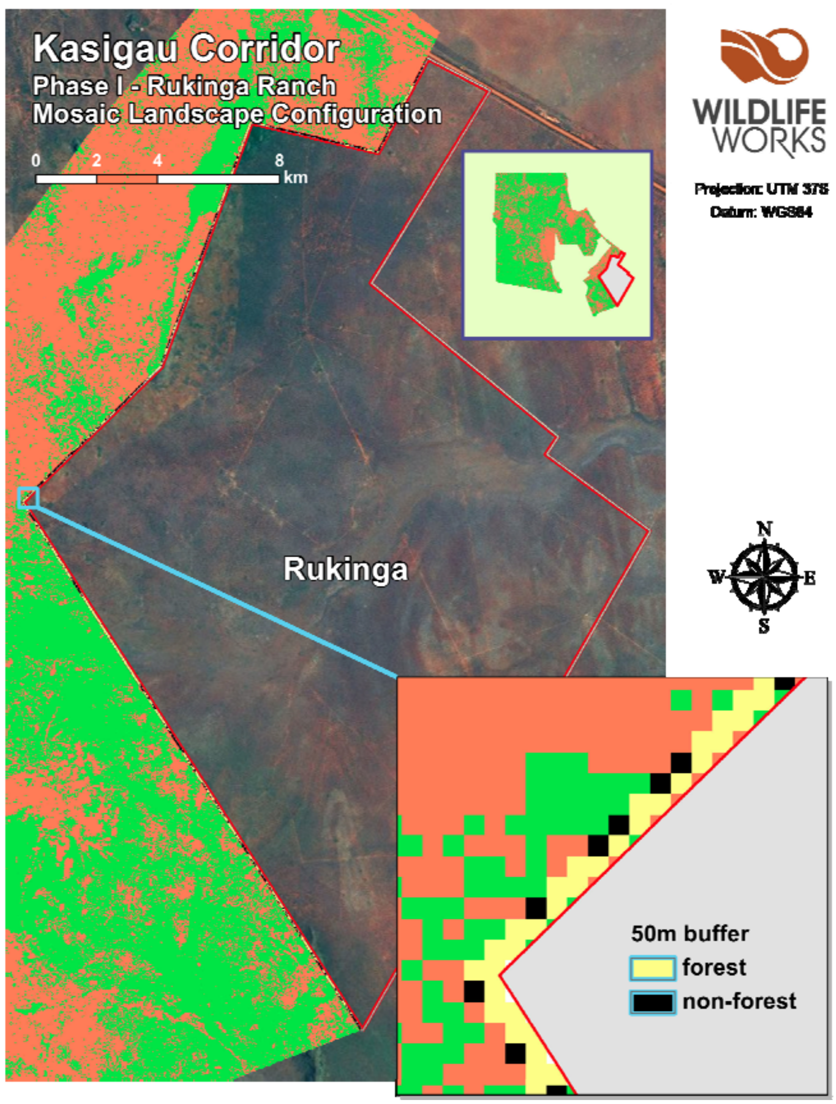
1. Description of Project:

1.1 Project title

The Kasigau Corridor REDD Project – Phase I Rukinga Sanctuary

1.2 Type/Category of the project

This project falls under VCS sectoral scope 14 Agriculture, Forestry and Other Land Uses, under project activities Reduced Emissions from Deforestation and Degradation (REDD) and most specifically Avoiding unplanned mosaic deforestation and degradation (AUMDD). This project falls into this category by the definition provided in the VCS Program Update of May 24th 2010, by virtue of the fact that > 25% of the boundary of the Project Area is within 50m of land that was anthropogenically deforested in the ten years prior to the project start date, as illustrated in the table and map below.



Rukinga Landscape Configuration Analysis
Imagery date: 02-06-2003
Imagery source: Landsat 7 (ETM+)

Total Ranch Perimeter (km)	84.05338
Perimeter coincident with reference region (km)	42.8745
coincident ratio	51.00%
Coincident forest (px)	1034
Coincident non-forest (px)	1147
% deforested (coincident w/ reference region)	52.59%
Total % deforested within 50m (Rukinga perimeter)	**26.83%**

This is not a Grouped Project.

1.3 Estimated amount of emission reductions over the crediting period including project size:

Rukinga Sanctuary (the project area) is 30,168.66 ha. The project is neither a mega nor a micro project, as the estimated gross emissions reductions over the 30 year crediting period are 7,542,945 m.t. GHG or on average, 251,432 m.t. GHG per year.

1.4 A brief description of the project:

Through a combination of Dryland Forest protection and extraordinary community sustainable development activities, this project is estimated to avoid the emission of over 7 Million metric tonnes of CO2e which would have been emitted due to slash and burn deforestation over the 30 year project life, or on average approximately 251,432 metric tonnes per year across the Carbon Pools of Above and Belowground Biomass (forest carbon), and Soil Carbon.

The Project Area is home to a fantastic diversity of mammals (over 50 species of large mammal, more than 20 species of bats), birds (over 300 species) and important populations of IUCN Red List species such as Grevy's zebra (*Equus grevyi*), Cheetah (*Acinonyx jubatus*), Lion (*Panthera leo*) as well as over 500 African elephants (*Loxidonta africana*) seasonally.

The project is clearly additional (under the project financial additionality tool) and the Baseline far from being hypothetical is an extension of actual deforestation that was occurring aggressively in the reference region immediately adjacent to the Project Area at the time Wildlife Works came on the scene, and that has been demonstrated clearly from historic satellite images.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The Kasigau Corridor REDD Project is located in SE Kenya, in the Marungu Sublocation, Voi Division, Taita Taveta District, Coast Province, Kenya, approximately 150 kms NW of Mombasa.

This Phase I PD covers all the land known as Rukinga Sanctuary which is all that 74,516 acres (30,168.66 ha) of land originally known as LR 12263, historically reduced by subdivisions 12263/1 and 12263/2 at dates prior to the start date of this project.

Rukinga is part of that land that forms a corridor of land (the Kasigau Wildlife Corridor) between the Tsavo East National Park and the Tsavo West National Parks to the East of the Marungu range. The Project Area and Reference Region are clearly delineated in the image below, and the shape files representing the boundaries have been made available to the project validator. The land within the project boundary has been tropical dryland forest[1] for at least 20 years and has been a primary forest since recorded times[2].

1.6 Duration of the project activity/crediting period:

The Project Start Date and the Crediting Period Start Date are both January 1st, 2005.
VCS project crediting period: The VCS Project Crediting Period is January 1st 2005 thru December 31st 2034.

1.7 Conditions prior to project initiation:

It was not difficult to identify the baseline scenario for this project which is rapid deforestation due to unplanned slash and burn agricultural expansion by subsistence farmers, as all the conditions of the baseline were in place before the arrival of Wildlife Works and in fact even the Project Area itself was beginning to be cleared before we arrived. There is little need for speculation as to what would happen in the absence of our project if we ceased to protect the Project Area and ceased to provide alternative livelihoods for the community, the pattern of deforestation would pick up right where it left off, but now accelerated by a much larger population base than was present when we arrived.

The Project Area had previously been used for grazing of cattle and for ecotourism. Both activities failed due to lack of funds, because cattle ranching is difficult due to a fragile ecosystem and lack of water, which lead to the sale of the land to the current owners in 2000.

Aforestation of plantation species and agricultural activities cannot profitably be carried out in this sort of area due to a lack of water and a fragile ecosystem. Therefore we believe that we have demonstrated through our activities to attempt many different economic activities and the activities that preceded us that there are no credible alternative economic uses for this land that could compete with the Project financially, or provide financial sustainability that would protect it from slash and burn use by the community.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

Refer to Supporting Document - VCS Methodology PD Requirements Section 6.1.

1.9 Project technologies, products, services and the expected level of activity:

Refer to Supporting Document - VCS Methodology PD Requirements Section 6.1.

1.10 Compliance with relevant local laws and regulations related to the project:

It is our belief that Wildlife Works meets all local, National and International laws related to this project.
The laws that are relevant to this project are:

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[1] UN IPCC, Good Practice Guidance for LULUCF, Table 3A.1.8;
[2] Earliest record that has been located is dated 1895 which identifies the area as forested [Hobley 1895 – Upon a Visit to Tsavo and the Taita Highlands – The Geographical Journal 1895 Vol 5 No 6 pp 545-561]

EMPLOYMENT LAWS.

- Export Processing Zone's Act (Cap. 547)

As an Export Processing Zone Company we are exempted from the standard Labour Laws of Kenya, and instead must conform to those laws that that have been deemed applicable to (General Provisions of the Employment Act (Cap 226-229) or amended for EPZs as covered by the Export Processing Zone's Act (Cap. 547).

- National Health Insurance Fund.

N.H.I.F was established on 12th July 1966 by an act of parliament Cap 255 of the Laws of Kenya, and become a state corporation on 15th February 1999 through an act of Parliament no.9 of 1998. The objective of its establishment is to enable majority of Kenyans to access healthcare services at supplemented costs. Contribution to the fund are compulsory for all persons whose income is Ksh.1000/= and above. We physically go to the NHIF offices in Voi monthly to submit our monthly payroll and have the NHIF amount calculated by them, we pay and they give us a receipt. We are also subject to random checks with the NHIF inspector visiting our facility without notice and inspecting our books. We have never been found in violation of this act.

- The National Social Security Fund act ,Cap 258, is a government fund established by the National Social Security Fund Act,1965 ,For the benefit of the Members. It is a compulsory savings scheme into which the employer pays a statutory contribution for every employee who is a member. We physically go to the NSSF offices in Voi monthly to submit our monthly payroll on a NSSF form, and we pay the monthly dues. We are subject to strict audit checks by the NSSF inspector who visits our facility every two months and on passing the audit provides us with an official letter indicating we are in compliance. We have never been found in violation of this act.

- Pay As you Earn(P.A.Y.E)

Section 37 of the Income Tax act.
The "Pay As You EARN" method of deducting income tax from salaries and wages applies to weekly wages, Monthly salaries, annual salaries, bonuses, commissions, Directors fees (Whether the director is resident or non-resident). Monthly we are required to go to the bank (Kenya Commercial Bank = KCB) to pay the tax withheld from our employees wages and salaries, the bank takes one folio from our KRA receipt book, and stamps the other two folios, one of which we then take to the KRA office in Voi and give it to them.

- The Factories and Other Places of Work Act

The Factories Act (Cap. 514) deals with the health, safety and welfare of an employee who works in a factory or other place of work. We have never been audited by this department in the Government as it is very small and covers the whole country, however we have good reason to believe we are in full compliance with this act as a result of a third party audit of our factory and operations performed by the independent NGO Verite,from the USA.

- The Work Injury Benefits Act (Cap. 236) provides for ways through which an employee who is injured when on duty may be compensated by the employer. We are required to maintain private insurance to cover our responsibility under this act.

- Regulation of Wages and Conditions of Employment Act (Cap. 229)

This act sets the conditions of work and the minimum wage guidelines. The EPZ Act supersedes this act with regard to minimum wage and in fact the EPZ minimum wage guidelines are slightly higher than the National Employment Act guidelines.

- Labour Relations Act, 2007 (Acts No. 14)

This is the new version of the old Trade Unions Act and the Trade Disputes Act, revised to harmonize the old Trade Acts with Kenya's recent ratification of many of the elements of the ILO Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87). We are required to provide our workers with the freedom of association. We are required to honor a dispute process as laid out in the act. We currently have no collective bargaining agreement in place nor are we required to do so. To the best of our knowledge none of our employees belong to any Trade Unions, and it is our belief that our employees do not at this time feel that the benefits of membership outweigh the costs of dues which are born solely by them under the Act. We have never had a dispute with any employee that resulted in any collective action, lock out etc. and we have no disputes at all at this time, and we believe that we are in full compliance with this Act. To ensure that employees are aware of their rights under the Act, we have added the following language to all employment contracts issued by Wildlife Works;

"Wildlife Works, EPZ Ltd. acknowledges the importance of the recently enacted Labour Relations Act 2007, and therefore we wish to inform you that you are entitled to Freedom of Association, and specifically to join the Kenya Textile Workers Union(KTWU) should you so choose. Should you choose to join the KTWU, all membership dues and agency fees for the Union will be payable directly by you."

<u>CORPORATE LAWS.</u>

- Companies Act, (Law of Kenya Cap. 486);

We must remain a company in good standing, and are required to maintain our Corporate records with The Registrar of Companies in Nairobi annually.

- Bankruptcy Act (Cap. 53);

Lets hope this never applies to us.

<u>LAND and ENVIRONMENT LAWS.</u>

- Environmental Management and Coordination Act (Act 8, 1999)

We were required to undergo an environmental audit by the National Environmental Management Authority. We passed.

- Registration of Titles Act:

The terms of the Title Deed by which Rukinga Ranching Company Ltd is the owner of Rukinga Ranch are governed by this Act.

<u>LOCAL DISTRICT LAWS.</u>

County Council of Taita Taveta Rates are paid at the rate determined under the local By-Laws of our District.
It is confirmed that:

- the project is in compliance with all national laws and license requirements relating to conservation projects in Kenya; and

- there is no law mandating that the Land is a conservation area. It is noted that no category of land use relating to conservation exists under Kenyan law. The current land use category for the Rukinga Sanctuary project and other privately owned conservation projects is classified as agriculture.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

The major risks that could have an impact on the project are:

- Change in legislation – government expropriating the Land through compulsory purchase for development scheme; as the Government of Kenya is very supportive of our project and has no recent history of expropriation of private conservation lands this risk is very low. We will continue to seek international press for our project as keeping it in the spotlight ensures the Government remains aware of the values it is providing to the country;

- Income - Risk that carbon market revenues do not eventuate or are less than adequate to sustain the project financially; our financial sustainability was modeled at very conservative Carbon offset sale values, and we have a very well known project with high potential value in the marketplace so the likelihood of this occurring is small, especially in light of existing offtake contracts for the life of the project with BNP Paribas and Nedbank, two major international banks;

- Crop Failure - substantial and repeated crop failure in surrounding communities could lead to increased poaching and use of trees for financial benefit; this is very likely and all of our alternative economic development efforts are aimed at mitigating this risk, and we have demonstrated the ability to prevent this risk from damaging the forest for almost ten years;

- Invasion of cattle grazers due to famine in adjacent communities, or lack of grazing elsewhere. However any influx of cattle only affects quantity of grass on Project Area and leads to no significant change in carbon stock. Again this is possible especially as the Somalis have used land in this area to feed and water their cattle over the years, sometimes with permission sometimes without, however the increasing aridity in the area we believe will force the Somali's to look elsewhere for rangelands. We will be using funds from the Carbon project to increase Ranger patrolling to better protect the Project Area and Leakage Area from illegal incursions;

- Drought – drought is an increasing reality in this part of Kenya and we anticipate that with Climate Change it will only worsen in the years covering the project crediting period. Drought introduces two additional risks;

- Wildlife – drought obviously places a lot of stress on wildlife in the Project Area, and Leakage Area. However many of the species living in this ecosystem are extraordinarily drought adapted, and have no problem surviving in extended drought. For those that aren't we plan to continue to provide emergency water sources at Rukinga as we have for the past ten years;

- Cash crops – drought will make the survival of cash crops, such as jojoba, citrus trees etc. more difficult but these high value cash crops will be planted sparingly and need much less water than an entire field of maize, and are able to survive higher temperatures, provided they receive some water, which the farmers will be in a position to provide to preserve the financial value of the crop;

- Fire – grass fires are common in the region due to the intense heat and dry conditions, although naturally occurring fires are extremely rare, so our strategy is to continue to educate the local population especially the youth about the dangers of burning fallows to improve grazing for their animals. Fires tend to burn the grasses and shrubs but move quickly and do not kill the trees which have become tolerant of grass fires.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The Baseline emissions case has nothing to do with the Project Proponent, who entered the scene expressly to prevent the deforestation of the Kasigau Corridor.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project has not created another form of environmental credit, and as far as we know is not eligible for any other form of environment credit.

1.14 Project rejected under other GHG programs (if applicable):

Not Applicable

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

The Project Proponent for the Kasigau Corridor REDD Project – Phase I Rukinga Sanctuary is Wildlife Works Inc., a California Corporation in good standing. Wildlife Works Inc. acquired the carbon rights from the landowner, Rukinga Ranching Company Ltd. after a process of Free Prior and Informed Consent, through a Carbon Rights Agreement/Easement that was approved by a full vote at an AGM of the Shareholders at Rukinga on February 13th 2009, at which AGM the Shareholders present were given an explanation of the potential of the Carbon project, a copy of which has been provided to the Validator, and following which the Shareholders unanimously approved the pursuit of this opportunity by the Managing Director and majority shareholder of the land, Mike Korchinsky. This decision was ratified again unanimously by an extraordinary general meeting of shareholders of Rukinga Ranching Company Ltd on December 9th, 2009.

The carbon project is managed in the field in Kenya by Wildlife Works Carbon LLC, a joint venture of Wildlife Works, Inc. and Colin Wiel Investments II, in return for which Wildlife Works Carbon LLC is eligible for a share of the proceeds from the sale of the carbon credits generated by the project. Details of this arrangement are specified in the Membership Agreement of Wildlife Works Carbon LLC, which was provided to the Validator.

Contacts:
Wildlife Works Inc.:
Founder & CEO – Mike Korchinsky
Tel: +1-415-332-8081
Fax: +1-415-332-8057
Email: mike@wildlifeworks.com

Wildlife Works Carbon, LLC.:
President – Mike Korchinsky

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

Wildlife Works is working closely with the REDD Focal Point within the Government of Kenya to ensure that any future REDD legislation considers Projects such as this in the design of sub-national nesting rules. We do not believe there are any issues that could effect the eligibility of the project. All information related to the quantification of emission reductions has been detailed in the appropriate sections of the Supporting Document - VCS Methodology PD Requirements.

1.17 List of commercially sensitive information (if applicable):

The Carbon Rights Agreement between Wildlife Works, Inc. and Rukinga Ranching Company, Ltd contains commercially sensitive information and has been excluded from the public version of the PD. It was of course provided to the Validator during validation.

The Membership Agreement of Wildlife Works Carbon LLC between Wildlife Works, Inc. and Colin Wiel Investments II contains commercially sensitive information and has been excluded from the public version of the PD. It was of course provided to the Validator during validation.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

This project used the VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests, approved by the VCS for sectoral scope 14 on January 11th, 2011.

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests was developed by the Project Proponent based on their experience on this Project, and was developed to be especially suited to the slash and burn agricultural conditions found in this project, and the mitigation activities conducted by the Project Proponent in this project. This project meets all of the applicability conditions of the methodology.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

Refer to Supporting Document - VCS Methodology PD Requirements Sections 5.3 and 5.4.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Refer to Supporting Document - VCS Methodology PD Requirements Section 6.1.

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

Refer to Supporting Document - VCS Methodology PD Requirements Sections 6.1 and 7.

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

This project used the VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests, approved by the VCS for sectoral scope 14 on January Nth, 2011.

VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests was developed by the Project Proponent based on their experience on this Project, and was developed to be especially suited to the slash and burn agricultural conditions found in this project, and the mitigation activities conducted by the Project Proponent in this project. This project meets all of the applicability conditions of the methodology.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

Refer to Supporting Document - VCS Methodology PD Requirements Sections 13.14.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Refer to Supporting Document - VCS Methodology PD Requirements Sections 13.14.

3.4 Description of the monitoring plan

Refer to Supporting Document - VCS Methodology PD Requirements Sections 13.14.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

This project used the VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests, approved by the VCS for sectoral scope 14 on January 13th, 2011.

VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests was developed by the Project Proponent based on their experience on this Project, and was developed to be especially suited to the slash and burn agricultural conditions found in this project, and the mitigation activities conducted by the Project Proponent in this project. This project meets all of the applicability conditions of the methodology.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Refer to Supporting Document - VCS Methodology PD Requirements Section 8.

4.3 Quantifying GHG emissions and/or removals for the project:

Refer to Supporting Document - VCS Methodology PD Requirements Section 11.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Refer to Supporting Document - VCS Methodology PD Requirements Section 11.

5 Environmental Impact:

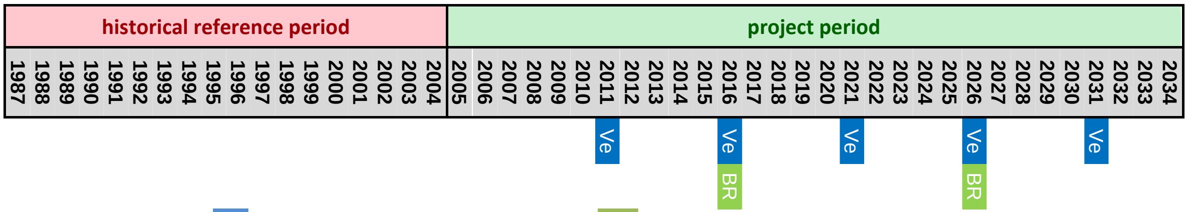
We were required to undergo an environmental audit by the National Environmental Management Authority. We passed. Results provided for review by the Validator.

6 Stakeholders comments:

Stakeholder comments were solicited via public comment periods on the internet, and by postings on local area notice boards. Copies of the public comments received were provided to the Validator.

7 Schedule:

A complete timeline of Project Activities was provided to the Validator. The overall Schedule for the project is shown below. Project Start Date and Crediting Period Start Date are both January 1st 2005, and Project end Date is December 31st 2034. Project Activities began on January 1st 2005, with an escalation of activities in 2009 after receipt of initial carbon project finance, costs prior to 2009 being born solely by the Project Proponent.



project timeline (Ve = external verification year, BR = baseline re-evaluation year)

8 Ownership:

8.1 Proof of Title:

Rukinga Ranching Company Ltd has legal title to all of the land of the Project Area, known as Rukinga Sanctuary. A copy of the title deed was provided for the Validator. Wildlife Works Inc. acquired the carbon rights from the landowner, Rukinga Ranching Company Ltd. after a process of Free Prior and Informed Consent, through a Carbon Rights Agreement/Easement that was approved by a full vote at an AGM of the Shareholders at Rukinga on February 13th 2009, at which AGM the Shareholders present were given an explanation of the potential of the Carbon project, a copy of which has been provided to the Validator, and following which the Shareholders unanimously approved the pursuit of this opportunity by the Managing Director and majority shareholder of the land, Mike Korchinsky. This decision was ratified again unanimously by an extraordinary general meeting of shareholders of Rukinga Ranching Company Ltd on December 9th, 2009.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not Applicable

Boden Creek Ecological Preserve
Forest Carbon Project
June 15, 2011

Forest Carbon Offsets LLC
600 Cameron Street
Alexandria, VA 22314, USA
Technical Contact: Jeff Waldon, Chief Technical Officer
Phone: +1 540-230-2854, Email: jeffwaldon@forestcarbonoffsets.net
Web: http://www.forestcarbonoffsets.net

Cover Photo: Station #6 Boden Creek Trail, April 3, 3008 03:47h, jaguar likely pair (Miller and Miller 2008).

1.0 Project Description

1.1 Project title

Boden Creek Ecological Preserve (BCEP) Forest Carbon Project (the "project").

1.2 Type and Category of Project

AFOLU: Reduced Emissions from Deforestation and Degradation

1.3 Estimated Emission reductions over the crediting period

The total predicted avoided emissions over 25 years exceeds 1.4 million mtCO2e

1.4 A brief description of the project

BCEP is located on 5,213 hectares of which 3,980 ha are considered the project area. The goal of the project is to develop the project as a carbon sink by means of conserving and protecting the property which will maintain the biodiversity values of the property and enhance the local economic environment with sustainable livelihoods through private-sector eco-tourism. The climate objective is to avoid emissions from deforestation during the project timeframe.

The project consists of protection of the property for the timeframe of the project through patrols, outreach with and job creation for the local villages, and placing a restrictive covenant on the property deeds for the life of the project. Belize Lodge and Excursions (BLE) is the contractor charged with running an ecotourism operation on the property. BCEP is the entity that owns the property and the entity charged with managing the property. BLE has an ecotourism contract for use of the property from BCEP. Forest Carbon Offsets LLC (FCO) is an agent of BCEP to develop BCEP as a carbon finance project. Conservation Management Institute at Virginia Tech (CMI) is a subcontractor hired to conduct technical analysis on behalf of FCO.

1.5 Project location

The property boundary consists of 5,213 ha of which 3,980 ha are considered the project area. The project area is completely available for aquaculture, industrial logging and commercial agriculture (with the exception of a one-chain buffer around perennial streams) according to Belize's national plans for agriculture[1] and aquaculture development[2] in the absence of finance from any carbon financing mechanism. The project is situated at Latitude 16^{0}17'37" North and Longitude 88^{0}48'47" West in the Toledo District, Belize 23 km north of Punta Gorda, Belize (Figure 1: General location of Boden Creek Ecological Preserve). The project's boundaries are defined by the 931 ha Pine Hill Mennonite Community, the 7,516 ha Seven Hills Estate, the 2,192 ha Manatee Creek Parcel, the 3,866 ha Golden Stream Parcel, and Indian Creek Village.

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[1] National Food and Agriculture Policy (2002-2020). Available at http://www.agriculture.gov.bz/PDF/Policy_Document.pdf accessed 1/21/2010.

[2] National Aquaculture Zoning Plan for Belize: Schedule I (DRAFT). Available at http://www.coastalzonebelize.org/reports/draft_nationa_aquaculture_policy.pdf accessed 1/21/2010.

Figure 1: General location of Boden Creek Ecological Preserve[3]

[3]Source: CIA World Factbook via the University of Texas (http://www.lib.utexas.edu/maps/belize.html

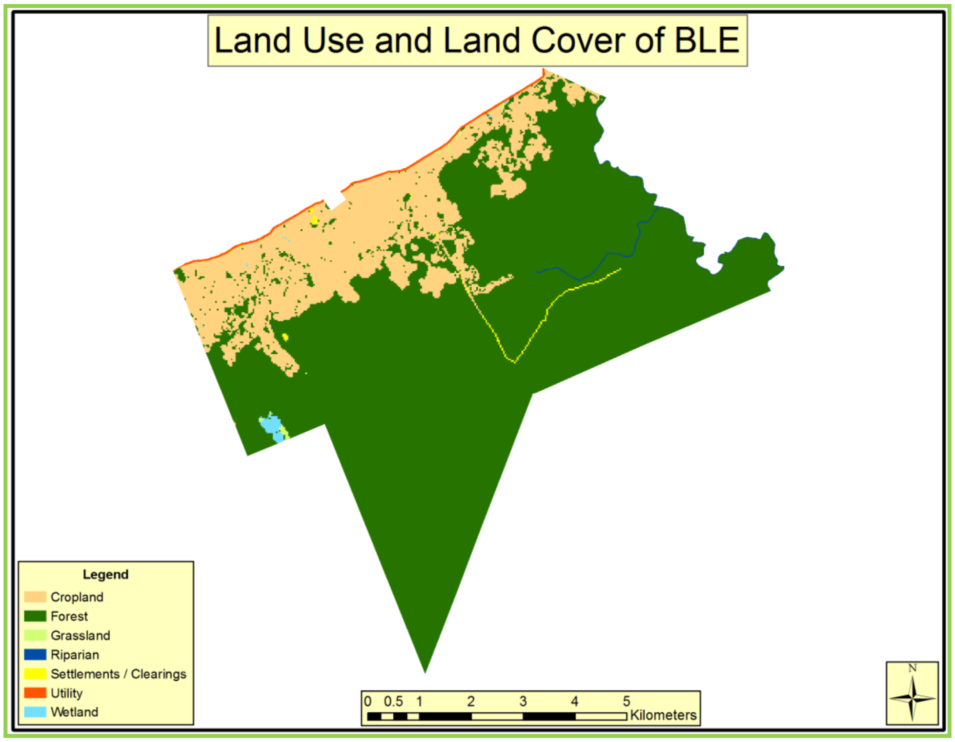

Figure 2: Project Area: Forest vs. Non-Forest Map

1.6 Duration of the project activity/crediting period

- Historical reference period January 1995 through December 2004
- Funding secured for carbon project and developer signed September 2009.
- Start of project 1/1/2005
- Crediting period 2005 to 2029.
- Baseline reset 2015 and 2025.
- Project end date is December 31, 2029.

1.7 Conditions prior to project initiation

The property was purchased from the previous owner who was in the process of converting the property to a mix of agriculture (bananas and citrus primarily). The evidence on the ground of this history is self-evident as a part of the property was cleared and remnant banana and orange trees are still visible. The project started when the property was purchased (2000-2004). The previous landowner received and seriously considered at least one other offer of purchase for conversion so the agent of deforestation was determined to be a class of deforestation agent.

In 2001, a hurricane damaged the biomass on the property. In the period 2004 to 2008, the property owner protected the property with investor funds and sought outside support for a carbon financing project. In 2008/2009, FCO was contracted as an agent of the landowner to perform the due diligence required, collect and analyze the data, and prepare the documentation for the REDD project.

1.8 Project description

The major project activities are:

- Partner with BLE to conduct ecotourism activities at the site to generate jobs for local people,
- Control access to the site through regular patrols,
- Continue to conduct outreach with the local communities,
- Place a restrictive covenant on the property, and
- Monitor results.

The project will use carbon financing to avoid the threat of conversion to citrus, pasture, and/or aquaculture. A successful and financially stable BCEP will provide livelihoods both through management of the property and through the ecotourism operations conducted by BLE. These livelihoods are badly needed in the local communities. Financial stability means that the taxes can be paid, and all the other activities necessary to maintain and protect the property are sustainable. The primary activity for management of the property is patrols and interaction with local communities. These activities ensure the long term protection of the climate and biodiversity values of the project by preventing illegal hunting and harvesting of timber. A substantial monitoring program will be undertaken by BCEP.

1.9 Project technologies, products, services and the expected level of activity

The primary technology employed to achieve the desired results is patrols of the property to prevent incursions and illegal removal of biomass. The following activities will occur:

- Rangers and patrols,
- Assisting forest carbon data collection,
- Assisting biodiversity data collection,
- Ecotourism services,
- Accounting,
- Personnel management,
- Maintenance, and
- Restrictive covenants.

Monitoring will occur regularly with verification audits no less frequently than every 5 years.

1.10 Compliance with relevant local laws and regulations related to the project

BCEP complies with all applicable local, district, and national labor standards. BCEP follows all applicable environmental laws including the Belize Environmental Protection Act Chapter 328, Revised Edition 2000.[4] Belize has the following relevant labor laws:

- International Labour Organization Conventions Act,
- Labour Act,
- Labour (Subsidiary Laws),
- Protection Against Sexual Harassment Act,

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[4] See www.belizelaw.org.

- Protection Against Sexual Harassment Commencement Act Order,
- Public Safety Act,
- Trade Unions Act,
- Trade Unions Regulations,
- Trade Unions and Employers Organizations (Registration, Status and Recognition) Act, and
- Trade Unions and Employers Organizations (Registration, Status and Recognition) Act (Commencement) Order.

The project team conducted an exhaustive law review for the PDD:

- Belize Private Forests (Conservation) Act, Chapter 217, Revised Edition 2000.
    - This is a revised edition of the law, prepared by the Law Revision Commissioner under the authority of the Law Revision Act, Chapter 3 of the Laws of Belize, Revised Edition 1980 - 1990.
- Forests Act, Chapter 213, Revised Edition 2003.
    - This is a revised edition of the Subsidiary Laws, prepared by the Law Revision Commissioner under the authority of the Law Revision Act, Chapter 3 of the Substantive Laws of Belize, Revised Edition 2000.
- Forest Fire Protection Act, Chapter 212, Revised Edition 2000.
- Water and Sewage Act, Chapter 222.
    - Defines riparian protection as "that the flow of the stream does not fall below the minimum quantity necessary to secure the interest of public health and the protection of the rights of riparian and other land-owners." (p. 46)
- Water Industry Act, Chapter 222.
- Belize Agricultural Health Authority Act, Chapter 211.
- Fisheries Act, Chapter 210.
- Timber Industry Act, Chapter 341.
- Land Utilization Act, Chapter 188.
    - The Minister may, for the better utilization of land, make regulations-
        - to demarcate areas, water catchment areas or watersheds and prohibiting the clearing of any vegetation within those areas;
        - to provide for such other measures as may be required to prevent soil erosion; restricting the construction of buildings within stipulated distances from the middle line of any road or street;
        - to demarcate specific areas as special development areas and to stipulate the type of development that will be permitted within those areas;
        - for the clearing of any forest or the felling of any trees; and
        - to provide for all such other things as may be necessary for the better carrying out of the provisions of this Part of the Act.
- Citrus (Processing and Production) Act, Chapter 277.

From this analysis and based on personal communication with the Ministry of Natural Resources and the Environment and the Belize Forest Department, it is clear that the BCEP property could easily be converted legally to a citrus plantation. The only caveat is that there should be a one-chain riparian buffer on either side of Golden Stream and Boden Creek (personal communication with the Ministry of Natural Resources and Environment, Belize), even though this one-chain buffer is not required by law. There are no property disputes within the project area per personal communication with the Belize

Forestry Department and the legal resources assisting with the claims of the 38 Mayan villages of southern Belize.

1.11 Identification of risks

Political Risk

Risks to the project from instability in the Government or a change in leadership at BCEP or BLE are considered minimal. In any case, BCEP has agreed to a restrictive covenant for the life of the project to ensure permanence once carbon finance becomes available. The restrictive covenant is envisioned as a commitment by the landowner on the title to comply with the project plan over the life of the project. The purpose of this restrictive covenant is (in the unlikely event that the land changes hands) to bind any new owners to compliance with the CCB and VCS project plans e.g. no removal of forest, regular monitoring, patrols, and outreach to the local communities.

Risk from Oil and Gas Development

To the best of FCO's knowledge no oil or mineral resources occur on the project site and exploration for mineral resources is not occurring nor is it expected to occur. If oil or gas is discovered on the site, it would belong to the Government of Belize. Similar sites in Belize where oil extraction is taking place have minimal above ground disturbance. Section 26 paragraph 6 of the National Petroleum Act states:

> "(6) Subject to this Act, where, in the course of conducting petroleum operations pursuant to a contract, the rights of the owner or lawful occupier of any land are disturbed or damage to any crops, trees, buildings, stock, works or other property thereon is caused, the contractor is liable to pay the owner or lawful occupier fair and reasonable compensation in respect of the disturbance or damage according to the respective rights or interests of the owner or lawful occupier concerned. The amount of compensation payable shall be determined by agreement between the parties or if the parties are unable to reach agreement or the agreed compensation is not paid, the matter may be treated in accordance with the Arbitration Act."

Based on this, the contractor for the Government extracting the oil would be responsible for compensating the owner of the credits for any reversals suffered as a result of the oil extraction process.

Natural Risk

The greatest natural risk to the project is a direct hit by a hurricane. Hurricane Iris struck the project site in 2001 resulting in a blow down of trees. Therefore, this area is currently in a state of ecological regeneration as is much of the Toledo District likewise impacted in this natural cycle.

Leakage Risk

Since the risk to the forest is determined to be a class of deforestation agents that convert land in Belize to agricultural uses, and the most conservative agricultural use, from a carbon sequestration standpoint is citrus development, a market leakage analysis was conducted following methodology module "Estimation of emissions from activity shifting for avoided planned deforestation (LK-ASP)". A reduction in claimed avoided emissions was made to account for leakage risk.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions

No GHG emissions have been created by this project. The objective of this project is to avoid emissions.

1.13 Other forms of environmental credit

No other environmental credit has been created by this project. The co-benefits of the project have been validated to the Climate, Community, and Biodiversity 2nd Edition Gold Standard at the project level by SCS July 14, 2010.[5]

1.14 Project rejected under other GHG programs

This is the first and only application for this project to a GHG program.

1.15 Project proponents roles and responsibilities

BCEP is the project proponent. BCEP has hired FCO to develop the strategy, implementation, and monitoring of the carbon credits generated by this project. FCO has hired CMI Virginia Tech to collect initial data, develop the monitoring protocol and conduct the baseline study for the monitoring program. Supporting documents are available by contacting FCO. BLE is the partner actually conducting the ecotourism enterprise. Decisions on implementation of the project activities are the responsibility of the BCEP board. FCO will be a member of the BCEP board at least through 2014.

1.16 List of commercially sensitive information

Land titles, economic analysis, and inventory data.

[5] CCB Website: http://www.climate-standards.org/projects/index.html

2.0 VCS Methodology

2.1 VCS methodology applied

VM0007 REDD Methodology Modules (http://www.v-c-s.org/methodology_rmm.html). In particular the following methodology modules were used for this project:

- REDD-MF
- M-MON
- T-ADD
- T-BAR
- X-UNC
- X-STR
- BL-PL
- LK-ASP
- CP-AB
- T-SIG
- E-BB
- A/R Methodological tool "Estimation of direct nitrous oxide emission from nitrogen fertilization" (Version 01) with correction for percentage of nitrogen in applied fertilizer (NC_{SFi})

2.2 Justification of the choice of the methodology

Based on the methodology and the reference for the methodology, VCS "Tool for AFOLU Methodological Issues", this project qualifies because of a reduction in emissions of carbon dioxide from planned deforestation in the project scenario. This methodology is applicable because:

- Land in the project area qualified as forest at least 10 years before the project start date,
- No peat soils are present on the project site,
- Project proponents can show ownership of the project site and ownership of the carbon rights for the project area,
- Baseline deforestation in the project area falls within the category of planned deforestation (VCS category APD),
- Baselines shall be renewed every 10 years after the start of the project except where triggers lead to a more frequent renewal,
- No areas registered under the CDM or any other carbon trading scheme are included within the project site. Validation under the Climate, Community, and Biodiversity Alliance for co-benefits has been disclosed,
- The baseline condition is conversion of the property to a permanent deforested state of citrus agriculture,
- No reforestation is proposed for the project, and
- Leakage avoidance activities do not include either agriculture lands flooded to increase production, or intensifying livestock production.

The project is considered under the category "Avoided Planned Deforestation". This project qualifies because:

- Conversion of forest lands to a deforested condition is legally permitted,
- Documentation is available to clearly demonstrate with credible evidence that the land would have been converted to non-forest use if not for the REDD project, and
- Post deforestation land use does not include reforestation.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project

The approach to measuring carbon stock in the project was based upon the "Sourcebook for Land Use, Land-Use Change and Forestry Projects" (Pearson et al 2005). These methods comply with the Intergovernmental Panel on Climate Change's 2006 Guidelines for National GHG Inventories for Agriculture, Forestry and Other Land Use.

Emrick and Dorr (2008) identified 10 general cover types at BCEP and created a preliminary vegetation map using a 2003 Quickbird image that covered approximately 50% of BCEP. Two of the 10 types, Wet Tropical Broadleaf Forest and Mixed Cohune/Tropical Broadleaf Forest, accounted for over 95% of the forested area at BCEP. Observations during subsequent field visits indicated that these boundaries corresponded poorly to the forested vegetation types. As a result FCO concluded that accurately mapping separate forest types in a young forest recovering from a series of disturbances would be difficult if not impossible. Therefore FCO classified the entire forested area at BCEP as *Lowland Broad Leafed Wet Forest* (Meerman and Sabido 2001).

Thus, for the purposes of assessing carbon stocks at BCEP, FCO classified the landscape into one of the six Land Use Land Cover classes (Forest Land, Crop Land, Grass Land, Wetlands, Settlements and Other Land) defined by IPCC (2006).

<u>Carbon Pools</u>

The carbon pools selected for measurements were the above ground tree (> 5cm diameter at breast height) and below-ground biomass. Non-tree above ground and below ground biomass were either not measured (lianas), or measured and set aside for a future revision of the project (palms and cecropias). Down or standing dead wood and leaf litter were also not measured. Omitting these potential carbon pools resulted in a conservative estimation of carbon stocks. It was determined that some existing trees may be harvested in the baseline scenario. These few trees were analyzed from the inventory data and found to be insignificant. In the baseline scenario, emissions attributable to biomass burning were analyzed and included, as were avoided emissions from fertilizer use.

Table 1: Carbon Pools and Sources of Emissions

Carbon pools	**Included / excluded**	**Justification / explanation of choice**
Above ground	Included	Recovering secondary tropical forests have high growth / carbon accumulation rates and rapidly fix key nutrients in the above and below ground biomass (Vitousek and Stanford 1986, Vitousek 1991, Guariguata and Ostertag 2001, Hughes et al 1999).
Below ground	Included	Recovering secondary tropical forests have high growth / carbon accumulation rates and rapidly fix key nutrients in the above and below ground biomass (Vitousek and Stanford 1986, Vitousek 1991, Guariguata and Ostertag 2001, Hughes et al 1999).
Dead-wood	Excluded	Excluded to be conservative and make the monitoring cost-effective.
Harvested wood products	Excluded	The standard practice in Belize for conversion of forest to agricultural lands is to remove valuable timber species and then bulldoze and burn the remaining trees. This pool was analyzed for significance and found to be de minimis.
Litter	Excluded	Excluded to be conservative and make the monitoring cost-effective.
Soil organic carbon	Excluded	Excluded to be conservative and make the monitoring cost-effective.
Fuel Wood Collection	Excluded	While some fuel wood collection was occurring prior to the project and would presumably occur in the baseline scenario, an analysis was conducted based on local population data and found that this pool is de minimis and therefore excluded.

Sources	**Gas**	**Included / excluded**	**Justification / explanation**
Biomass burning	CO_2	Excluded	CO_2 emissions are accounted for by biomass changes in the above ground and below ground biomass pools.
	CH_4	Included	CH_4 emissions from land clearing and burning are included in the stock change model for the baseline. No biomass burning is proposed as a project activity.
	N_2O	Included	N_2O emissions from land clearing and burning are included in the stock change model for the baseline. No biomass burning is proposed as a project activity.
Combustion of fossil fuels	CO_2	Excluded	Conservatively omitted from both the baseline and project scenarios.
	CH_4	Excluded	Conservatively omitted from both the baseline and project scenarios.
	N_2O	Excluded	Conservatively omitted from both the baseline and project scenarios.
Use of fertilizers	CO_2	Excluded	Conservatively omitted from both the baseline and project scenarios.

	CH_4	Excluded	Conservatively omitted from both the baseline and project scenarios.
	N_2O	Included.	The baseline scenario of citrus agriculture would utilize chemical fertilizer.

2.4 Description of the identified baseline scenario

Prior to the start of the project, the previous owner was in the process of removing timber and converting the property to a banana plantation. The baseline scenario therefore is considered to be a continuation of that process of conversion. As far as is known, no written plan was produced for this process by the previous landowner so proxy areas were analyzed to support a rate of conversion consistent with current practice in the area.

Carbon financing will stabilize the protection and maintenance budget which includes patrols, monitoring, outreach to local communities, road maintenance, trail maintenance, and other activities.

<u>Additionality Analysis</u>

Per instructions from the methodology, the following analysis is offered of alternative baseline scenarios according to the procedure presented in "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities"

This tool is applicable because a) the proposed project activities will not violate any Belizean law, and b) the use of this tool results in identification of the most plausible baseline scenario of the several possible baseline scenarios identified below.

Some of the alternative land uses are more likely and pose a much larger deforestation threat than others. The following is a "ranking" of the three most likely alternative land uses. Each alternative is considered legal in Belize.

1. Conversion to Agriculture (continuation of the preproject land use)

The most likely alternative land use scenario is the conversion to agriculture, and it is the most pervasive driver for deforestation and land use change in the project area. Agricultural products could include cattle, citrus, bananas, aquaculture, cacao, rice, and other products. The conversion of forestland in Belize to agriculture is both a national and regional trend. The FAO (2003) estimated that by 1989 about 217,241 hectares, or about 10%, of the national land area had been converted from forest to agricultural land. Furthermore, by the first half of the 1990's 25,000 hectares of forested land were being lost yearly due to conversion to agricultural land (FAO 2003).

Suitability of soils for conversion to agriculture, particularly citrus were evaluated using the literature. According to Baillie (1993) soils throughout the Project Area are derived from mudstones, sandstones limestone deposits. Soils are moderately shallow clays that are fairly well drained. The soils are underlain by flat-bedded mudstones with some minor sandstones and limestones. Most soils are clay and well-drained while calcium and magnesium are present. The soils are moderately acidic.

Citrus soils need 1) to be moderately acidic, 2) well-drained, and 3) without a deficiency of calcium and magnesium and soils in the project area meet all necessary criteria (Baillie 1993).

BCEP is bordered and in close proximity to several farms involved in the production of banana, citrus, and cattle. The owner has indicated that some of these landowners expressed an interest in buying portions of BCEP in order to expand their operations. Furthermore, the previous owners of BCEP operated a citrus, banana and cattle operation on the project site which ceased only after the current owner purchased the property (Bowen-Jones 2001).

2. Purchase of the Land to Operate Ecotourism Lodges

One alternative land use would be the purchase of BCEP by a different owner to operate the ecotourism lodges. The economics of the current operation, running the lodge system and supporting protection of a large conservation area, is not sufficient, and it would be unlikely to change appreciably to allow a different landowner to succeed.

Commercializing the value of the avoided CO_2 emissions will provide the capital required to support the management of the property as a conservation area independent of the ecotourism operation. There are no other ecotourism operations in Belize with a large conservation area and no other outside sources of income either through agriculture or external donors.

3. Purchase of the Land as a Conservation Area

There are privately owned protected areas in the area and throughout Belize. Most landowners, and the landowner at BCEP, that own these properties are members of the Belize Association of Private Protected Areas (BAPPA). Landowners purchase properties for conservation for a variety of reasons. Some establish nonprofit companies to hold the property and some simply hold onto the property out of a desire to protect the biodiversity or other values of the site. There is no inherent financial income stream from owning a private protected area while there are several required expenses. The initial purchase price, annual taxes, maintenance, and protection from trespass are all expenses that can run into the millions of dollars. Landowners that pursue this strategy are required to be relatively wealthy or have outside sponsors or pursue a strategy of income generation that is consistent with conservation such as ecotourism.

<u>Analysis of Alternatives</u>

The ecotourism operation is a separate entity. No financial resources are planned for transfer from the ecotourism operation to the carbon project. At present the ecotourism operation is negative. No income is expected from the carbon project. Simple financial analysis would indicate that without the carbon income the financial situation will be negative. The baseline scenario of agriculture and particular citrus is considered positive since it was underway at the time of the purchase of the project (Bowen-Jones 2001) and the citrus industry is a healthy part of the Belizean economy (Tzul 2010). Therefore at least one of the baseline scenarios is more profitable than the project scenario excluding the carbon project income.

Financial plans for both the ecotourism operation and the carbon project will be made available to the auditors.

Common Practice Analysis

- The practice of converting land to industrial agriculture is commonplace in the region as indicated in Tzul 2010, FCO's land cover analysis, and observations on the ground.
- Two other nearby properties owned by nonprofits are of similar size and are managed as protected areas.
- Both nearby properties are supported by an international donor base not available for the project site making the situations quite dissimilar. The essential difference between this project site and others is that this project site has no external funding source on which to draw in the absence of carbon financing.

2.4 Strategy for reduction of GHG in the baseline scenario

The climate objective is to avoid emissions from deforestation during the project timeframe. The major project activities are:

- Partner with BLE to conduct ecotourism activities at the site to generate income for expenses of maintaining and managing the property,
- Control access to the project site through regular patrols,
- Continue to interact with the local communities,
- Place a restrictive covenant on the titles, and
- Monitor results.

The project will use carbon financing to avoid the threat of conversion to agriculture. A successful and financially stable BCEP will provide livelihoods both for management of the property and through the ecotourism operations conducted by BLE. These livelihoods are badly needed in the local communities. Financial stability means that taxes can be paid, and all the other activities necessary to maintain and protect the property are sustainable.

The primary activity for management of the property is patrols and interaction with local communities. These activities ensure the long term protection of the climate and biodiversity values of the project by preventing illegal hunting and harvesting of timber. Employment within local communities makes local communities stakeholders in protecting the property.

A substantial monitoring program will be undertaken by BCEP. The monitoring protocol and baseline study are being designed and initially conducted by staff of CMI and FCO. CMI conducted the initial studies at BCEP and both FCO and CMI have significant field experience in Belize.

3.0 Monitoring

3.1 VCS methodology applied to the project activity:
REDD Methodology Modules (http://www.v-c-s.org/methodology_rmm.html) particularly modules M-MON and LK-ASP.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches

Purpose of Monitoring

The purpose of monitoring is to:

- Revise the baseline in year 10 of the project,
- Detect carbon stock changes and greenhouse gas emissions,
- Describe leakage of carbon stocks and greenhouse gas emissions attributable to leakage, and
- Estimate ex-post net carbon stock changes and greenhouse gas emissions.

Types of Data and Information to be Reported, Including Units of Measurement

The types of data and information to be reported are reproduced from the methodology in Appendix A.

Origin of the Data

The origin of the data will be from field observations made on an annual basis and verified by a 3rd party auditor at least every 5 years.

Monitoring, Including Estimation, Modelling, Measurement or Calculation Approaches

The monitoring plan is reproduced in Appendix A.

Monitoring Times and Periods, Considering the Needs of Intended Users

The monitoring times will be during the dry season, typically December through April of each year. Each permanent plot will ideally be remeasured each year, but at least in the year prior to the verification event. Monitoring reports will be produced for use by the 3rd party auditors at each verification event.

Monitoring Roles and Responsibilities

BCEP has responsibility for monitoring and has budgeted personnel and funds for this purpose.

Managing Data Quality

The data quality will be assessed at each verification event. The monitoring protocol is available for review and includes a QA/QC component.

3.4 Data and parameters monitored

The monitoring protocol is reproduced in Appendix A.

3.5 Description of the monitoring plan

The monitoring protocol is reproduced in Appendix A. The overall plan is that staff from BCEP will be trained by the Conservation Management Institute to measure each permanent plot each year. At periodic intervals, no less frequently than every 5 years, the data will be summarized, written up within a monitoring report, and verified by a 3rd party auditor.

4.0 GHG Emission Reductions

4.1 Explanation of methodological choice

This REDD Methodology Framework is applicable to project activities that fall within the AFOLU project category "REDD" as defined in the VCS AFOLU Guidance document. By choosing the appropriate modules on the basis of the applicability conditions mentioned in each of the modules, a project-specific methodology can be constructed. Prior to project initiation, the project site was being deforested. This project avoids planned deforestation by means of the purchase of the property for the purpose of protecting it.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario

In order to estimate potential carbon stock changes over the life of the project, a detailed description of a plausible and realistic baseline scenario is required. Based upon FCO analysis of alternative land use scenarios, the conversion to agriculture is the most likely land use in the baseline scenario. Of the various agricultural conversion options common in the area, citrus conversion is used as a likely, and most conservative from a biomass perspective, choice for performing the calculations necessary to describe the scenario.

Estimate of Greenhouse Gas (GHG) Loss in the Baseline Scenario

In order to estimate GHG loss und the baseline scenario the following variables are required:

1. Area of forest available for conversion,
2. Baseline carbon stocks,
3. Forest growth/biomass/carbon accumulation annual rates,
4. Maximum carbon stocks for secondary tropical forest in Belize,
5. Deforestation/conversion rates,
6. Allocation of deforestation among agro-ecosystems,
7. Carbon stocks in agro-ecosystems,
8. Fate of commercial timber and long-lived wood products,
9. Losses of biomass attributable to fuel-wood collection,
10. Avoided emissions from fertilizer use,
11. Avoided emissions from biomass burning, and
12. Avoided emissions from transportation fuel use.

1. Area of forest available for conversion

Of the total area of the property, 5,213 ha, 3,980 ha is available for the project. A reduction of 1,233 ha was made to account for land that was not forested at least 10 years prior to the start of the project plus land that is within a 1 chain buffer of perennial streams. This figure is based upon Landsat TM data and represents the total forest areas minus a one-chain buffer along perennial streams. An additional 228 ha of forest was conservatively removed from the project (from the forest class) to account for the discrepancy between the title acreage and the GIS boundary file.

2. Baseline Carbon Stocks

Baseline carbon stocks consisted of above ground biomass and below ground biomass. The mean carbon pool in 2011 was based on field measurements conducted in 2009 and 2011 and independently verified. The allometric equation for biomass prediction published in Chave et. al. (2005) for wet forest stands (without Height) was used to predict above ground biomass. A factor of 50% was used to convert biomass to carbon. The Chave et. al. equation requires the use of specific gravity for each species of tree (Zanne 2009). All trees were not identified to species as is commonly reported in the literature (Chave et. al. 2005) so a weighted average specific gravity for the site was developed based on the specific gravity for known trees on all plots. That weighted average (.6253) was used for all trees that were not identifiable to species.

Below ground biomass was estimated based on above ground biomass using the equation found in Pearson et al (2005).

An uncertainty level of 25.33% was calculated using module "Estimation of uncertainty for REDD project activities (X-UNC)".

3. Forest Growth / Biomass/Carbon Accumulation Annual Rates

A critical factor in calculating changes in carbon pools under the baseline scenario is the recovery of the forest from the impact of Hurricane Iris. Recovering secondary tropical forests have long been recognized to have high growth/carbon accumulation rates and rapidly fix key nutrients in the above and below ground biomass (Vitousek and Stanford 1986, Vitousek 1991, Guariguata and Ostertag 2001). Published rates of carbon accumulation and/or growth rates for young secondary *Lowland Broad Leafed Wet Forest* specifically for Belize are not available. However, Guariguata and Ostertag (2001) in a review of neotropical forest succession studies, reported above ground biomass accumulation rates of up to 100 t/ha over a 15 year period or a 6.7% accumulation rate /year.

Hughes et al. (1999) in a study conducted in the Los Tuxtlas region of Mexico, calculated mean yearly above ground biomass accumulation for a series of different aged secondary tropical forests. This study is particularly pertinent to carbon accumulation rates at BCEP because:

- The general vegetation composition of the communities is similar to those of BCEP.
- The ages of the forest stands used in their study encompass the age distribution of the forest at BCEP over the entire project (i.e. space for time substitution).
- Environmental variables (soils, bedrock geology, and climate) and land use history are similar to BCEP.

Using the data from Hughes et al (1999) the average annual above ground biomass accumulation rate for secondary tropical forests of all ages was 6.3%/year. Because southern Belize has substantially higher rainfall compared to the Los Tuxtlas region of Mexico the 6.3% rate was determined to be an appropriate and conservative figure to estimate biomass accumulation within the project area.

4. Maximum Carbon Stocks for Secondary Tropical Forest in Belize

The published steady state maximum for carbon stocks in tropical forest in southern Belize is 318 C tons/ha (Gibbs et al 2007).

5. Rate of Deforestation and Agricultural Conversion

Based on FCO analysis of proxy areas, the deforestation rate for the baseline scenario is considered to be 10.8% Six proxy areas were selected using the methodology described in "REDD Methodological Module: Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation (BL-PL)". An uncertainty level of 7.43% was calculated using module "Estimation of uncertainty for REDD project activities (X-UNC)".

6. Allocation of Deforestation/Conversion among Agro-Ecosystems

Under the baseline scenario, forest cover at BCEP would be converted to mixed agricultural uses. The conversion of tropical forest to mixed agriculture (i.e. citrus / banana plantations, pasture) does not result in a complete loss of carbon from the ecosystem. Each new agro-ecosystem will fix carbon albeit at a much lower rate compared to tropical forest. The one exception would be aquaculture where carbon fixation would be minimal. As opposed to citrus plantations, conversion to aquaculture will result in a 100% loss of carbon from the ecosystem.

7. Carbon stocks in agro-ecosystems

Of the terrestrial agro-ecosystems citrus plantations fix the most carbon, so citrus conversion was chosen as the most conservative assumption. Based on the best available literature, we determined an undeniably conservative estimate is 50% above the average found in Morgan et. al. (2006) or 141 kg/tree dry weight. Converting that weight to tons C/ha requires a presumption of tree density which is provided in Spreen et. al. (2010) as 107 trees/acre at year 20. That estimate then works out to 37 tons C/ha. Based on the literature, the other terrestrial agro-ecosystems had substantially lower maximum carbon stocks.

8. Fate of Forest Resources Lost to Agricultural Conversion (Long-lived Wood Products)

The standard practice in Belize for conversion of forest to agricultural lands is to remove valuable timber species and then bulldoze and burn the remaining trees. An analysis was conducted based on the inventory data and found that the available timber for a long-lived wood products pool was de minimis.

9. Loss of biomass attributable to fuel-wood collection

According to Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation (BL-PL), if pre-project, unsustainable fuel wood collection was occurring within the project boundaries, modules BL-DFW and LK-DFW shall be used to determine potential leakage. BCEP pre-project, limited fuel wood extraction was occurring on the portion of the property that is excluded from the above-ground biomass carbon pool. Given the estimated 1997 populations of the two villages pre-project at 751 (Toledo Maya Cultural Council 1997) individuals, and after applying Tool for testing significance of GHG emissions in A/R CDM project activities (Version 01) (T-SIG), the impact on this carbon pool was determined to be de minimis. Therefore emissions from fuel wood collection are not included in the baseline scenario, and monitoring leakage from fuel wood collection is not included in the monitoring plan.

10. Avoided emissions from fertilizer use

Avoided emissions from fertilizer use for the baseline was calculated using CDM A/R Methodological tool "Estimation of direct nitrous oxide emission from nitrogen fertilization" (Version 01). A low rate recommended by the Belize Citrus Growers Association (Tzul 2011) is 3.3 lbs of fertilizer (19-9-19)/tree-year. This rate was determined to be indisputably conservative and was used to calculate an annual application of .21 metric tons fertilizer/ha-year application rate in the baseline scenario.

11. Avoided emissions from biomass burning

In the baseline scenario, land clearing would include piling and burning of biomass on the site. An analysis of emissions from biomass burning was conducted to determine CH_4 and N_2O using module "Estimation of greenhouse gas emissions from biomass burning (E-BB)". Avoided emissions from CO2 release are omitted because they are accounted for by biomass changes in the above ground and below ground biomass pools.

12. Avoided emissions from transportation fuel use

Emissions from transportation fuel use are conservatively omitted in both the baseline and project scenarios.

4.3 Quantifying GHG emissions and/or removals for the project

GHG emissions and/or removals for the project are described for the same pools and variables as the baseline scenario with the addition of activity shifting leakage which only applies to the project scenario.

1. Area of forest available for conversion

Same as baseline.

2. Baseline carbon stocks

Same starting point as baseline.

3. Forest growth/biomass/carbon accumulation annual rates

Since the forest is recovering from a hurricane event, a growth multiplier (6.3% per year) is used on an annual basis to estimate ex ante C stocks based on the literature (Hughes et al 1999). Given the phase of growth that the forest is experiencing right now and for the life of the project, a more sophisticated sigmoidal growth model is not warranted.

4. Maximum carbon stocks for secondary tropical forest in Belize

Same as baseline, 318 tons C/ha.

5. Deforestation/conversion rates

No reductions or removals are planned for the life of the project.

6. Allocation of deforestation among agro-ecosystems

N/A, no conversion is allowed in the project.

7. Carbon stocks in agro-ecosystems

N/A, no conversion is allowed in the project.

8. Fate of commercial timber and long-lived wood products

No reductions or removals are planned for the life of the project.

9. Losses of biomass attributable to fuel-wood collection

No reductions or removals are planned for the life of the project.

10. Avoided emissions from fertilizer use

No fertilization is anticipated as a project activity.

11. Avoided emissions from biomass burning

N/A, no conversion is allowed in the project. In the event of ex-post fires occurring, the REDD Methodological Module: Estimation of greenhouse gas emissions from biomass burning (E-BB) Sectoral Scope 14 will be applied.

12. Avoided emissions from transportation fuel use

Emissions from transportation fuel use are conservatively omitted in both the baseline and project scenarios.

13. Activity shifting leakage

Leakage was determined using module “Estimation of emissions from activity shifting for avoided planned deforestation (LK-ASP)”.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project

Total uncertainty was calculated according to module “Estimation of uncertainty for REDD project activities (X-UNC)” for the above ground biomass pool and the proxy area analysis to determine deforestation rate by summing the uncertainty of each pool and subtracting 15% resulting in a combined project uncertainty of 21.58%. This percentage of the claimed avoided emissions was removed. The other pools and calculations were determined from the literature and considered to be undeniably conservative.

Table 2: Annual avoided emissions 2005 to 2029 in mtCO2e

Year	Project Emissions	Baseline Emissions					Total Avoided Emissions	Risk Buffer (15%)	Net Total
	Leakage	Biomass Change	Fertilizer Use	Non-CO2 Biomass Burning	Uncertainty Deduction	Total Baseline Emissions			
2005	236	8,480	76	1,863	2,248	8,171	7,935	1,190	6,745
2006	485	17,449	152	1,988	4,227	15,362	14,876	2,231	12,645
2007	760	27,321	228	2,121	6,403	23,269	22,509	3,376	19,132
2008	1,062	38,180	304	2,264	8,793	31,956	30,894	4,634	26,260
2009	1,394	50,112	381	2,416	11,417	41,492	40,098	6,015	34,083
2010	1,758	63,213	457	2,579	14,295	51,953	50,195	7,529	42,665
2011	2,158	77,585	533	2,752	17,450	63,420	61,262	9,189	52,073
2012	2,503	90,002	609	2,926	20,184	73,353	70,850	10,627	60,222
2013	2,947	105,940	685	3,110	23,679	86,056	83,109	12,466	70,643
2014	2,217	79,706	706	910	17,548	63,775	61,557	9,234	52,324
2015	1,924	69,170	706	0	15,078	54,798	52,874	7,931	44,943
2016	2,045	73,528	706	0	16,018	58,216	56,170	8,426	47,745
2017	2,174	78,160	706	0	17,018	61,848	59,674	8,951	50,723
2018	2,311	83,084	706	0	18,081	65,710	63,399	9,510	53,889
2019	2,457	88,319	706	0	19,210	69,815	67,358	10,104	57,254
2020	2,611	93,883	706	0	20,411	74,178	71,567	10,735	60,832
2021	2,776	99,797	706	0	21,687	78,816	76,041	11,406	64,634
2022	2,951	106,085	706	0	23,044	83,747	80,796	12,119	68,677
2023	3,137	112,768	706	0	24,486	88,988	85,851	12,878	72,974
2024	3,334	119,872	706	0	26,019	94,560	91,225	13,684	77,541
2025	3,544	127,424	706	0	27,648	100,482	96,938	14,541	82,397
2026	3,768	135,452	706	0	29,381	106,777	103,010	15,451	87,558
2027	4,005	143,986	706	0	31,222	113,470	109,464	16,420	93,045
2028	4,257	153,057	706	0	33,179	120,583	116,326	17,449	98,877
2029	4,526	162,699	706	0	35,260	128,145	123,620	18,543	105,077
Total	61,341	2,205,273	14,722	22,929	483,985	1,758,938	1,697,597	254,640	1,442,957

5.0 Environmental Impact

The Project does not anticipate any negative biodiversity impacts within the area surrounding the Project. Offsite impacts will be positive since larger habitat and forest areas will improve the long-term viability of fauna and flora populations offsite. Avoiding conversion to agriculture also avoids release of sediment and agricultural chemicals into waterways and the Port Honduras Marine Sanctuary. If any negative impact is identified, the BCEP team and the community representative will address such problems with fast and effective solutions. The issue will be discussed and mitigation actions will be designed.

The Project is not expected to have negative social impacts on the communities surrounding the Project area. It is not expected that the Project will negatively impact any of offsite communities. In the case of any potential negative impacts, representatives of the impacted community will bring it to the attention of the conflict resolution coordinator. No unmitigated social or economic impacts are expected from the Project.

According to personal interviews and official correspondence, Indian Creek Village has never traditionally used the BCEP property for hunting, medicinal plant collecting, or other activities. All hunting has traditional occurred west and north of the village (Toledo Maya Cultural Council 1997).

According to personal interviews and official correspondence, Golden Stream Village has never used the BCEP property for hunting, medicinal plant collecting, or other activities (Toledo Maya Cultural Council 1997).

The Pine Hill Mennonite Community, a Kleine Gemeinde Mennonite community, is reclusive and interacts minimally with others from outside their community. They have no record of using the BCEP property for hunting or other activities. Currently, they receive from BCEP road access to their property through BCEP property.

Project has been awarded Gold Level certification by the Cilmate, Community, and Biodiversity Alliance.

An environmental impact statement is not required for the project. Environmental impacts of the project are conservatively projected to be all positive for biodiversity, water quality, air quality, and climate impacts.

6.0 Stakeholders' Comments

BCEP has actively engaged local stakeholders in designing the project with various onsite consultations. Members of the local communities are the primary employees of BCEP participating in permanent sample plot measuring, setting up remote large mammal camera traps, setting up acoustic recording devices, conducting forest patrols, educating other local community members about forest protection, and engaging in other knowledge transfer activities. Stakeholder involvement has been solicited formally and informally since early 2010 so as to inform stakeholders about the project, to receive their feedback, and to publicize the project for public comment.

- Information posted on the website (http://www.belizelodge.com/home.html) since late February 2010.

- Direct email and phone contact with economist Dr. Jim Bass.
- Direct email and phone contact with Belize ecology specialists Dr. Miller and Mrs. Miller.
- Held meeting with management representatives from TIDE, YCT, and Golden Stream Corridor and Alcaldes and representatives from Indian Creek and Golden Stream March 17, 2010, 5pm to 8pm.
- Direct email and phone contact culminating in meeting with the Belize Association for Private Protected Areas (BAPPA) on March 19, 2010 in Belize City, Belize.
- Visited Indian Creek Village, and sharing the CCB Project PDD with the Indian Creek Village and hosted public meetings at Indian Creek Village and Golden Stream Village, April 10th, 2010. Indian Creek Village meeting had 31 attendees with formal representation from the Indian Creek Village Parent Teacher Association, primary school, water board, Chairman, Secretary, Vice President, and Alcalde. Golden Stream Village meeting had 9 attendees with formal representation including the Alcalde, Chairmen, and others.
- Displayed for all clients of BLE at Indian Creek eco-lodge entrance point since late February.
- Displayed and shared with all BLE employees and their community members through printed materials and presentations with staff stakeholder meeting attended by 7 local women and 16 local men and local men and local women in managerial positions on Wednesday March 17th, 2010 at 5pm.
- The PDD was made available on the CCBA webpage and open to public comments (http://www.climate-standards.org/projects/index.html) beginning February 12, 2010.
- Public meetings held at Indian Creek Village and Golden Stream Village, April 10th, 2010.
- Direct personal meetings with the Alcalde, Chairman, Secretary, and Vice President from the villages of Indian Creek and Golden Stream.
- Notification of Embassy of Belize, Ambassador A. Joy Grant, Mission to the European Comission and to the World Trade Organization, in person and via email.

The plan for continuing involvement by the local communities includes regular public meetings held in the villages by a staff member of BCEP hired for that role. Public comments are available on the CCBA web site.

7.0 Schedule

The project began in 2004 with the title transfer of the last parcel. The crediting timeframe of the project extends from 2009 through 2029 (Table 3: BCEP Project Timeline) and final verification will take place the year after the project ends in 2029.

Table 3: BCEP Project Timeline

Milestone	2004-2009	2010	2011	2015	2020	2025	2029	2030
BCEP Formed, Project Start								
Survey Work Conducted								
Project Start								
CCBA Project Validation								
VCS Project Validation								
Initial financing								
Restrictive covenant								

Second Verification								
Third Verification								
Fourth Verification								
Project End								
Fifth Verification								

8.0 Ownership

8.1 Proof of title

Forest Carbon Offsets, LLC has a legally binding agreement with the landowner which transfers management of the environmental service rights of the property. The agreement also sets out the obligations and responsibilities placed on the landowners for the duration of the project. BCEP follows all applicable environmental laws including the Belize Environmental Protection Act Chapter 328, Revised Edition 2000.[6] Belize ratified the Kyoto Protocol September 26, 2003. BCEP title proof is available if requested from the Department of Land and Surveys, Market Square, Belmopan, Belize (Table 4: BCEP land registry information).

Table 4: BCEP land registry information

Title	Ha	Registry	Date Recorded	Title Search Completed
Block 131A	213	Surveyors Plan Book No. 7, Folio 75	November 28, 2000	August 5, 2009
Block 131	2,882	Surveyors Plan Book No. 4, Folio 54	November 28, 2000	August 5, 2009
Whitney block	2,118	Entry No. 10573, Register 15	February 19, 2004. December 31, 2008. Deed of Conveyance on file.	August 5, 2009
Total ha	5,213			

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program

Not applicable.

9.1 Tool for AFOLU non-permanence risk analysis and buffer determination

Population Surrounding the Project Area

The population density in the surrounding area is very low. It is < 50 people / km2. The Project's boundaries are defined by the 931 ha Pine Hill Mennonite Community, the 7,516 ha Seven Hills Estate, the 2,192 ha Manatee Creek Parcel, the 3,866 ha Golden Stream Parcel, and Indian Creek Village for a total of 14,505 ha. There are three communities located in the Project Zone. The communities are Indian

[6] See www.belizelaw.org.

Creek Village, Golden Stream Village, and Pine Hill Mennonite Community. The population of three communities is roughly 1,250 individual (Table 5: Population surrounding the Project area 2008 midyear population estimates). Population density is roughly 8.6 individuals per km2. Population density in the surrounding area is very low risk.

Table 5: Population surrounding the Project area 2008 midyear population estimates

	Total	Male	Female	% Toledo District rural population
Indian Creek Village	447 (1997 estimate)	(no data available)	(no data available)	~2%
Golden Stream Village	304 (1997 estimate)	(no data available)	(no data available)	~1%
Pine Hill Mennonite Community	500 (2010 estimate, pers. communication)	(no data available)	(no data available)	~2%

Fire

This ecosystem is a wet tropical system with a range of 90 mm/month in the dry season to 750 mm/month in the wet season. Fires in this system are rare events. A superb discussion of fire (Meerman and Sabido 2001) in Belize may be viewed at http://biological-diversity.info/fire.htm. The project area is in the lowest fire risk category.

The best practices for fire prevention in Belize are primarily excluding humans from the property through patrols as is proposed in the project plan.

Hurricanes

The southern region of Belize has one of the lowest frequencies of hurricane landfall in the Caribbean with an average of one landfall every 23 years (Lugo et al. 2000). Since the forest is recovering from Hurricane Iris in 2001, and the trees are smaller and less prone to breakage, the risk of reversal as a result of hurricanes is low for the life of the project.

Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination

The version of the tool used is dated 18 November 2008.

Table 6: Generic AFOLU project risk factors

Project risk	**BCEP risk**
Risk of unclear land tenure and potential for disputes: Independent third-party title search has confirmed title is held by BCEP with no liens. See section 8.0 Ownership.	Low
Risk of financial failure: BLE has proven track record of repaying loans to Conservation International, The Nature Conservancy and the Ecologic Development Fund. Project proponent manages eco-tourism business that is dependent on protected forest for tourism income.	Low
Risk of technical failure: FCO and CMI have proven long-term track record of	Low

designing, implementing, and monitoring high quality ecosystem management projects and forest carbon projects.	
Risk of management failure: FCO and CMI have proven long-term track record of designing, implementing, and monitoring high quality ecosystem management projects and forest carbon projects.	Low
Economic risk	
Risk of rising land opportunity costs that cause reversal of sequestration and/or protection: Project proponent manages eco-tourism business that is dependent on protected forest for tourism income.	Low
Regulatory and social risk	
Risk of political instability: Belize has low regional political instability. The project area does not include local communities. Local communities are not reliant upon the project area for essential food, fuel, fodder, medicines or building materials where such resources are not readily available elsewhere, or where the project area includes areas of cultural, ecological, economic or religious significance.	Low
Risk of social instability: Belize has low regional social instability. The project area does not include local communities. Local communities are not reliant upon the project area for essential food, fuel, fodder, medicines or building materials where such resources are not readily available elsewhere, or where the project area includes areas of cultural, ecological, economic or religious significance.	
Natural disturbance risk	
Risk of devastating fire: BCEP has no recorded history of devastating fire.	Very low
Risk of pest and disease attacks: BCEP has no recorded history of pest and disease attacks.	Very low
Risk of extreme weather events (e.g. floods, drought, winds): BCEP has hurricane occurrence recorded roughly every 50 to 100 years.	Low
Geological risk (e.g. volcanoes, earthquakes, landslides): BCEP has no recorded history of geological risk.	Very low

Table 7: BCEP specific risks

Risk factor	**BCEP risk**
Land ownership / land management type	
Land owned by private conservation organization, BCEP, with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land.	Very low
Technical capability of project developer	
BCEP, CMI, and FCO have proven capacity to design and successfully implement activities that are likely to ensure the longevity of carbon benefits (e.g., effectively managing protected areas).	Very low
Net revenues/financial returns from the project to all relevant stakeholders	
Higher to pre-project or similar to alternative land-uses. Land owned by private conservation organization, BCEP, with a good track record in forest conservation activities and able to obtain and enforce nationally recognized	Very low

legal protection of the land.	
Infrastructure and natural resources	
Low likelihood of new road(s)/rails being built near the BCEP project boundary. BCEP is bordered on two sides with protected areas. Land owned by private conservation organization, BCEP, with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land.	Very low
No high-value non-forest related natural resources (oil, minerals, etc.) known to exist within BCEP project area. Land owned by private conservation organization, BCEP, with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land.	Low
No hydroelectric potential within BCEP project area. Land owned by private conservation organization, BCEP, with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land.	Low
Population surrounding the project area	
Decreasing or increasing, but with low population density (e.g., <50 people/km^2). BCEP project area population is estimated to be less than <50 people/km^2.	Very low
Incidence of crop failure on surrounding lands from severe droughts, flooding and/or pests/diseases	
Frequent (>1 in 10 years)	Low
Project financial plan	
Credible long-term financial strategy in place (e.g., endowment, annuity-paying investments, and the like). Funding BCEP will fund investment trust with annuity payment with guaranteed income for employees of BCEP for lifetime of project.	Low
BCEP has legal easement for ongoing protection tied to land title in place.	Very low

Overall Risk Rating

Overall risk rating is low, or 15%.

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Appendix A: Monitoring Plan

The overall objectives of the monitoring plan are to detect any reversals in forest cover and to update the growth rate assumption (Guariguata and Ostertag 2001, and Hughes et al. 1999) for baseline renewal after 10 years. To accomplish this, a system of permanent plots has been established and remote sensing will be used to produce a forest/nonforest map. The plot data will be used as ground truth for the mapping work as well as to confirm growth rate assumptions. The map will be produced for each verification audit and the plots will be measured annually and a report of the results produced for each verification audit. There may be years when all plots are not measured due to weather or other factors that cause remeasurement to be too costly or unsafe. In that case enough plots will be measured to support the required precision goals of the methodology or the verification audit will be delayed until such time as enough plots can be remeasured to meet those guidelines.

Fuel wood collection was analyzed and considered de minimis prior to project start and is considered de minimis during the project and will not be monitored during the project.

All data collected as part of monitoring will be archived electronically on DVD (or similar media) in Excel compatible spreadsheets or Arc/View compatible (.shp) files and kept at least for two years after the end of the project. All of the data will be monitored if not indicated otherwise in tables below.

Monitoring data will be collected annually, except in cases where some plots are inaccessible due to high water or other factor making access unsafe, and summarized for periodic 3rd party independent audits. Audits will occur no less frequently than every 5 years. It is the responsibility of the landowner to conduct monitoring either utilizing contractors or in-house staff.

<u>Updating of Strata</u>

The *ex-post* stratification shall be updated if the following conditions occur:

- unexpected disturbances occurring during the crediting period (e.g. due to fire, pests, storms, or disease outbreaks), affecting differently various parts of an originally homogeneous stratum; and
- unplanned forest management activities (illegal reversals) that affect the existing stratification.

Established strata may be merged if reason for their establishing said strata have disappeared.

<u>Data and Parameters Monitored</u>

The following parameters will be monitored during the project activity. These estimates shall be based on measured or existing published data where possible and the project participants will retain a conservative approach: that is, if different values for a parameter are equally plausible, a value that does not lead to over-estimation of net anthropogenic GHG removals by sinks will be selected. Field measurements will be conducted by revisiting the permanent plots.

Procedures for calculating the impacts of changes in these parameters, selection of external data sources (e.g. remote sensing data), post-processing and accuracy assessment, and documentation will follow approved VCS module VMD0015 Version 1.0 “Methods for monitoring of greenhouse gas emissions and removals (M-MON)”.

Data / parameter:	*Project Forest Cover Monitoring Map*
Data unit:	Ha
Description:	Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event
Source of data:	Remote sensing in combination with GPS data collected during ground truthing
Measurement procedures (if any):	The minimum map accuracy should be 90% for the classification of forest/non-forest in the remote sensing imagery. If the classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Measurement Frequency	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures	Based on plot remeasurements.
Any comment:	If stratification is required in the future due to a reversal, then new strata will be identified using module X-STR.

Data / parameter:	*ADefPA,i,t*
Data unit:	Ha
Description:	Area of recorded deforestation in the project area at time *t (if any occurs)*
Source of data:	Remote sensing imagery
Measurement procedures (if any):	Head's up delineation using GIS and landsat imagery (or higher resolution) using multiple images to get a cloud free image.
Measurement Frequency	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures	Remeasurement of permanent plots.
Any comment:	This is presumed to be zero ex ante.

Data / parameter:	$A_{burn,i,t}$
Data unit:	Ha
Description:	Area burnt at time *t (if any occurs)*
Source of data:	Remote sensing imagery
Measurement procedures (if any):	Head's up delineation using GIS and landsat imagery (or higher resolution) using multiple images to get a cloud free image.
Measurement Frequency	Areas burnt shall be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures	Remeasurement of permanent plots.
Any comment:	This is presumed to be zero ex ante.

Data / parameter:	*ADefLK,i,t*
Data unit:	Ha
Description:	The total area of deforestation by the class of agent of the planned deforestation at time t
Source of data:	Remote sensing imagery
Measurement procedures (if any):	Head's up delineation using GIS and landsat imagery (or higher resolution) using multiple images to get a cloud free image or published data.
Measurement Frequency	Must be reexamined at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures	Groundtruthing using GPS if necessary.
Any comment:	Ex ante, project proponents shall determine and justify the likelihood of leakage based on characteristics of the class of deforestation agent.

Data / parameter:	*CAB,tree,i,*
Data unit:	t CO2-e ha-1
Source of data:	Field measurements applied with allometric equation published in Chave et. al. (2005)
Description:	Carbon stock in aboveground biomass in trees in the project case in stratum *i*
Measurement procedures (if any):	See field methods section.

Measurement Frequency	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures:	Independent 3rd party audit of field measurements utilizing remeasurement of a sample of plots.
Any comment:	Key variable used to calculate with project carbon stocks and year by year growth rate.

Data / parameter:	*DBH,*$_{tree,i,}$
Data unit:	cm
Source of data:	Field measurements
Description:	Diameter at 1.3 meters above the ground of each tree on each plot
Measurement procedures (if any):	See field methods section.
Measurement Frequency	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures:	Independent 3rd party audit of field measurements utilizing remeasurement of a sample of plots. Field observation sheets will include DBH of each tagged tree for evaluation of reasonableness of measurement based on feasible growth rate.
Any comment:	Key variable used to calculate with project carbon stocks and year by year growth rate.

Data / parameter:	*species,*$_{tree,i,}$
Data unit:	unitless
Source of data:	Field observations
Description:	Identify each tree to species or species group whenever possible.
Measurement procedures (if any):	See field methods section.
Measurement Frequency	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC Procedures:	Independent 3rd party audit of field measurements utilizing remeasurement of a sample of plots. Field observations sheets will

	include species of each tree tagged for reconfirmation in the field.
Any comment:	Key variable used to determine specific gravity to calculate with project carbon stocks and year by year growth rate.

Variables Used but not Monitored for Boden Creek Ecological Preserve Carbon Project

Variable	Source of Data
Carbon fraction of dry matter in t C t-1 d.m:	Common practice 50% (Pearson et. al. 2005)
Average annual aboveground biomass accumulation rate for secondary tropical forests of all ages was 6.3%/year.	Using the data from Hughes et al (1999) the average annual aboveground biomass accumulation rate for secondary tropical forests of all ages was 6.3%/year.
Combustion factor for stratum i (vegetation type)	Default values in Table 2.6 of IPCC, 2006 (Annex 2).
Combustion Emission factor for stratum i for gas g - source of data	Defaults can be found in Volume 4, Chapter 2, of the IPCC 2006 Inventory Guidelines in table 2.5 (see Annex 2: emission factors for various types of burning for CH_4 and N_2O).
Total area of stratum	GIS coverages, ground survey data and/or remote imagery (satellite or aerial photographs).
Emission Factor for emissions from N inputs	Updated country-specific data when available. In the meantime, IPCC.
The fraction that volatilizes as NH_3 and NOX for synthetic fertilizers	IPCC default
Mass of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NOX	Published rates from Belize Citrus Growers Association
Nitrogen content of synthetic fertilizer type I applied	Producers of synthetic fertilizer purchased and used as recommended by the Belize Citrus Growers Association
Proportion of available area for production of commodity that is currently forested	GIS analysis plus consultation with experts
Total area of planned deforestation over the fixed baseline period	GPS coordinates and/or Remote Sensing data and/or legal parcel records.
Leakage factor for displacement of class of planned deforestation agents	GIS analysis

Field Plot Methods

Sampling Framework

The sample size required to achieve the desired precision and confidence is 20 forest inventory plots. However, to ensure that the full range of variability was captured in the 'Forest Land' – the *Lowland Broad Leafed Wet Forest* - class on the project site, a total of 31 forest inventory plots were allocated. Plots were randomly allocated within the 'Forest Land' land-use and land cover (LULC) class using geographic information systems (GIS) and identified by specific XY coordinates (Table 8).

Table 8: UTM locations of forestry plots used to determine aboveground biomass (coordinates are in WGS 84 zone 16)

Plot ID	X coordinate	Y coordinate
1	307223	1801041
2	310014	1804373
3	306734	1805336
4	309546	1799665
5	310373	1803894
6	305126	1800216
7	307018	1803584
8	307918	1805047
9	307806	1804326
10	306569	1801938
11	307239	1800066
12	310192	1803071
13	307140	1801838
14	308038	1805429
15	305784	1800156
16	307517	1805715
17	309332	1802438
18	308703	1805334
19	307561	1806108
20	307594	1799864
21	304106	1800663
22	304949	1800058
23	308801	1804441
24	311735	1803043
25	312012	1803278

26	312003	1802413
27	303676	1801725
28	304951	1799165
29	302985	1801203
30	306658	1799374
31	307121	1798628

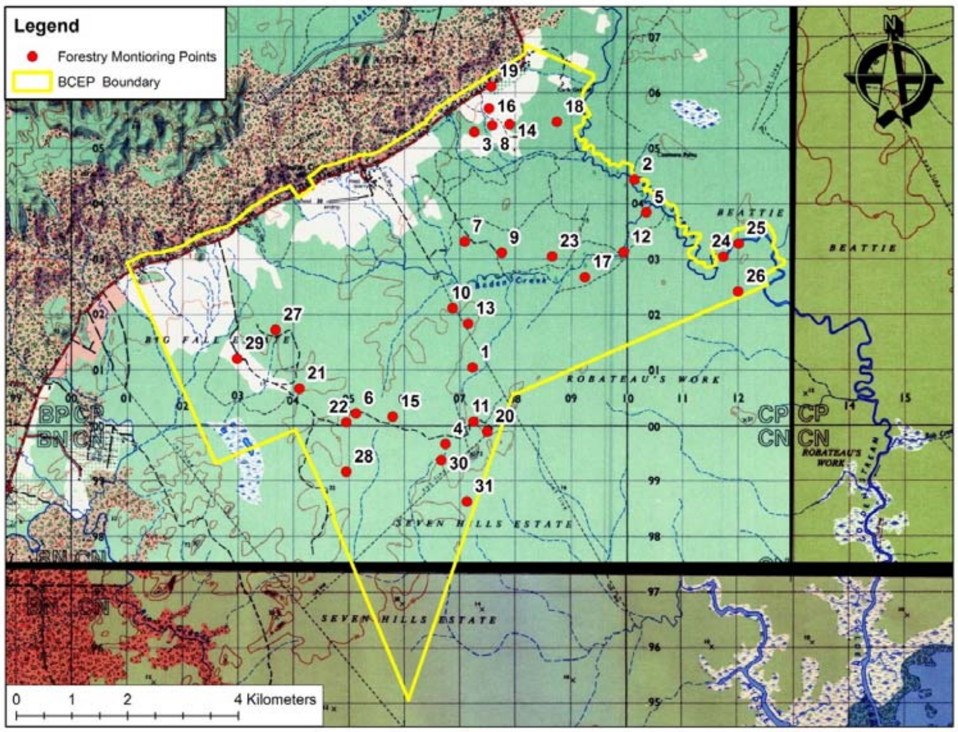


Figure 3. Location of forest sample plots at BCEP.

Field Plot Measurements

The methods for measuring the carbon pools at BCEP were based on the *Sourcebook for Land Use, Land-Use Change and Forestry Projects* (Pearson et al 2005). Because destructive sampling was not practical to measure above ground carbon stocks, published allometric equations were used to determine aboveground biomass based upon the DBH of hardwood trees and the height of palms. The following forest inventory techniques will be used to collect the appropriate data (Pearson et al 2005). All of the 31 plots have been monumented in the field and trees within each plot tagged and numbered. Data collection is based on a nested circular plot design described in Pearson et al (2005). All trees 5 - 20 cm DBH will be tallied within a 4 meter radius of the plot center, all trees 20 - 50 cm DBH will be tallied within a 14 meter radius of plot center and all trees > 50 cm DBH will be tallied within a 20 meter radius from plot center. If a tree splits into separate branches below breast height it is treated as multiple trees. If the tree is growing irregularly, or fallen down, it is measured at 1.3 meters above the ground. If the side branches of a fallen tree are large enough to be measured, DBH is measured from the ground. Palms are selected for height measurements based upon the same criteria. Each tree will be named to species with the help of the local guides, if possible. The DBH will be recorded and each tree will be placed into one of the following height classes:

(A) 0 - 1 meter
(B) 1 - 3 meters
(C) 3 - 6 meters
(D) 6 - 10 meters
(E) 10 - 20 meters
(F) 20 + meters.

Every tree tallied is tagged and given a unique ID number for future monitoring. If a tree is found on the plot without a tag, an effort will be made to determine if the tree lost its tag and can be identified or if it was missed in previous measurement events and should receive a new tag. Regardless, every tree will be tagged at every monitoring event and discrepancies noted in the database. Raw data will be entered in a spreadsheet for data summaries and carbon calculations.

Plot Re-measurement:

The following are detailed procedures for monitoring above ground biomass at BCEP. The following supply list is recommended for re-measurement of established forest monitoring points:

GPS (using WGS 84 Datum)	Data Notebook
30 Meter Fiberglass Measuring Tape	Writing Utensils
Compass	Machete for clearing
Tree diameter at breast height (DBH) tape	1.3m pole or stick (x2)
Clinometer (percent scale)	Fluorescent Orange Flagging

The following are the basic steps necessary to consistently measure aboveground biomass in forest monitoring plots.

Step 1: Navigate to plot center using Global Positioning System (GPS), XY coordinates and appropriate datum (table 8). The plot center should be conspicuously marked with bright colored flagging, and a PVC or rebar center marker. Mark additional trees and plot center with brightly colored flagging (orange or pink) to augment the remaining markings. Replace PVC as necessary.

Step 2: Fill out a data sheet by recording field crew members, date, plot number, slope, azimuth, and any additional notes on plot characteristics or vegetation.

Step 3: Starting from a due north position, begin measuring living trees within 4m of the plot center, measured to the face of the tree, with a minimum diameter of 5.0 cm at breast height (1.3m) using a DBH tape or calipers. Examine each tree making sure it is still living, it is not a liana, and checking if it has been tagged previously. Trees which are greater or equal to 5.0 cm and within 4m of the plot center will be recorded. Continue measuring and recording all trees within 4.0m of plot center in a clockwise direction around the center.

Step 4: Once all of the trees within the 4.0 m class have been measured, all trees greater than or equal to 20.0 cm will be measured and recorded within 14.0 m of the plot center, starting due north and moving in a clockwise direction.

Step 5: Once all of the 20.0cm trees have been measured within 14.0m of the plot center, any trees within 20.0 m of the plot center greater than or equal to 50.0cm will be measured starting due north, and working in a clockwise direction. Figure illustrates the plot design.

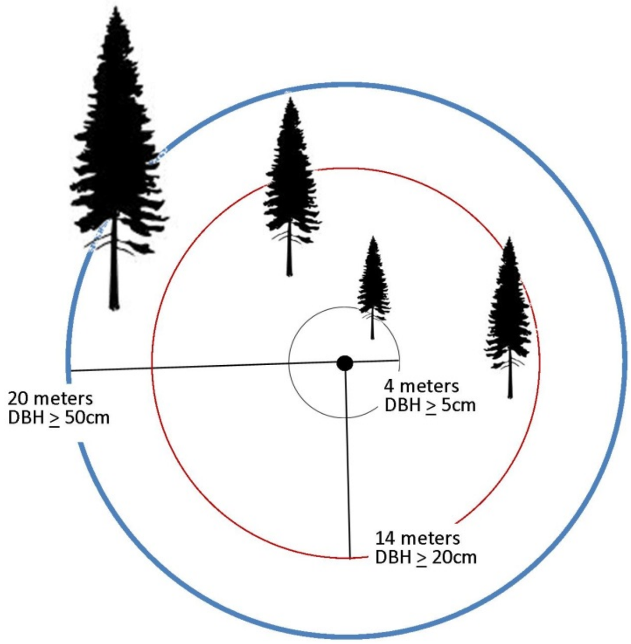


Figure 4. Nested forestry plot design. 4m radius for trees measuring 5cm to < 20cm dbh 14m radius for trees ≥ 20cm to < 50cm dbh 20m radius for trees ≥ 50cm dbh.

Plot Measurement Best Practices

Careful and consistent measurements make it possible for others to replicate identical measurements.

Measurement of DBH

When measuring DBH, set a pole/stick cut to exactly 1.3m on the ground adjacent to the tree and measure the DBH at the top of the measuring stick. When using a DBH tape insure that the tape is wrapped around the tree without any folding or kinks. Measure trees with their natural angle, if a tree is leaning wrap the tape around at the same angle. If a tree is growing straight the tape must be parallel to the ground. If a tree splits into separate branches below breast height it is treated as multiple trees, and if the branch is the appropriate size it is tagged and recorded. If a tree is on a slope, DBH will be measured from the uphill side of the slope. If the tree is growing irregularly, or fallen down, the tree will be measured where it reaches breast height. If the side branches of a fallen tree are large enough to be measured, their DBH will be measured from the ground, not 1.3m from the top of the downed tree.

In all cases the DBH tape should be directly against the bark around the entire circumference of the tree being measured. Vines growing up a tree should be pulled away from the bark, and the DBH measured underneath. If the vine cannot be manually pulled away it can be cut, or the tree diameter estimated using the reverse side of the DBH tape. It is important to leave the majority of vines intact to allow the plots to maintain similar growing conditions to surrounding stands. When applicable, measure above other natural growths at breast height, including irregular tree growths, termite nests, fungal growths, etc. If the natural growths extend out of reach measure just below growth. If the tree has buttresses which would affect the diameter at breast height, measure above the buttresses. If the buttresses extend out of reach, measure as high as possible while remaining accurate. Make a note of the buttresses which can be corrected in later calculations.

Measuring Distance from Plot Center

When measuring the distance from the plot center have one crew member stand at the plot center with the measuring tape zero set on a 1.3 m stick and pull the tape tight. Another crew member will pull the tape, allowing no bends due to trees or snags, and set the measuring end on a 1.3 m pole or stick. If any part of the tree's trunk is in at breast height the tree is considered in.

Previously Tagged Trees

Trees large enough to be recorded in each class will be inspected for previous tags. Trees which have been previously tagged will be recorded with the identification number, adjusted DBH, species (if known), and height (if applicable to the allometric equation). If the tree has not been tagged, they will be tagged with an aluminum uniquely numbered tag and aluminum nail. In this case the new identification number, DBH, species (if known), and height (if applicable to the allometric equation) are also recorded. If the tree species is unknown attempt to identify the tree using any available resources. If the tree cannot be correctly identified, the tree type will be recorded (e.g. hardwood, pine, palm, tree fern, etc.).

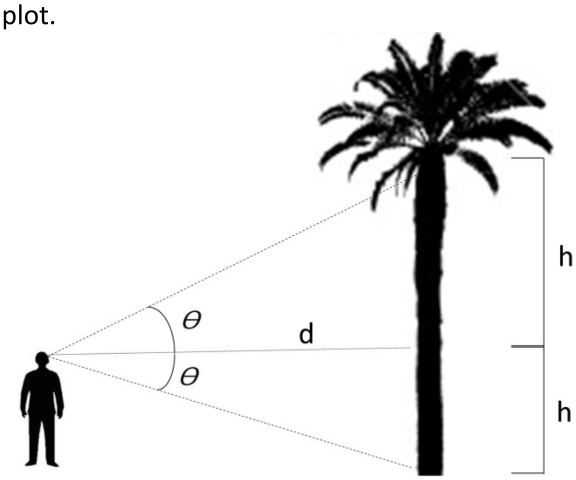
Palms

At BCEP the most common palm is the cohune. Cohune palms in the early years of growth have no true trunk, just a series of palm fronds which slough off as the tree grows. Thus it is impossible to tag young trees for the purposes of monitoring. Thus only cohune palms old enough to have a true trunk will be measured for inclusion in the above ground biomass pool. Once the palm has aged to a point where there is a true trunk at 1.3 m, the DBH is measured and the same rules apply for inclusion in the nested plot design. If the palm is considered in, the height is measured.

Tree Height Measurements

To measure the height of a tree either use a distance range finder and follow the manufacturer's instructions, or use a clinometer. A clinometer can be used more accurately when standing further away from an object. For this reason, it is recommended that the observer stand at least 15 m from the tree being measured. From a vantage point with a clear line of sight, measure and record angle to the top of the trunk (not the leaves) and the base of the tree with a clinometer. Using a fiberglass measuring tape, measure distance from tree to the observer using the 1.3 m poles for consistent measurements. The height can be calculated using simple trigonometry, the two angles, and the distance to the tree (See Figure 5).

Once all of the trees have been measured and tagged, review data sheet to ensure no data points have been forgotten (slope, azimuth, tree measurements, etc.) and recheck plot for any trees missed. If everything is checked, and the team agrees everything has been completed, all gear is collected and the team continues to the next plot.



$$\tan(\theta) = h / d$$

Figure 5. Measuring palm heights in the field with a clinometer.

At the end of each day a designated team member will check that there are completely filled out data sheets for each plot inventoried. Completed data sheets will be stored in a portfolio case that is not taken into the field.

Mapping Methods

Remote sensing methods will follow industry best practices using Landsat TM or higher resolution imagery. Head's up digitizing utilizing trained analysts will be employed to produce a forest/nonforest map of the project area and if necessary the leakage area. A classification accuracy of 90% or better will be achieved.

Areas burned, damaged by wind, or illegally cleared will be mapped using a combination of these methods plus ground surveys with a GPS.

WILDLIFE WORKS

The Kasigau Corridor REDD Project
Phase I – Rukinga Sanctuary

Project Document (PD) For Validation

Using the Voluntary Carbon Standard (VCS) 2007.1 / Sectoral Scope 14

VM0009 Methodology for Avoided Mosaic Deforestation of Tropical Forests

Version 9

January 31st, 2011

In partnership with the Landowner

Rukinga Ranching Co Ltd.

Technical Assistance Provided by

eco PARTNERS

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Asante Sana!

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Section 4 Applicability Conditions

For the Kasigau Corridor REDD Project the following conditions apply;

- The primary driver of deforestation is conversion of forest to cropland for annual crops, typically maize, as evidenced by the substantial conversion to maize in the Reference Area during the Reference Period. The primary agents of deforestation are a growing population of local Taita and Kamba people living in the Reference Area. Agriculture in the reference and leakage areas is permanent and cultivation activities do not shift.
- The land within the project area has been tropical dryland forest[1] for at least 20 years and has been a primary forest in its current state since recorded times[2]. The Project Area forest has an average canopy of 39% and mature tree height of 5-10m, and therefore has qualified as forest as defined by FAO 2010, or that of the definition of forest set by the residing designated national authority (DNA) (10% canopy, 4m height) for the project country for a minimum of 10 years prior to the project start date (VCS, 2008)
- No biomass is harvested for use in long-lived wood products in the project area under the with-project scenario. Therefore, carbon sequestered in long-lived wood products under the project during any monitoring period may be accounted for as zero.
- The project is located in a semi-arid tropical region.
- The primary agents of deforestation are local Taita and Kamba peoples, with a small minority of other tribes who moved in during the El Niño rains of the mid 1990s, when the land was still sparsely populated, or to work as herders for the former cattle operations. Tribal mobility for farm land in Kenya is very low, as Kenya's population is relatively high everywhere that leakage could potentially shift, and the population in the Reference Area outside of the Project Area, and the proposed Phase II Project Area (see map in Section 6.3) is high. There exists no opportunity for the agents of deforestation to shift their activities outside the leakage area.
- The project is not mandated by any enforced law, statute, or other regulatory framework.
- The project area does not contain organic or peat soils. (see soils Map in section 6.5 below).
- A reference area has been delineated meeting the requirements described in sections 6.3.1 and 6.3.2 of the methodology VM0009, 'Methodology for Avoided Mosaic Deforestation of Tropical Forests' (MED), including the minimum size requirement.
- As of the project start date, historic imagery in the reference region exists with sufficient coverage to meet the requirements of section 6.4.2 of the MED.
- A wide range of project activities have been implemented to mitigate deforestation by addressing the agents and drivers of deforestation as described in section 10.1 of the MED.
- The project start date and end date and crediting period are clearly defined (see Section 6.3).

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[1] UN IPCC, Good Practice Guidance for LULUCF, Table 3A.1.8;
[2] Earliest record that has been located is dated 1895 which identifies the area as forested [Hobley 1895 – Upon a Visit to Tsavo and the Taita Highlands – The Geographical Journal 1895 Vol 5 No 6 pp 545-561]

- Wildlife Works (the Project Proponent) has access to the leakage area to sample forest degradation, as evidenced by implementation of the leakage plots used to create the leakage model.
- The lag period for the cumulative leakage model was estimated after the project start date but before the end of the first monitoring period, and initial leakage plot measurements showed that no activity-shifting leakage had occurred prior to the estimation of the lag period.
- The project area does not include lands designated for legally sanctioned logging activities.

Section 5 Project Boundaries

Section 5.1 Spatial Boundaries

Kasigau Corridor Phase I - Rukinga Ranch

This Phase I Project Document covers 100% of the land known as Rukinga Sanctuary (see map below) which is all that 74,516 acres (30,168.66 ha) of land originally known as Rukinga Ranch, LR 12263, historically reduced by subdivisions 12263/1 and 12263/2 at dates prior to the start date of this project. Project lands conform to the latest VCS definition of forest, with an average canopy cover of 39%, and mature tree height at 5-10m, and have been primary forest since historic times. A GIS database with canopy measurements for Rukinga Ranch is available upon request.

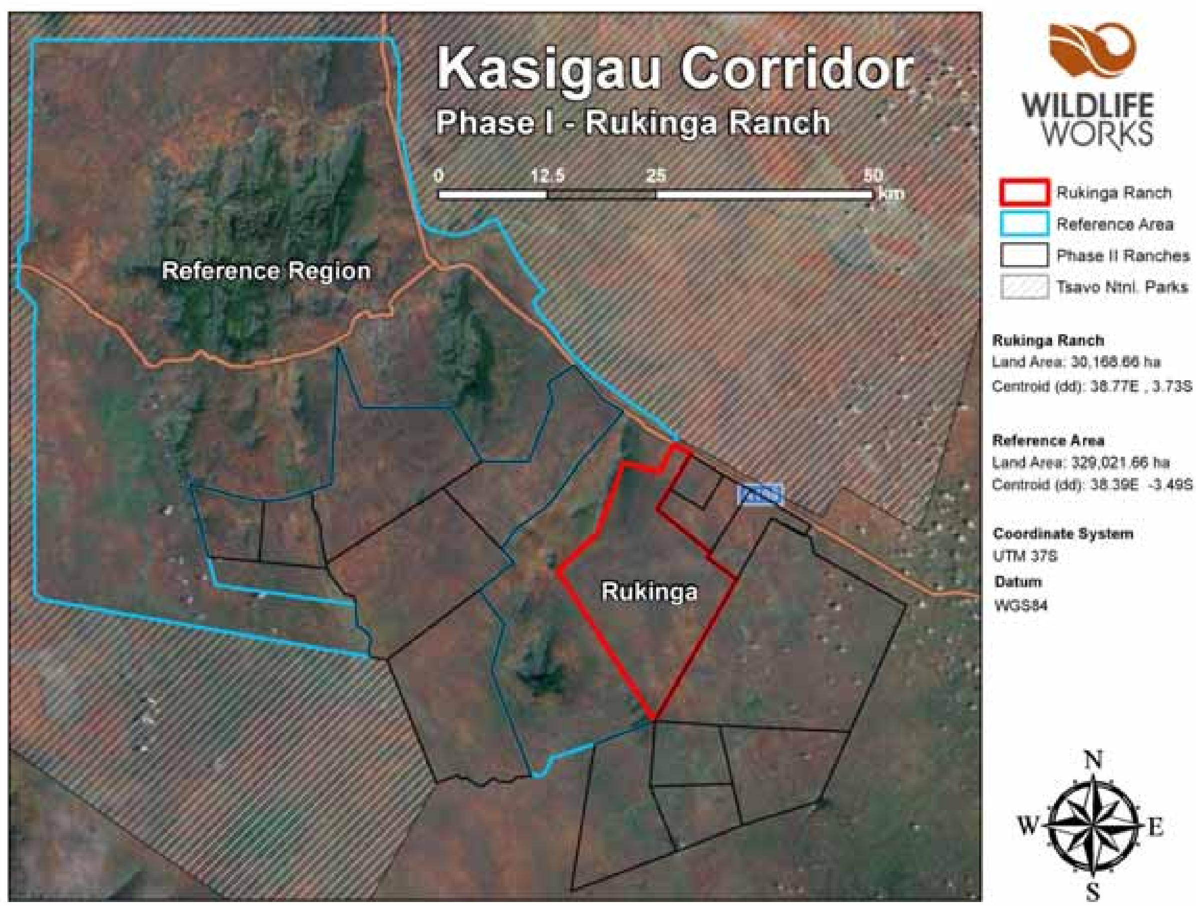


Figure 1. Rukinga Ranch REDD Project and Reference Region Spatial Boundaries

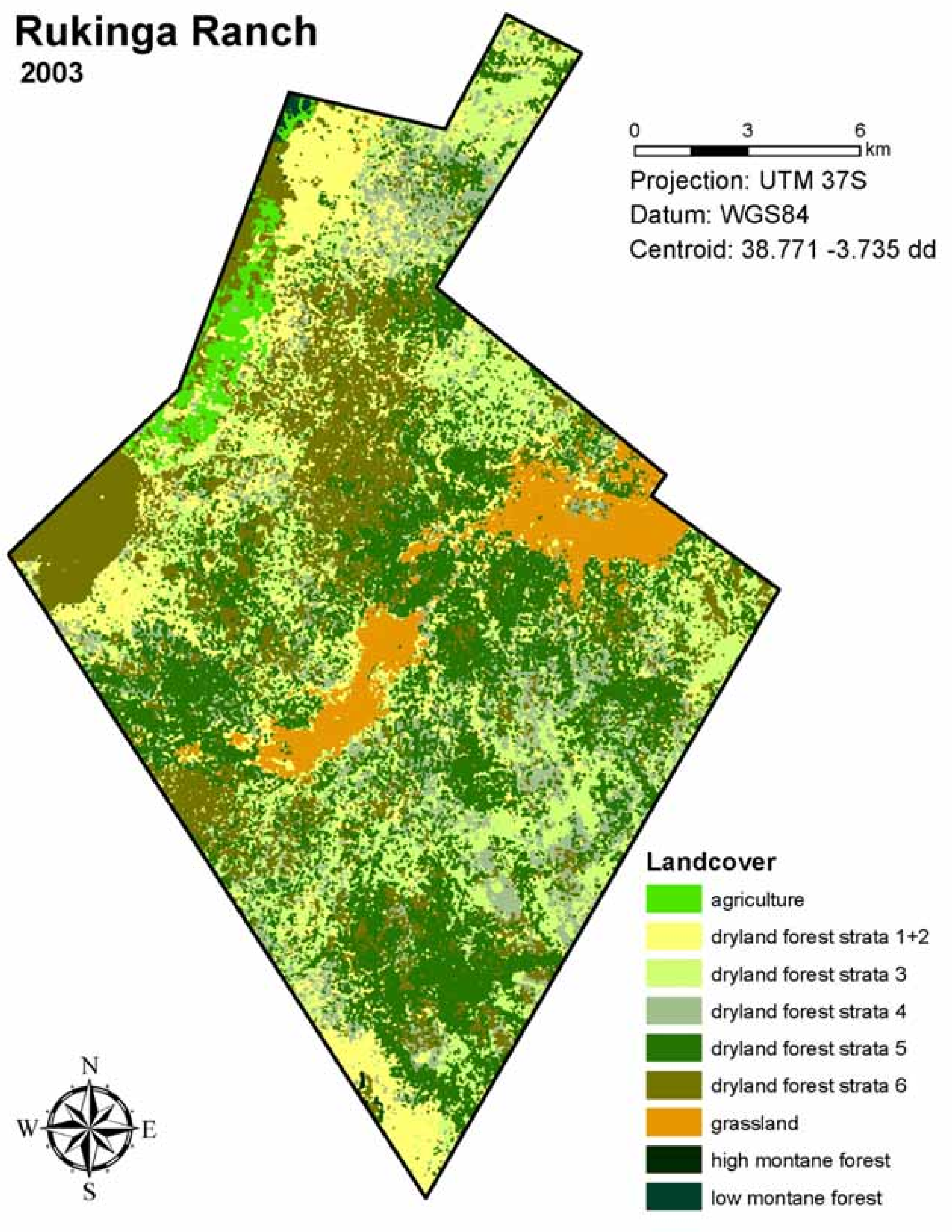


Figure 2. Rukinga Landcover Map, Classified from Landsat 7 ETM+ Acquired February , 2003

The following table shows the landcover strata for Rukinga Ranch and their respective areas. Strata sum to the total area for the Ranch, 30,168.66 ha.

Stratum	Area (ha)
ag active	713.7
dryland forest strata 1+2	6,883.6
dryland forest strata 3	5,651.1
dryland forest strata 4	2,773.4
dryland forest strata 5	8,133.4
dryland forest strata 6	4,345.5
Grassland	1,610.9
montane forest	570.6
Total area:	**30,168.7**

Table 1. Landcover Strata area for Rukinga Ranch, Febrary 2003

Using these values, forested area for the Sanctuary at project start date is calculated as:

27,844 / 30,168.7 = **93% forested 10 years prior to project start date**

Land Ownership

Rukinga Sanctuary is privately owned by Rukinga Ranching Company Ltd., the majority shareholder being Mike Korchinsky, Founder & CEO of Wildlife Works. The leasehold on the title will be due for renewal in 2038, and can then be renewed for either 33, 66 or 99 years under Kenyan law, at the leaseholder's option. Wildlife Works has had a wildlife conservation and land management operating agreement with Rukinga Ranching Company Ltd. since 2005, and more recently acquired the carbon rights from the landowner, Rukinga Ranching Company Ltd. after a process of Free Prior and Informed Consent (FPIC), through a Carbon Rights Agreement/Conservation Easement that was approved by a full vote at an AGM of the Shareholders of Rukinga Ranching Company Ltd. on February 13th 2009. At that AGM the shareholders were given a presentation - explaining in lay terms - the potential of the REDD project, a copy of which has been provided to the validator. Following the presentation, the shareholders unanimously approved the pursuit of this opportunity by the Managing Director and majority shareholder of the land. This decision was ratified again unanimously by an extraordinary general shareholder meeting of Rukinga Ranching Company Ltd. on December 9th, 2009, at the request of the CCB Validators, Scientific Certification Systems, Inc (SCS).

Section 5.2 Temporal Boundaries

The project was commenced on January 1, 2005. Since this time, Wildlife Works has been successfully protecting Rukinga Ranch from agricultural encroachment (deforestation), wildlife poaching and forest degradation. The Phase I Project is 30 years in length. The project will therefore end on December 31, 2035.

Wildlife Works took financial responsibility for all conservation activities within the Project Area as of January 1st 2005, as a result of the agreement between Wildlife Works and Rukinga Ranching Company, Ltd., the landowner, a copy of which was provided to the Validators.

Wildlife Works began conservation activities centered around our ecofactory prior to 2005, but all activities were located outside the Project Area. The figure below illustrates the relationship between the companies involved with Rukinga Sanctuary.

The VCS rule for AFOLU projects starting after Jan 1 2002 states that there is no specific time requirement for validation and verification. Language exists in the MED to clarify the type of project activities that qualify a project for a historical project start date, and Wildlife Works fully conforms to these MED requirements.

Wildlife Works will monitor the project every year, producing accurate and credible documentation for all VCS required project accounting. Wildlife Works will validate the project once every 5 years throughout the life of the project until the project end date.

Per VCS minimum requirements, a baseline revision will be performed once every 10 years, on January 1, 2016 and January 1, 2026. If the VCS standard regarding baseline revision periodicity changes in the future, Wildlife Works will commit to performing baseline revisions whenever specified by the VCSA.

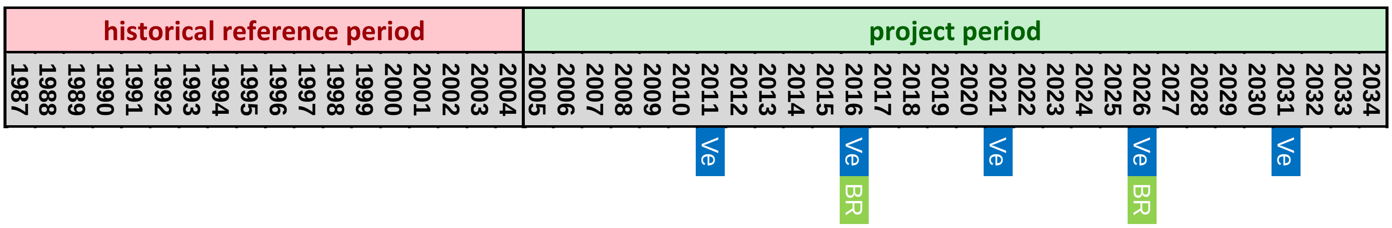
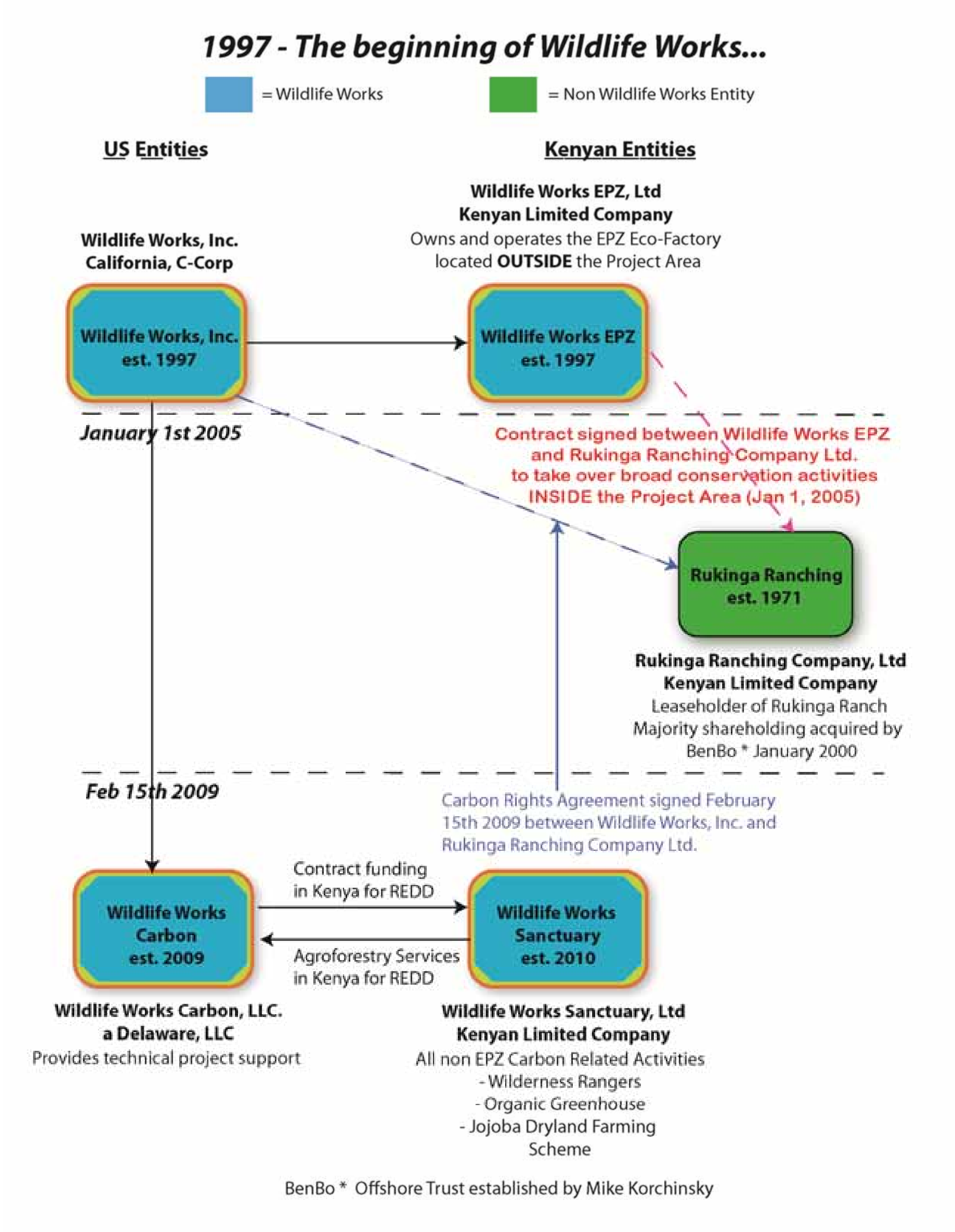


Figure 3. Project Timeline (Ve = verification year, BR = baseline re-evaluation year)

Rukinga Sanctuary is comprised of primary Acacia-Commiphora dryland forest, and therefore conforms to the minimum requirement for project land to have qualified as "forest" (10 years per VCS 2007.1). The landcover classification shown above in figure 2 was performed on ETM+ imagery acquired from the Landsat 7 satellite on February 6, 2003. As both dominant tree species in this ecosystem (Acacia and Commiphora) grow very slowly (some trees on Rukinga Ranch are estimated to be over 300 years old), we make the assumption that Rukinga ranch was in virtually the same forest state in 1996 as it was in 2003.


1997 - The beginning of Wildlife Works...
= Wildlife Works
= Non Wildlife Works Entity
US Entities
Kenyan Entities
Wildlife Works EPZ, Ltd
Kenyan Limited Company
Owns and operates the EPZ Eco-Factory
located OUTSIDE the Project Area
Wildlife Works, Inc.
California, C-Corp
Wildlife Works, Inc. est. 1997
Wildlife Works EPZ est. 1997
January 1st 2005
Contract signed between Wildlife Works EPZ
and Rukinga Ranching Company Ltd.
to take over broad conservation activities
INSIDE the Project Area (Jan 1, 2005)
Rukinga Ranching est. 1971
Rukinga Ranching Company, Ltd
Kenyan Limited Company
Leaseholder of Rukinga Ranch
Majority shareholding acquired by
BenBo * January 2000
Feb 15th 2009
Carbon Rights Agreement signed February
15th 2009 between Wildlife Works, Inc. and
Rukinga Ranching Company Ltd.
Contract funding
in Kenya for REDD
Wildlife Works Carbon est. 2009
Wildlife Works Sanctuary est. 2010
Agroforestry Services
in Kenya for REDD
Wildlife Works Carbon, LLC.
a Delaware, LLC
Provides technical project support
Wildlife Works Sanctuary, Ltd
Kenyan Limited Company
All non EPZ Carbon Related Activities
- Wilderness Rangers
- Organic Greenhouse
- Jojoba Dryland Farming
Scheme
BenBo * Offshore Trust established by Mike Korchinsky

Section 5.3 Greenhouse Gases

The dominant method of deforestation in the Kasigau corridor is conversion to subsistence agriculture by slash and burn techniques. As such, only Carbon Dioxide (CO_2) was selected as a source for greenhouse gas emissions in the project. Although Methane (CH_4) and Nitrous Oxide (N_2O) are also greenhouse gases, they are conservatively excluded from this project, as neither of which are present to a significant degree in the Kasigau corridor region.

Section 5.4 Carbon Pools

The following table indicates carbon pools required for consideration under the MED, including those pools that are mandatory, optional and respective justification for selection under this project:

Pool	Required	Included in Project?	Justification
Above-ground large tree biomass	Yes	Yes	Major pool considered
Above-ground small tree biomass	Yes	Yes	Major pool considered
Above-ground non-tree biomass	Optional	Yes	Major pool considered
Below-ground large tree biomass	Optional	Yes	Major pool considered
Below-ground small tree biomass	Optional	Yes	Major pool considered
Below-ground non-tree biomass	Optional	Yes	Major pool considered
Litter	No	No	Conservatively excluded
Standing dead wood	Optional	Yes	Major pool considered
Lying dead wood	Optional	No	Conservatively excluded
Soil	Optional	Yes	Major pool considered
Long-lived wood products	Yes	Yes	May be a significant reservoir under the baseline scenario

Table 2: Carbon pools selected for inclusion in the project and respective justification

Size Class Diameter Selection and Justification

Expert knowledge of the agents of deforestation and cultural practices in the Kasigau corridor ecosystem indicate that farmers invariably burn all stumps in the process of clearing land for agriculture, We therefore do not differentiate large trees from small trees for this project, and assume that all stumps (below-ground large tree biomass) are burned during agricultural conversion. Credible evidence can be produced through farmer polling and or interviews with Wildlife Works resident community liaison, Laurian Lenjo, who has intimate knowledge of farming practices throughout the corridor, knows many farmers personally, and advises Wildlife Works regarding issues such as this.

Section 5.5 Project Grouping

The Kasigau Corridor Phase I project is not a grouped project. Therefore, no supporting evidence is supplied.

Section 6 Baseline Scenario

Section 6.1 Obvious Agents and Drivers of Deforestation

Wildlife Works staff and employees possesses an incredible depth of local knowledge regarding both the Reference and Project Areas, as a result of direct involvement and integration with this community since 1997. As such, it was considered unnecessary for us to conduct a participatory rural appraisal (PRA) to demonstrate a clear understanding of the principle driver of deforestation in the reference region. This is observed as conversion of dryland forest to annual subsistence cropland by two main groups of local agents during the historic Reference Period.

List of Obvious Agents and drivers of deforestation

- Local farmers from the Taita Tribe (approximately 95% of local population according to the 1999 Kenyan census) deforesting for cropland.
- Farmers from the Duruma Tribe (approximately 5% of local farmers – from 1999 Kenyan census) deforesting for cropland.

Both of the aforementioned populations began aggressively converting land in the 1990s prior to Wildlife Works' arrival in the area in 1997. After rendering it impossible to illegally farm private group ranch land, immigration to the area virtually ceased, and in fact many Duruma families returned to their primary farms at the Coast, while most Taita farmers remained, establishing themselves as the dominant project community.

- Illegal charcoal trade – typically first element of degradation as it generates cash to fund the clearing of the land for subsistence farming.

Large scale Tribal mobility in Kenya today for access to cropland is very restricted, as Kenya is fairly highly populated, certainly in areas of adequate rainfall for farming, and the traditional tribes in any given area typically prevent the incursion of immigrants from outside.

Narrative describing why the agents of deforestation are evident

Wildlife Works contends that the reasons for the presence of the agents of deforestation is obvious. Agricultural conversion has occurred adjacent to - and even into - the Project Area during the historical reference period just prior to Wildlife Works' arrival in the area in 1997, and continues in a heavy and visible manner in the reference region today. Standing on the boundary of the Project Area, one can see the stark contrast to the converted land outside the Project Area without effort. This makes the deforestation process extremely evident. Forest degradation is in turn conspicuous judging by the amount of charcoal sale depots alongside the main Highway (A109) that leads from the Reference Region to the closest major coastal city, Mombasa.

Looking back towards Rukinga Sanctuary from deforested area in the Reference Area.

Descriptions of agents and drivers including any useful statistics and their sources

Local Taita Farmers have traditionally farmed the fertile cloud forested hills of the Eastern Arc Mountains, Kasigau, and Taita and Sagalla Hills. As their population exceeded the carrying capacity of the montane land they relocated to the dryland Acacia-Commiphora forest that dominates the lower elevations of the district. However, their traditional farming practices did not sustain, due to extremely low average rainfall. After colonizing all available land with permanent water sources, they began to clear any available unprotected land, hoping that the unpredictable rainfall would bless them with a crop. The larger blocks of remaining land in the area outside of communally owned land protected by local administrations were privately held group ranches - designated as cattle carrying areas - for the communities of the hills in the 1970s. However, due to the remoteness of these areas and a lack of permanent water sources, these areas were never been developed as cattle ranches, and remained as natural forest over the years until the mid 1990s, when rainfall patterns initiated a population boom in the area. This boom was also facilitated by the improvement of the main Mombasa highway (A109) and a local arterial road that runs along the edge of the Rukinga project area.

Duruma farmers, originally from the Kenyan Coast, came to the area in the mid 1990s due to anomalous El Niño rains, when there was still a very small Taita population living in the Dryland forested areas that now comprise the reference region. In many cases these Duruma families were lead by second wives of a man whose primary family was at the Coast, and who farmed this area on squatter land, sending the produce home to the primary family at the Coast. Because both of these agents of deforestation did not possess legal land tenure, they never invested in the land, and chose to simply farm with no inputs until the soil was depleted. They subsequently cleared more forest and began engaging in an annual depletion cycle. Wildlife Works addressed this issue by creating a land cooperative, providing farmland for those landless farmers who were deforesting the area[3].

List of Project Activities designed to mitigate deforestation

The Project Activities designed to mitigate deforestation include (in order of importance);

Wildlife Works Sustainable Development Initiatives

Wildlife Works has implemented a wide range of sustainable development initiatives at Rukinga over the past ten years, and is committing to continue with a new range of innovative co-benefits for the communities that are in the Project Zone once the funding for the REDD project begins. These initiatives collectively form the basis of Wildlife Works' deforestation mitigation strategy. An implementation schedule for these Project Activities, complete with timelines and budgets, was shared with the Project Validator.

Organic clothing factory

[3] Local history obtained through multiple conversations with community members over a period of 12 years.

Wildlife Works' core project has been the construction of an Ecofactory. We employed over 150 people from the local community during construction, and now trained and employ young women from the community to sew organic cotton clothing, which we export to the US and Europe for sale on the internet and in fashion boutiques. First and foremost, we plan to continue the level of investment we have been making for the past ten years in this Ecofactory.

In addition, going forward we have several new Project Activities in this area;

- Adding capacity – we plan to immediately rehire ten women previously trained by Wildlife Works but let go due to lack of funding
- Factory Expansion – we plan to complete a second production cell, capable of dyeing and screen printing fabric so that we can manufacture finished goods completely within our complex without having to send out for dye and print. We believe this will make our production capability much more attractive to a wider range of customers, and reduce our production costs. The walls for this production cell were built back when the first sewing cell was built, but it needs roofing, flooring, electrification and importation of the dye and screen print equipment acquired by Wildlife Works in the US. A full budget for this factory expansion was provided to the Validator.
- Increase Fabric Inventory and Produce 2010 Collection – we have been unable to produce a new fashion collection from Rukinga for the past two years due to lack of funding, so we plan to initiate a new Collection immediately in 2010, once carbon funding is received. This new collection will be sold online and will relaunch our brand into the international marketplace, now with 100% of production being done in Rukinga. This is critical to our long term strategy to wean local people away from agricultural employment that conflicts with wildlife, and to introduce elements of sustainability to our model for post carbon finance in 20 years.

Organic Greenhouse

Widlife Works established an organic greenhouse to grow citrus trees, which we sell at a discount to local farmers so that they may plant a tree for shade that has the added benefit of earning them income. We use the funds from the citrus sales to fund the growth and distribution of free agroforestry species such as Neem and Moringa Oliefera to local farmers, to meet their medicinal, nutrition and fuelwood needs. With the financing from the Carbon project, we plan to initiate a number of new Project Activities in this area;

Wildlife Works Organic Greenhouse

- Expansion of our core greenhouse at Rukinga HQ to add a second shade house, doubling our capacity by adding two additional greenhouse workers from the local community. A full budget for this activity has been provided to the Validator.

- Establishment of 5 nurseries in the villages surrounding the Eastern and Southern boundary of the Project Area and Kasigau Wildlife Corridor: Maungu, Itinyi, Sasenyi, Buguta, Makwasinyi. Each nursery will utilize the same template and budget as for our own shade house (see above), and each nursery will employ an additional 2 members of the local community, totaling 10 new employees. Each nursery will be responsible for working with their immediate community to plan and implement a cash crop and implement fuelwood and construction pole strategy for that community. They will plant the same combination of tree species currently being grown in our own greenhouse. Once again, for the foreseeable future, the nurseries will provide agroforestry species and native hardwood seedlings for free, while the sale of cash crop trees will contribute to the budget. We will provide training in organic agroforestry and our organic Project Team Leader, Joseph Mwanganda, will manage these new nurseries.

- We will continue a project activity through which we provide relatively small amounts of elephant dung from the Rukinga Sanctuary to a local women's group called the Imani Women's Group. Periodically and at their request, they can use the dung as a growing medium for their commercial mushroom farm, which is housed in a small shed within the women's group compound and provides a good income to the group, with little to no negative impact on biodiversity or land use.

- We will restart a 3 year reforestation project on the slopes of Mt. Kasigau, working closely with the Kasigau Conservation Trust (KCT) to plant 20,000 indigenous hardwood trees over the next three years in one of the Project Zone's High Conservation Value (HCV) areas. This project aims to replace trees taken out for charcoal or construction over the past years. We will be using the nursery built at Makwasinyi and Sasenyi (see above) as the base for propagating the seedlings of the indigenous trees in the first year, until Phase II of this project, at which time we plan to add an additional 4 nurseries on the South and East sides of Mt. Kasigau. We will be providing financial rewards to community members who plant those trees and protect them through two full years. We are confident that this project will go a long way in restoring the habitat and conserving the endemic species in this region. Its model might hopefully be emulated in other parts of the country so as to stop the loss of forests in Kenya. We have involved the community in all facets of the project, from the formulation of this proposal, the monitoring and as indicated in its implementation. This has ensured that the community has taken it up as its own initiative and will see it through even in the absence of Wildlife Works, thus ensuring sustainability.

Dryland Farming scheme

Our most recent project involves working with the Kenyan Agricultural Research Institute (KARI) to cultivate a climate appropriate plant called Jojoba (Simmondsia chinensis) that provides a cash crop through its seeds and is also extremely drought tolerant, non invasive and has the added critically important benefit that it is not eaten by any wildlife, birds or even insects. It is therefore viewed as the ultimate non-conflict crop. Wildlife Works is currently studying the impact of various levels of plant maintenance and irrigation on plant seed and oil productivity, with the idea that we can provide local farmers root stock to establish their own plants. They can then determine how much they can likely make if they are willing to put a certain level of effort into the plant maintenance. There are three specific Project Activities associated with this scheme;

- Complete our involvement in Phase I of the joint Research Project, taking place on the Jojoba fields at our HQ which will end in 2010
- Develop a full business plan on how to create a self sustaining venture to outplant jojoba in the surrounding community farmland, providing the local farmers with a drought tolerant and non-conflict crop.
- Source private funding to implement the Jojoba outplanting business plan, either from donors, private investors, Government of Kenya, or some combination thereof.

Wildlife Works REDD Forest and Biodiversity monitoring

There are a number of specific Project Activities in the Kasigau area that Wildlife Works will complete throughout the project lifetime;

- Continue daily ranger patrols to monitor of the health and vitality of the Project area – we have been performing daily patrols for almost fourteen years, and our rangers are very skilled at identifying potential threats to the forest and biodiversity of the Rukinga Sanctuary.
- Using Carbon finance, we have added a new permanent Ranger Station at the SoutEast end of the Project area, furthest from our headquarters. This supports the addition of a full new section of 8 Wildlife Works Rangers, recruited and trained from the local community, along with a new Team Leader promoted from within our existing force. This is primarily to prevent incursions of illegal cattle from that direction, to make patrolling the far boundary easier, and to develop closer working relationships with the Makwasinyi community.
- We have made a significant investment in modernizing our patrol fleet, by purchasing three new Toyota Land Cruisers, to reduce the carbon emissions from our patrol vehicles, and to reduce the cost of operating and maintaining them. Perhaps most importantly, we wish to ensure that we have a reliable fleet to support constant patrol activities. We have thus retired our oldest patrol vehicle, a 1980 Toyota Land Cruiser – HJ45 Diesel.
- We will improve our ability to monitor the HCV species in Rukinga by adding a dedicated Ranger Patrol, the HCV Ranger Team, which will be responsible for constant tracking and monitoring of the HCV species. Unlike the general ranger teams that are patrolling geographic sectors of the Project area, this dedicated team will be recruited from the existing ranger Patrols based on tracking ability and biodiversity knowledge, and the 4 members of the patrol will be backfilled in the geographic Ranger teams by hiring new rangers from within the community.

Wildlife Works ranger force team members

- Additionally, to improve our monitoring of HCV species, we plan to establish a GIS center of excellence at Rukinga HQ, for which we have hired one full time Kenyan GIS expert, and set up a state of the art GIS computer station. This individual is responsible for liaising closely with the HCV Ranger Team, with the Ecotourism partner in the Project Zone, and with all Wildlife Works ranger patrols to maintain daily sighting logs of the HCV species. They will also be responsible for monitoring those other species of ecotourism value, such as Elephant, Buffalo, Giraffe and Common Zebra. A biodiversity database is being collected with recordings made from standard daily ranger patrol sheets.

- We will begin annual monitoring of our carbon inventory by revisiting 20% of our permanent fixed plots each year to resample the trees, shrubs and grasses, looking for degradation or improvement in existing stocks. In addition we plan to acquire remote sensed imagery to prove the absence of large scale deforestation or boundary incursion. Wildlife Works subsidized the purchase of a gyrocopter by our VP African Operations, Rob Dodson, which he will use to perform periodic aerial monitoring of the project area and reference region.

- We will investing in third auditors to verify project carbon inventories and project progress every five years.

Ecotourism

Wildlife Works has located an ecotourism provider who now operates a safari camp in the center of the Rukinga Sanctuary. This provides employment for safari guides and other service jobs, as well a market for local produce. In the absence of REDD funding, and our continued protection of the biodiversity in the project area, this business would likely lose its support.

Ecotourism Center at Rukinga - "Camp Tsavo"

The primary ecotourism tenant, called Camp Kenya, brings groups of young people to the camp from the UK who stay at the camp, but spend their days in the communities of the project area implementing community projects, providing a significant benefit to the communities. Wildlife Works has negotiated for a second partner, called EcoTraining, to come to Rukinga. They are a South African safari guide training company, and have agreed to support the placement of local youth into their program, on a space available basis, to be trained as Safari Guides at a very high quality level. As a project activity, we plan to provide funding for two local youth per year to go through their program and be trained as safari guides.

Finally we plan to explore a second high end ecotourism retreat on Rukinga, to bring more jobs and income to the Project. This effort will be self funded by outside investment partners, and represents a significant capital expenditure.

School Construction and Bursary Scheme

When Wildlife Works arrived in the area, there were almost no schoolrooms, no books and no desks. None of the necessary infrastructure for children to have a hope of a decent education exisited. We began with a school building program, and over the years we have partnered with the community and various identified donors to build 18 classrooms throughout the district. We also build desks, and our original Kenyan manager Alice Ndiga launched a school bursary program, which she administers, called the Kelimu Trust, that has sent over 65 local children through private high school, and several on to college.


Old Kale School – no floor, no desks, one mud room New School block built by Wildlife Works

Once the Project Carbon funds start to come in we plan on two specific Project Activities in this scheme, as outlined in the Project Implementation Schedule provided to the Validator;

- Provide Wildlife Works direct funding to send 5 new students through four year secondary schools program and on to three or four year College/University should they qualify – this is an annual commitment of $2000 in the first four years of Secondary School fees and between $5000 and $10000 a year in college/university fees.

- Establish a Wildlife Works School Construction and Maintenance fund, by hiring a dedicated staff person to manage the fund with project management skills and ability to write grant proposals, and provide $10,000 per year in Wildlife Works funding above and beyond the compensation of the fund manager to seed school construction and maintenance projects in the Project Zone. The Fund Manager will work closely with the local District Education Officer, and the existing school boards in the area to determine which projects should receive funding each year.

Please note that this document outlines minimum levels of financial commitment to project activities, and funding levels will be revisited as project financing becomes more clear based on carbon credit sales each year.

A List of External Drivers of Deforestation (Covariates) Used in the Deforestation Model

We explored the most obvious covariate - population - and found that it did not significantly affect the deforestation baseline rate. We ultimately decided to not use any covariates, basing deforestation on historical information alone.

Section 6.2 Participatory Rural Appraisal

As a result of Wildlife Works extensive knowledge of the Reference Region and Project Area, we are intimately familiar with the agents and drivers of deforestation and therefore we found it unnecessary to perform a Participatory Rural Appraisal.

Analysis of Agents of Deforestation

This section is Not Applicable.

Analysis of Drivers of Deforestation

This section is Not Applicable.

Section 6.3 The Reference Region

Delineation of the Reference Area

The Reference Region for the Kasigau Corridor Phase I project was chosen to specifically address the behavior of the local agents of deforestation as well as the drivers of deforestation for the ecoysystem. Specifically, the area is comprised almost entirely of local inhabitants engaging in subsistence farming practices. In the area that are not zoned for group ranch ownership, local agents practice slash and burn agriculture. This type of deforestation is prevalent and exclusive, as the dominant species (Acacia / Commiphora) are not commercially viable. For this reason, the main agents of deforestation, as described in section 6.2.1 consist of local community members, and the primary driver, as will be tested in section 6.4, the Cumulative Deforestation Model, is population.

Narrative describing the rationale for selection of the reference region boundaries

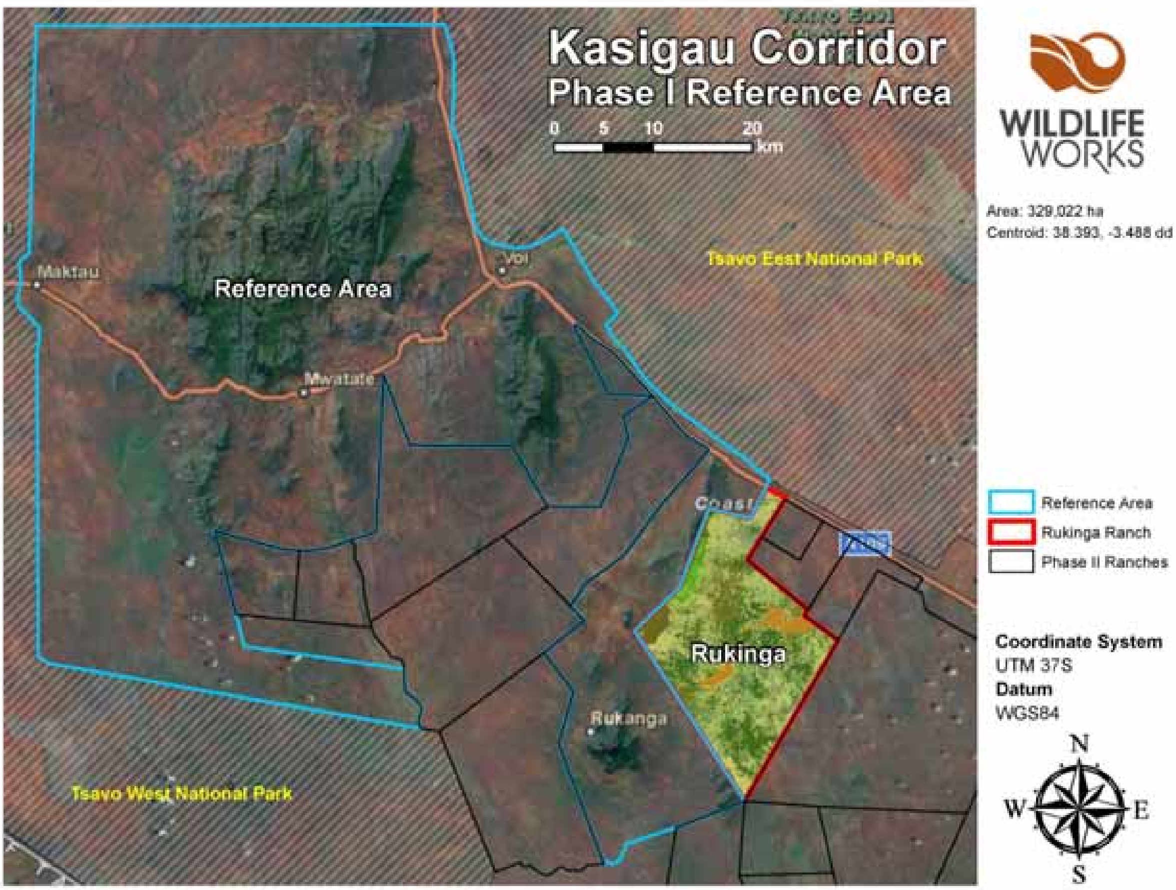
The Reference region boundaries were chosen to address the behavior of the agents of drivers of deforestation in the Kasigau Corridor. The reference area is bounded by Tsavo West national park to the west, Tsavo East national park to the Northeast, and group-owned ranches on all other boundaries. The area is therefore bound on all sides by either protected areas or tracts owned by groups under agreement with Wildlife Works for Kasigau Corridor Phase II Project. As such, unplanned deforestation will necessarily occur within the delineated reference area.

The region was specifically chosen to embody a region that has seen deforestation of a nature typical for this ecosystem. In fact, the area forms a corridor between the two aforementioned national parks, with virtually no extraneous space. As such, Wildlife Works is confident that by studying the area delineated as the reference region for this project, the culture and behavior of the agents and drivers of deforestation will be completely captured.

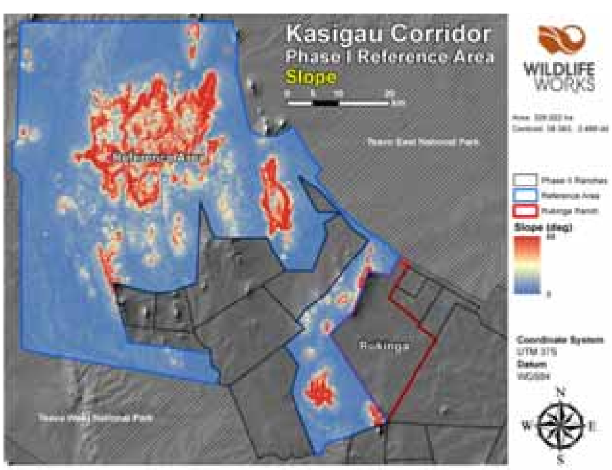
Additionally the geographic qualities of the reference region are similar to those of Rukinga Ranch. Forest type, soils, river density, and infrastructure are similar. The reference region does encompass the Taita Hills area; Wildlife Works feels that it is not only appropriate, but necessary to include these hills in the reference area, as they have been subject to subsistence conversion to agriculture as much, if not to a greater extent, than the surrounding lowlands. It would be inappropriate to omit the hills simply due to their elevation. The reference region was also chosen such that the agents of deforestation would, and are perfectly able, to act within its boundaries as an alternative to deforesting within Rukinga Ranch itself.

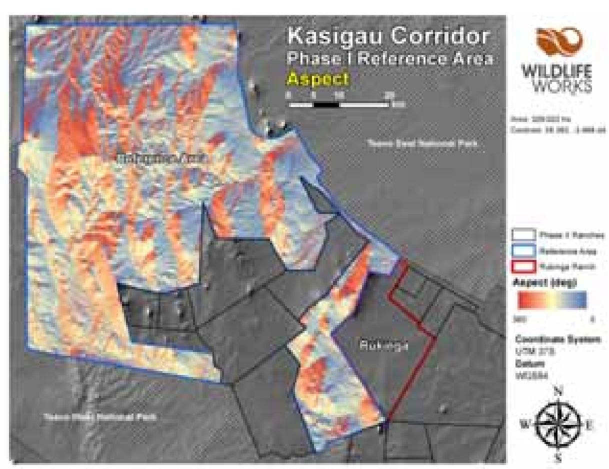
The following maps demonstrate the geographic features of the reference area that render it appropriate for evaluating the baseline scenario for this project.

Delineated boundaries



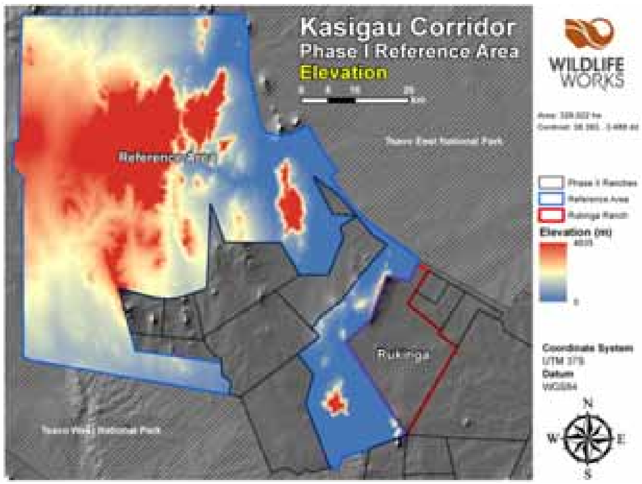
Reference Area and Land Tenure Boundaries, Roads and Major Markets



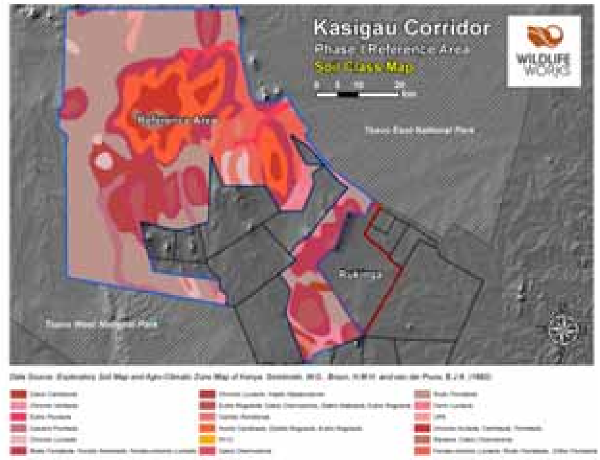


Reference Area Slope

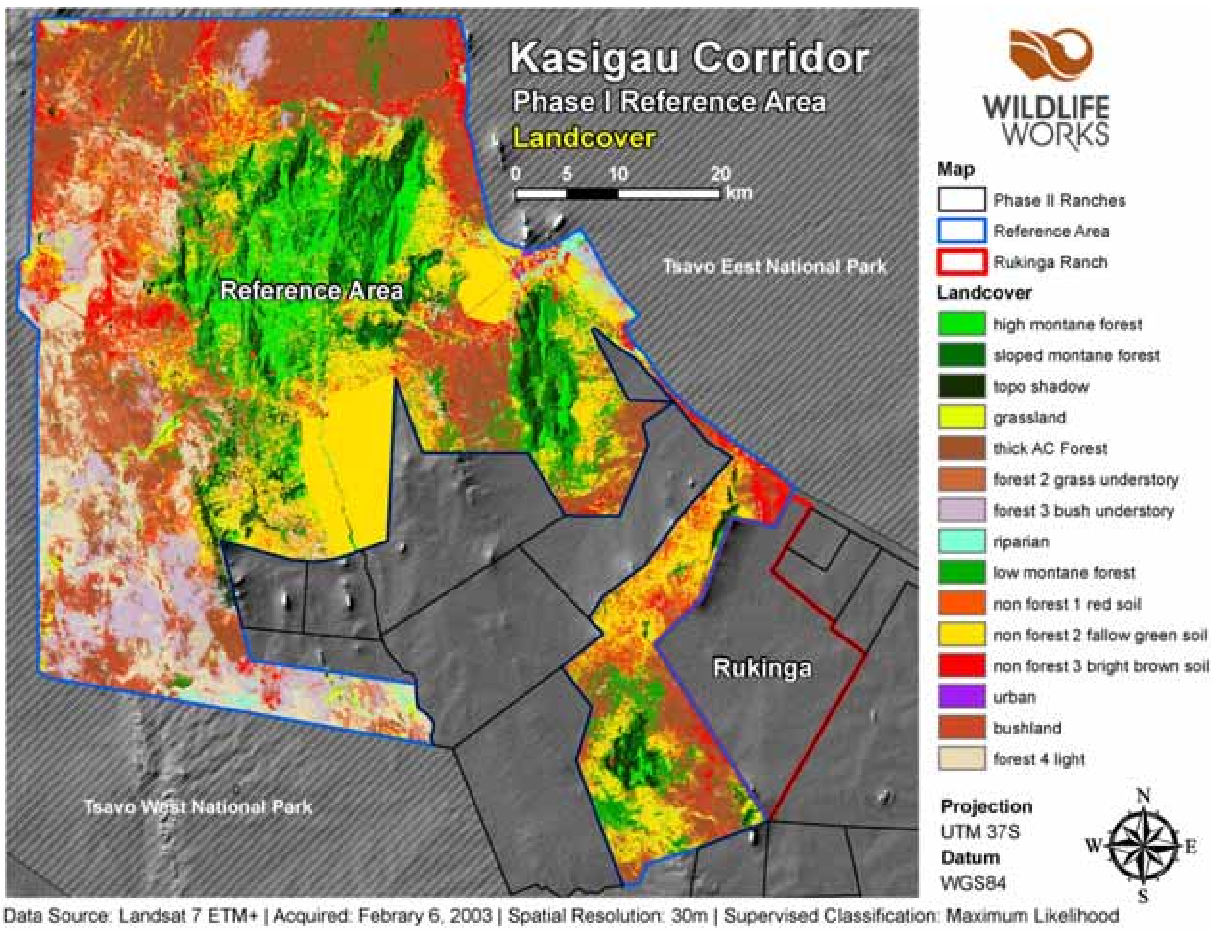
Reference Area Aspect



Reference Area Elevation



Reference Area Soil Classes



Reference Area Thematic Landcover

Infrastructure (roads, major markets, land tenure)

These characteristics are shown on the main maps of the reference region.

Defining the Reference Period

The reference period is defined by the following historic events;

- Population in the Taita Hills began to exceed the carrying capacity of the fertile hill top lands in the late 1980s, and families began to move down into the dryland forested areas.
- Local lore has it that the Coastal Duruma first came to the Reference Area adjacent to the Project Area in the early 1990s when they were promised land by a local Taita politician who had taken a Duruma wife in return for their votes in local elections. The only problem was he promised them land he did not own that falls within the Reference Area for this project. The Duruma are polygamists, and therefore the common practice was for a husband to bring his second or third wives to the Project area to establish agricultural plots. The husband would leave them in the bush with their small children and return to the Coast where they would spend most of the time with the family of the first wife. The husband would then return at harvest and claim a large portion of the crop should there actually have been a crop, and would take it back to the Coast family. These single parent families were rarely successful at agriculture, but continued to clear land aggressively hoping they would find the perfect location where the tragically localized rainfall patterns would find their land. In the interim, the teenage males would snare animals for food, the Duruma being much more comfortable in the bush than Taita farmers.
- El Niño Rains in the mid 1990s caused more landless families from both Taita and Coastal Duruma communities to move to the area, as they could get successful maize harvests, and the land was still relatively under populated.
- The main Nairobi - Mombasa highway that passes through the Reference Area (A109) fell into horrible disrepair in the late 1990s, so the high volume of trucks that travel up and down the highway from the main port of Mombasa to the interior of Kenya and beyond (as far as Zambia) was forced to make frequent maintenance stops. As a result, small towns such as Maungu, which is the town directly adjacent to Rukinga, sprang up along the highway.
- There are no significant economic factors involved in selection of the Reference Period, as the local population consists primarily of subsistence farmers, producing for their own consumption.
- These factors lead to a reference period beginning in February, 1987, before which there was very little population and very low deforestation, and extending to the Project sart date, January 1st, 2005. Wildlife Works then located historical imagery covering as much of the reference area as possible, both on a spatial and temporal basis. The following were found and used in building the cumulative deforestation model (CDM).

Kasigau Corridor Phase I Imagery

	Image Number	Image Year	plot line height	Imagery date	Satellite/sensor	Tile / record	Notes
Historical Reference Period	1	1987	10	2/18/1987	Landsat 5 - TM	167/62 167/63	
Historical Reference Period	2	1994	-12	11/20/1994	Landsat 5 - TM	167/62 167/63	
Historical Reference Period	3	1995	10	1/7/1995	Landsat 5 - TM	167/62 167/63	
Historical Reference Period	4	1995	20	2/8/1995	Landsat 5 - TM	167/62 167/63	
Historical Reference Period	5	1995	30	3/28/1995	Landsat 5 - TM	167/62 167/63	
Historical Reference Period	6	1999	10	10/25/1999	Landsat 7 - ETM+	167/62 167/63	
Historical Reference Period	7	2001	-12	3/4/2001	Landsat 7 - ETM+	167/62 167/63	
Historical Reference Period	8	2003	15	2/6/2003	Landsat 7 - ETM+	167/62 167/63	
Historical Reference Period	9	2003	30	10/1/2003	Quickbird-2 (Multi-spectral)		
Historical Reference Period	10	2004	10	9/4/2004	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	11	2005	-20	2/11/2005	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	12	2006	-12	1/29/2006	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	13	2008	30	1/3/2008	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	14	2008	20	9/7/2008	Landsat 5 - TM	167/62 167/63	
	15	2008	10	10/1/2008	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	16	2009	-12	2/22/2009	Landsat 7 - ETM+	167/62 167/63	SLC-OFF
	17	2009	-20	10/4/2009	Landsat 7 - ETM+	167/62 167/63	SLC-OFF

Figure 4. Historical imagery used for the Cumulative Deforestation Model (CDM).

It should be noted that the MED makes use of the post 2003 Landsat SLC-OFF imagery, that was in turn accessible and useful in the deforestation analysis.

Section 6.4 The Cumulative Deforestation Model

Historic Imagery Used to Build the Cumulative Deforestation Model

The imagery located for the reference period provided 100% “double coverage” over the reference area. Upon request, the valdiator will be shown a double coverage map to demonstrate this point. All images were registered to within 10% RMSE. The line plot of the historic images confirms stationarity.

Historical Reference Period Image Line Plot

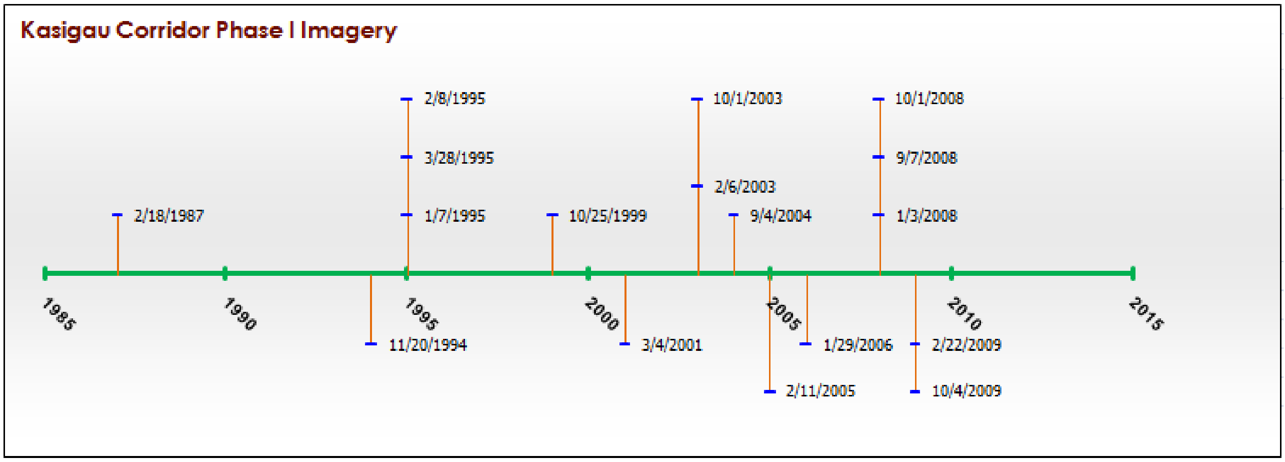


Figure 5. Line plot of historic images demonstrating stationarity.

Sampling Deforestation to Build the Cumulative Deforestation Model

Variance from the pilot sample (100 points) was collected and input to equation 6 to determine total sample size for the CDM:

$$\hat{\sigma}_{DF} = 0.3126$$

$$\widehat{m}_{DF} \geq \frac{1}{2}\left(\frac{\hat{\sigma}_{DF}1.96}{0.01}\right)^2$$

$$\widehat{m}_{DF} \geq \frac{1}{2}\left(\frac{(0.3126)1.96}{0.01}\right)^2$$

$$\widehat{m}_{DF} \geq \mathbf{1877}$$

We chose to use an even 2000 samples, as it is conservatively greater than 1877. To support the collection of data for the CDM, Wildlife Works developed an image classification protocol, and a grid classification tool, which generates the dot grid overlaid on the historic imagery, and supports the analyst in performing the deforestation analysis of each of the grid values over time. An excerpt of the image classification protocol is provided below, and the full document was provided to the Validator.

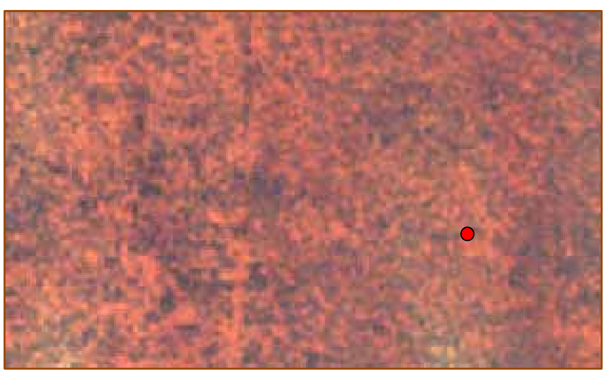
Evaluating points

When classifying the points in the grids it is very important to evaluate the area around each point to get a clear understanding of the land cover features and classification type, not just the area directly under the point. Points will often land in transition areas so a thorough review must be done to evaluate the relative proximity to the various land covers. The follow examples examine a range of land covers and features in the images and how to classify them correctly.

<u>Example 1: Forests</u>

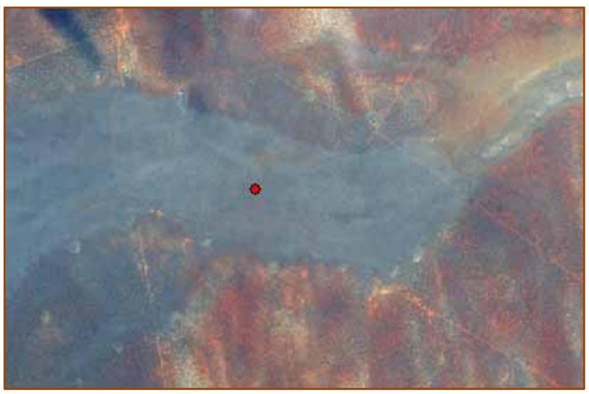
A. **High density** – This point is in the center of a forest. This forest is consistently deep green and very little to no soil is visible.

B. **Low density** – This point is on a low density forest where a lot of soil can be seen. The dark spots in the image are trees and the red area is soil visible between the trees.



C. **Low density –** This is another example of a low density forest.

D. **Shrub/grass land/naturally low vegetation** – This point is on a non-forest area; however this area has not been deforested. This is a very important distinction to be aware of; even though this area may not be forested it should still be classified as forest because the lack of forest was not caused by anthropogenic activities.



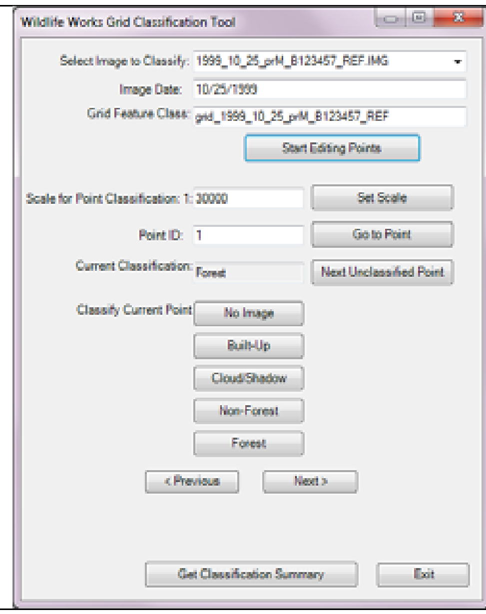
Example 2: Anthropogenic deforestation

The key to identifying anthropogenic deforestation versus land that is naturally non-forested or low density forest is the identification of unnatural patterns in the landscape. These patterns look very unnatural and include agricultural fields, mosaic deforestation and clear-cut area.

A. **Agricultural fields** – This point is in an agricultural field. The distinct lines and structure of the fields are common landscape characteristics of land that is used for agricultural activities.

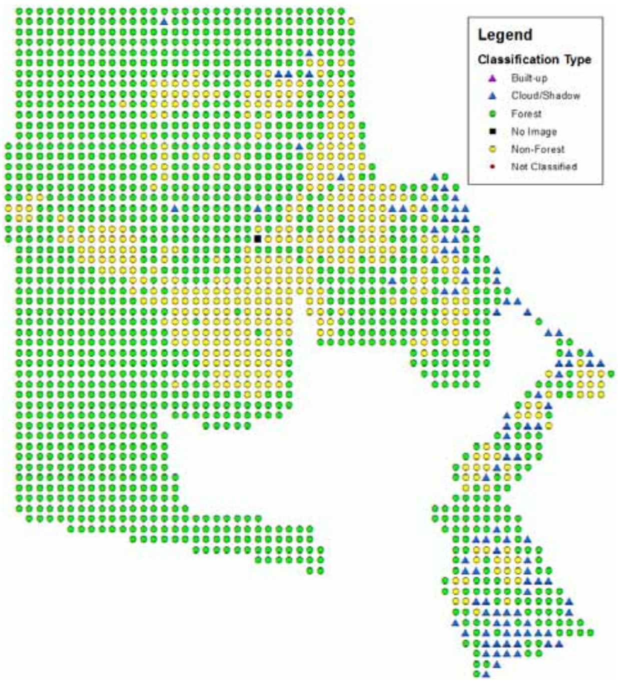
B. **Mosaic Deforestation** – This point is on a mosaic patch of deforestation. A common characteristic of mosaic deforestation is random patches of cleared areas that usually start in a dense area and become less dense and scattered as it spreads out.

The points in the grid can be classified to the appropriate land cover type using the Grid Classification tool. For more information about the Grid Classification tool see: **Grid Classification Tool User Manual**.

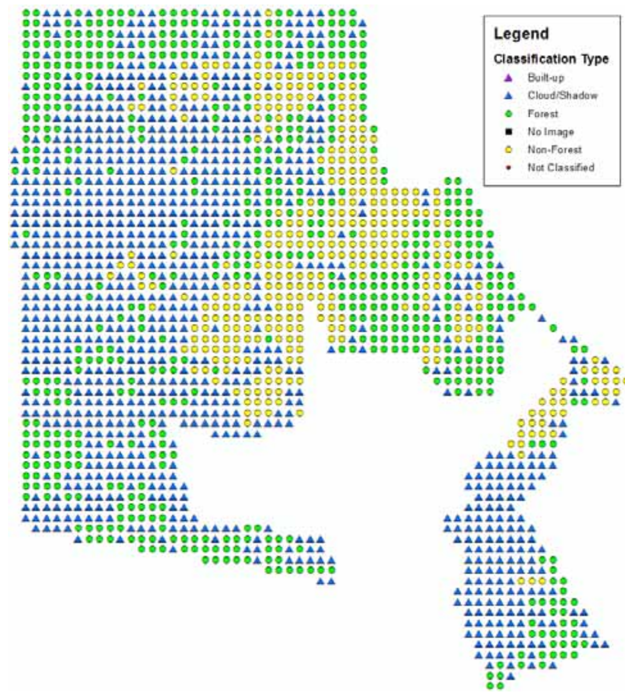


Excerpt from image classification protocol

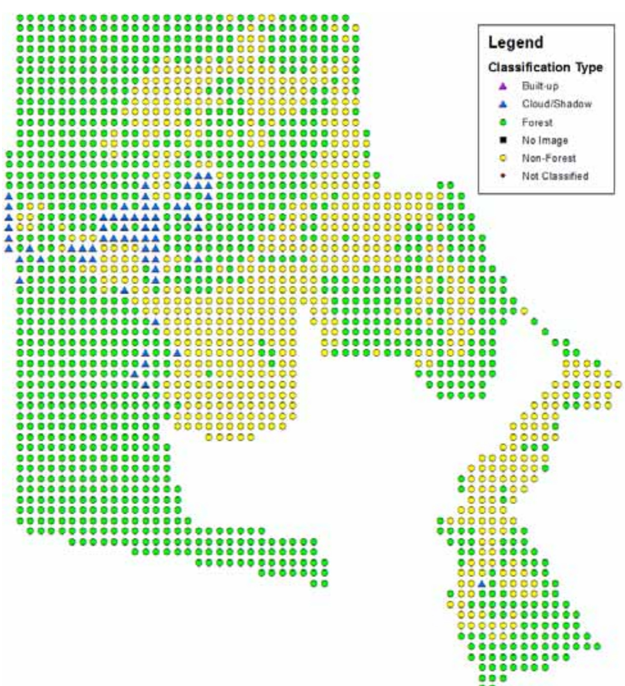
The grid data was collected according to the procedure described in the MED and using the Grid Classification Tool (shown above). The result of this data collection analysis for the Reference Area for all time periods follows;



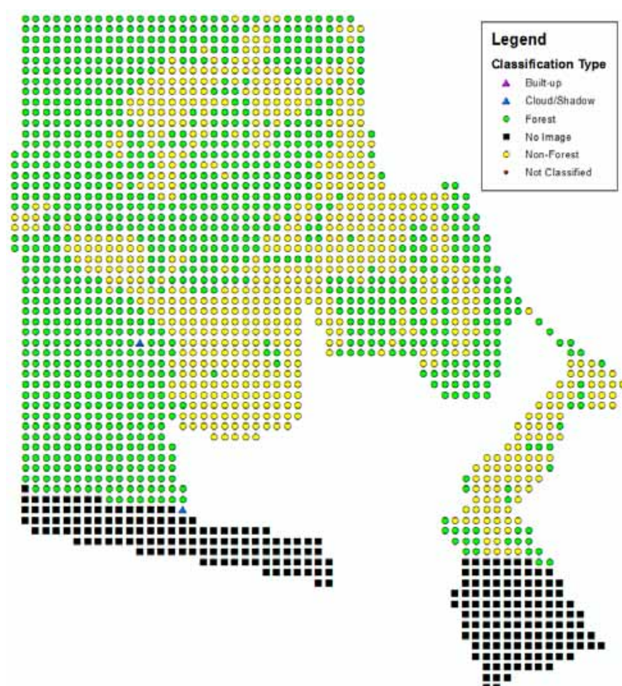
1987



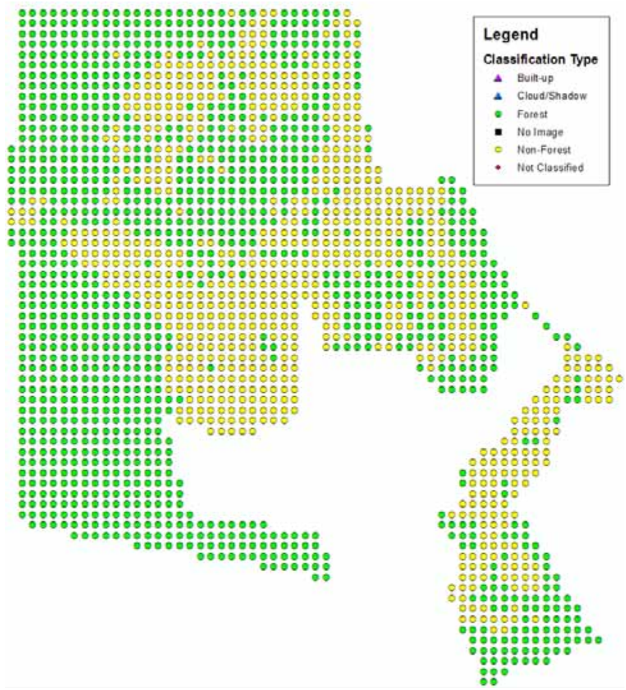
1994



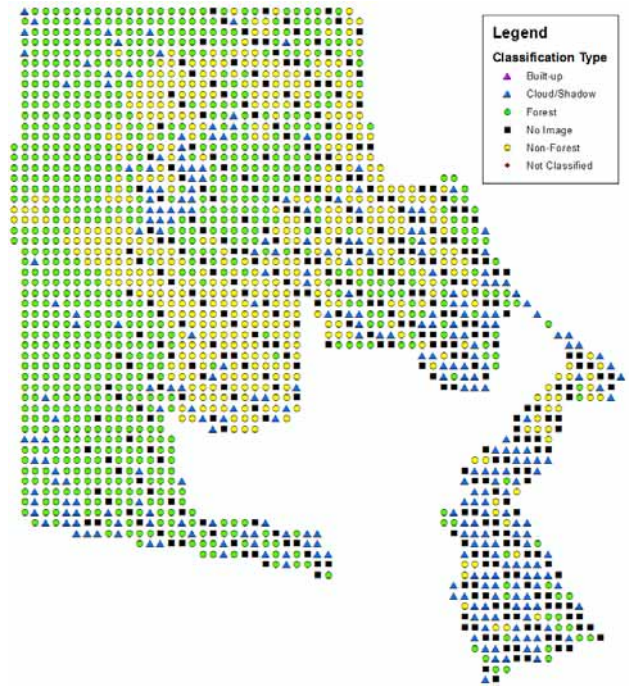
1999



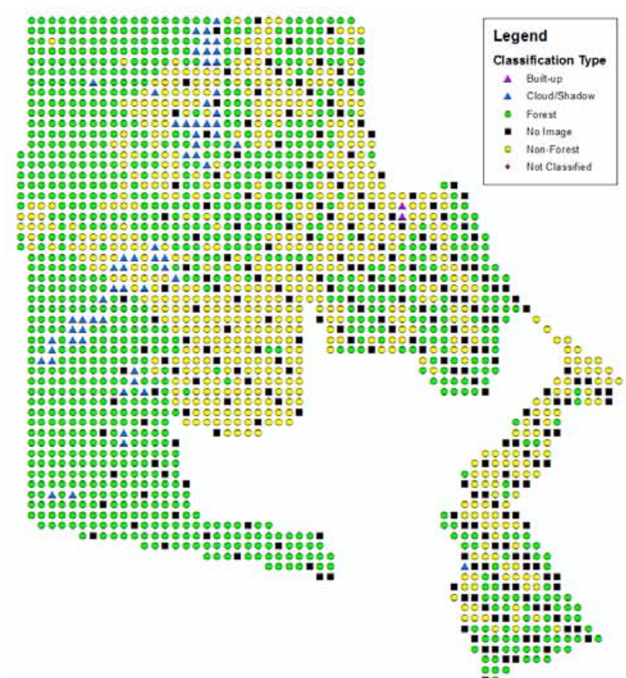
2001



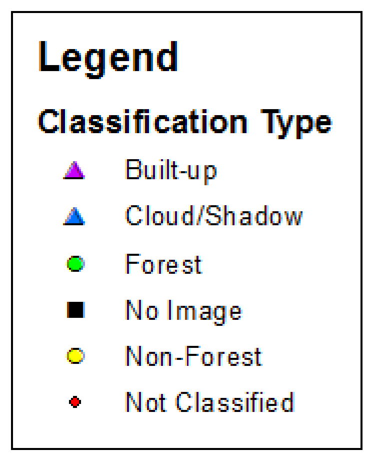
2003



2004



2005



Classification Legend

Figure 6. Data collected over the historical reference period used to fit the CDM

Minimizing Uncertainty in the Cumulative Deforestation Model

To minimize interpretation errors while evaluating forest state in the images used to develop the CDM, an image interpretation protocol was developed and followed by all interpreters. This protocol includes the following information;

- Instructions in how to interpret images using a grid of points overlaid on each image.
- A description of the set of thematic landcover classes used to interpret the points.
- Common (typically encountered) types of land cover patterns and features, and instructions as to how to recognize thematic classes using context.
- How to interpret the forest state of an image, including potential pitfalls to be cognizant of.

After forest state interpretation was completed for all the images within in the historical reference period, the data was independently checked for inconsistencies and systematic misinterpretation. This was accomplished by using an algorithm that flagged any points that had an unlikely forest state transition over the reference period (an example being a transition from non-forest to forest in less than 5 years). These points were then re-evaluated by examining all images at each point (the temporal span) in order to accurately identify and rectify any misinterpretations.

A total of 164 points out of 2000 were flagged for inconsistencies. A spreadsheet was used to evaluate and track the forest state change over the reference period. The images were then re-interpreted for each point and the errors were documented. After the points were reclassified, the check algorithm was run again to ensure that all flagged forest state transitions had been corrected.

The following documents were made available to the validator:

Image Classification Protocol: Image Evaluation Protocol, 01/12/2011

List of flagged and rectified forest state transition: Grid Data RefArea flaggedPointsv2, 01/12/2011

Fitting the Cumulative Deforestation Model

Observations of forest state from the reference region and applicable covariate data sets were used to fit the cumulative deforestation model using the free statistical program R. Population census data were considered as covariates to deforestation throughout time, and these data were obtained for two census districts near the project area – Sagalla and Kasigau – from the Kenya Census for 1989, 1999 and 2009. A linear interpolation was used to estimate population between 10-year census dates. However, these covariates did not inform the model when compared to the model evaluated using only historical observations of deforestation. Four models were evaluated using AIC and their linear predictors, and are presented in the table below.

Model	AIC
Forest State = Alpha + Time	4
Forest State = Alpha + Time + Sagalla	6
Forest State = Alpha + Time + Kasigau	6
Forest State = Aplha + Time + (Sagalla + Kasigau)	12

Table 3. Linear predictors considered and AICs.

The selected linear predictor, per equation 7 is

$$\hat{\eta} = -1.0804558 + 0.0003792x$$

where x is the number of days since the project start date. This predictor was selected because it gave the model with the lowest AIC. A graph of the selected model based on this linear predictor is given below.

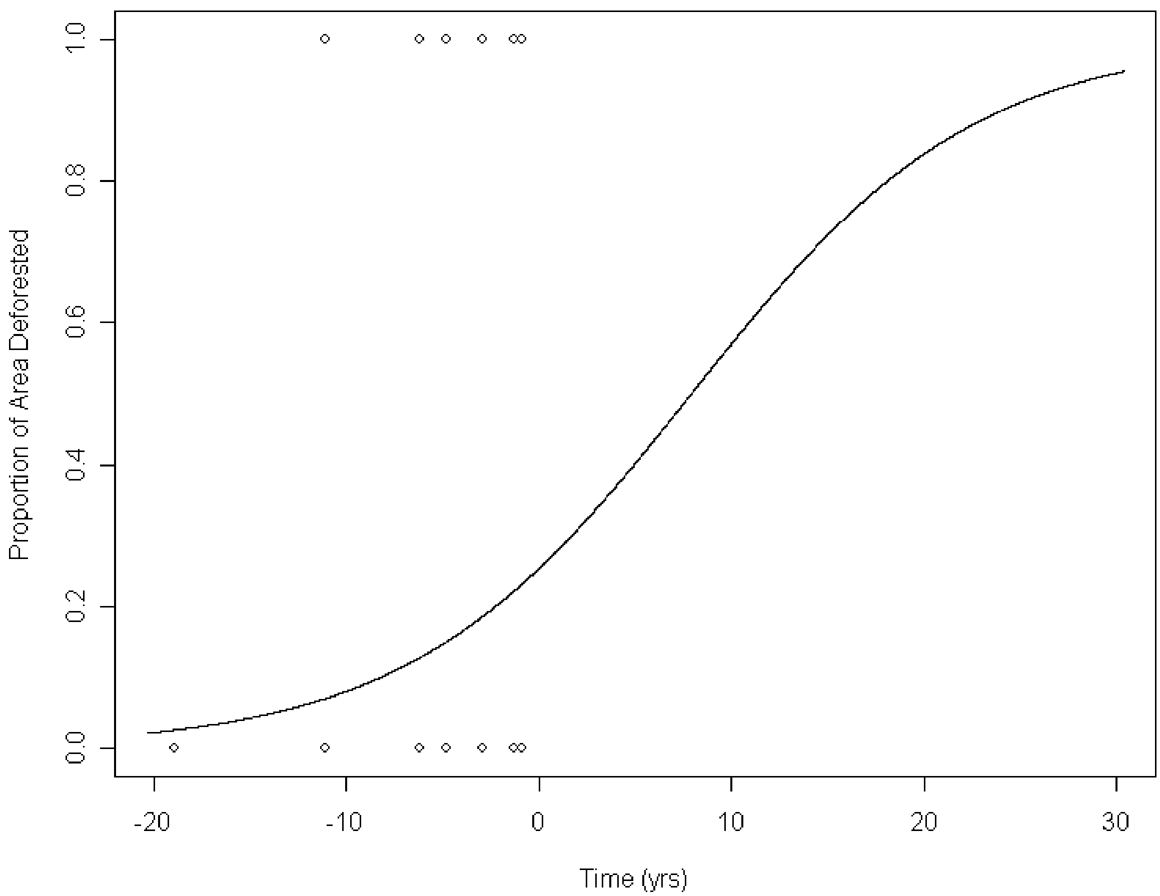


Figure 7. A plot of the selected logistical cumulative deforestation model.

Linear Prediction of Deforestation

A linear rate was selected to predict the cumulative deforestation for project accounting purposes. According to the notation of equation 7, the selected rate is

$$y = 0.031649x$$

where x is the number of days since the project start date, and y is proportion of area deforested. This linear rate is conservative because it predicts less baseline deforestation than the cumulative deforestation model, does not cross the CDM, and is at least 20 years in length. For the end date of this monitoring period, the projected proportion of cumulative deforestation by the cumulative deforestation model is 0.404, while the linear model is 0.1898, less than that predicted by the logistical cumulative deforestation model.

The following lists the proportion of cumulative deforestation for all monitoring periods to-date based on this selected linear rate.

Monitoring Period	Year Ending	Cumulative Deforestation
1	2010	0.1898

Table 4. List of cumulative deforestation by monitoring period.

A graph of the selected linear rate compared to the cumulative deforestation model from the project start date to end date is presented below to illustrate that the linear rate is conservative.

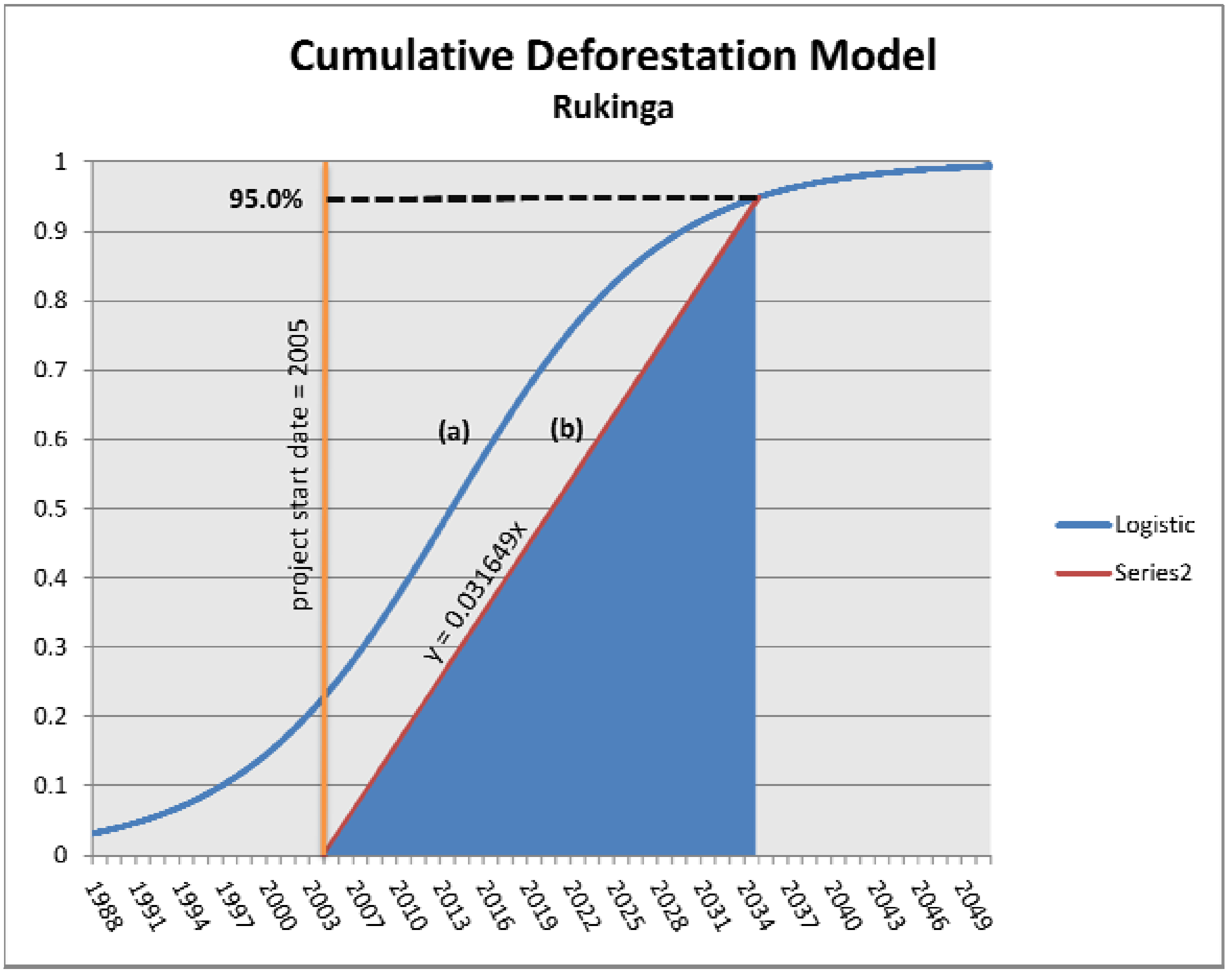


Figure 8. A plot of the logistical cumulative deforestation model (a) and the selected linear rate (b).

Estimating Uncertainty in the Cumulative Deforestation Model

Uncertainty in the cumulative deforestation model was quantified using equation 15 and 17. Equation 17 is calculated as

$$\hat{\sigma}_{DF} = \sqrt{\left[\sum_{i\in\mathcal{J}} w_i o_i\right]\left[1 - \sum_{i\in\mathcal{J}} w_i o_i\right]}$$

$$0.3126732 = \sqrt{0.1098263(1 - 0.1098263)}$$

where 0.1098263 is equal to $\sum_{i\in J} w_i o_i$.

Equation 15, the uncertainty in the deforestation model, is then calculated as

$$U_{DF} = \frac{1.96\hat{\sigma}_{DF}}{\sqrt{n_{DF}} \times \sum_{i\in\mathcal{J}} w_i o_i}$$

$$U_{DF} = \frac{1.96 \times 0.3126732}{\sqrt{8821} \times 0.1098263}$$

where 8821 is the number of state observations made to fit the cumulative deforestation model. The uncertainty in the deforestation model is

$$\boldsymbol{U_{DF} = 0.05941298}$$

Section 6.5 Soil Carbon Loss Model

Sampling Soil Carbon Loss

Soil carbon was determined to be an important pool for this project and was measured using purposive samples of farms in the reference area, most closely correlated to the original dryland forest conditions on Rukinga Ranch. This was possible because Wildlife Works primary shareholders, and of course all employees were in the region prior to the Project start date, so we were able to determine which farms were converted from dryland forest conditions most similarly matching those inside the Project area, as well as when they were converted.

We selected 25 soil sample locations outside of Rukinga's boundary in farms(shambas), all at least 10 years since conversion to farm land with conversion as recently as 10 years and as distant as 40 years ago. We also randomly selected 25 locations inside Rukinga in intact dryland forest.

This following is a table of the shambas that were sampled:

Name	Location	Plot Description	Sample Depth (cm)
Mzungu	Sasenyi	Farm cleared 28 yrs ago. Crops grown are maize and green peas	100
Nemu	Marungu	Farm cleared 10 yrs ago. Crops grown are maize & green peas	100
Nzangi	Kulikila	Farm cleared 17 yrs ago. Crops grown are maize & green peas	100

Ndaro	Sasenyi	Farm cleared 35 yrs ago. Crops grown are maize & green peas	100
Ngome	Sasenyi	Farm cleared 37 yrs ago. Crops grown are maize & green peas	100
Maziko	Sasenyi	Farm cleared 26 yrs ago. Crops grown are maize & green peas	100
Jira M	Sasenyi	Farm cleared 40 yrs ago. Crops grown are maize & green peas	100
Kazungu	Sasenyi	Farm cleared 30 yrs ago. Crops grown are maize & green peas	100
Kamau	Itinyi	Farm cleared 12 yrs ago. Crops grown are maize & green peas	100
Walter	Marungu	Farm cleared 10 yrs ago. Crops grown are maize & green peas	100
Kivuva	Itinyi	Farm cleared 20 yrs ago. Crops grown are maize & green peas	100
Mwanjila	Itinyi	Farm cleared 10 yrs ago. Crops grown are maize & green peas	100
Marungu primary	Marungu	Farm cleared 40 yrs ago. Crops grown are maize & green peas	100
J. Mkala	Sasenyi	Farm cleared 40 yrs ago. Crops grown are maize & green peas	100
Alima	Marungu	Farm cleared 10 yrs ago. Crops grown are maize & green peas	100
Mwikali	Lokichigio	Farm cleared 20 yrs ago. Crops grown are maize & green peas	100
Nicholus	Lokichigio	Farm cleared 10 yrs ago. Crops grown are maize & green peas	100
M. Ngele	Itinyi	Farm cleared 13 yrs ago. Crops grown are maize & green peas	100
Kibarangoma	Marungu	Farm cleared 13 yrs ago. Crops grown are maize & green peas	100
F. Kamau	Itinyi	Farm cleared 16 yrs ago. Crops grown are maize & green peas	100
Mwanyuma	Marungu	Farm cleared 14 yrs ago. Crops grown are maize & green peas	100
Chimanga	Mwagwede	Farm cleared 17 yrs ago. Crops grown are maize & green peas	100
Mwadule	Mwagwede	Farm cleared 17 yrs ago. Crops grown are maize & green peas	100
Lomitir	Lokichogio	Farm cleared 18 yrs ago. Crops grown are maize & green peas	100
M. Mtima	Marungu	Farm cleared 17 yrs ago. Crops grown are maize & green peas	100

Table 4. List of soil samples in the reference region.

The location of all the soil samples taken is shown below in a map of Rukinga Sanctuary and the immediately surrounding reference area.

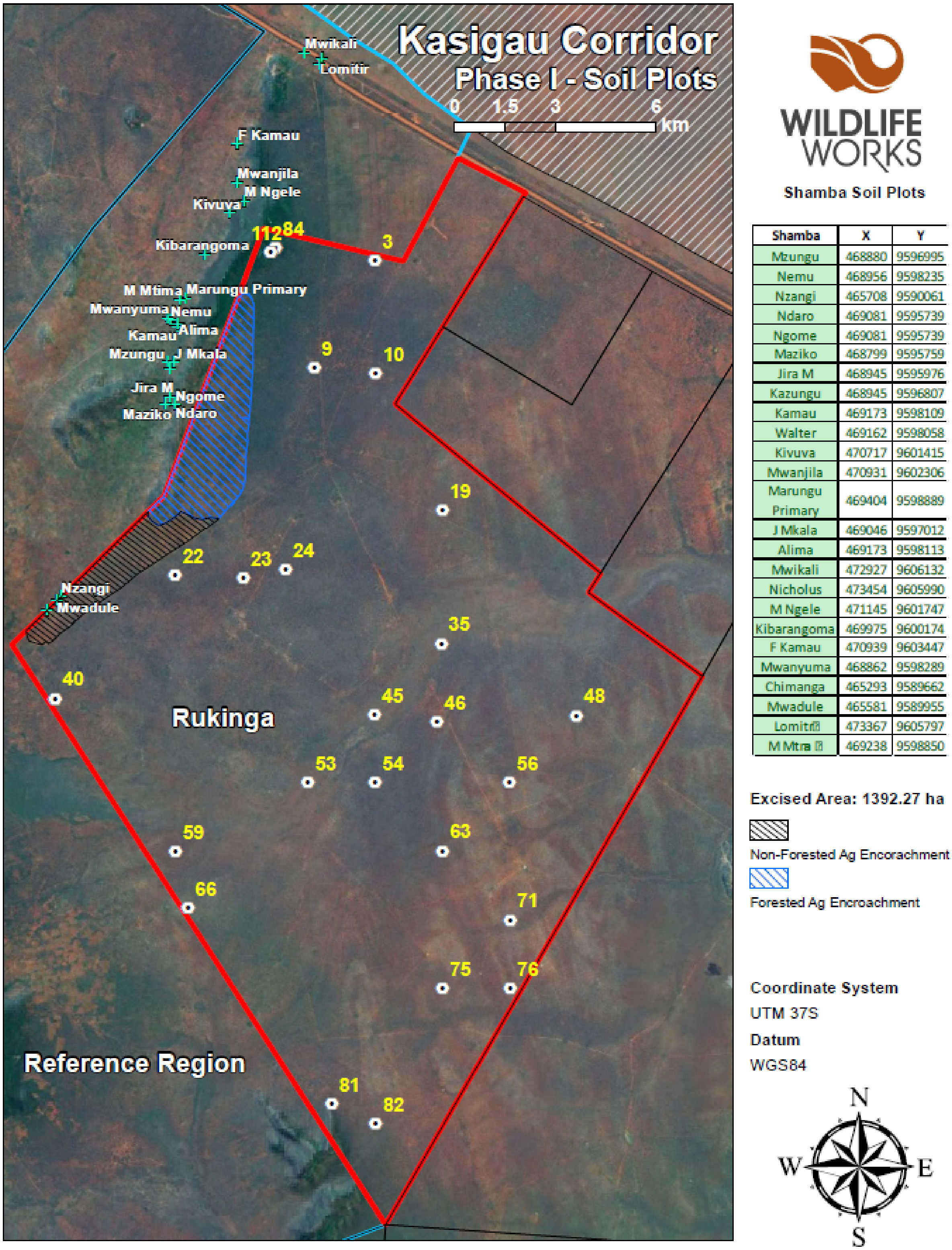


Figure 9. Soil samples in Rukinga and shambas in the reference region

For each plot location, soil was sampled to a consistent depth of 1m. We selected this depth due to the results of a pilot study using a few test pits. Analysis showed that soil carbon loss was still significant down to 1m. Farmers typically disturb the top 30cms with their ploughs, or with any farming practices they might use to improve or deteriorate soil condition, but we had surmised that the deep root systems of the dryland forest would lead to high soil carbon at lower depths over time, and we thus chose to sample to a 1m depth.

Each sample was performed in two "lifts", the first representing the top 30cm (Top Soil), the second from 31-100cm (Sub Soil), by digging a 1m square pit and thoroughly mixing the soil removed from the pit in each "lift" before extracting a sample in a bag for sending of to the independent Soil Laboratory in Nairobi. Wildlife Works has been using the same soil sampling laboratory - in fact using the same analyst - for several years. The laboratory analyst / manager has agreed to speak with the Validator should they require any/all of the following:

- calibration records
- certification documents
- a description as to how soil carbon is analyzed

All laboratory reports, depicting bulk density and soil carbon, have been provided to the Validator. The process for soil sampling is illustrated in a soil sampling protocol standard operating procedure , which serves as a training guide for the field sampling teams, and has also been provided to the Validator.

The following tables list soil data collected inside the project area and in the immediately surrounding reference area:

Reference area samples

Sample	Farm	Soil Depth	Comments	Bulk Density (g/cm^3)	Carbon (%)
CW019SA0290	Mzungu	Top Soil	Sasenyi - X0468880,Y9596995	1.57	0.64
CW019SA0291	Mzungu	Sub Soil	Sasenyi - X0468880,Y9596995	1.42	0.52
CW019SA0292	Nemu	Top Soil	Marungu-X0468956,Y9598235	1.43	0.80
CW019SA0293	Nemu	Sub Soil	Marungu-X0468956,Y9598235	1.36	0.55
CW019SA0294	Nzangi	Top Soil	Kulikila-X0465708,Y9590061	1.31	1.34
CW019SA0295	Nzangi	Sub Soil	Kulikila-X0465708,Y9590061	1.29	0.64
CW019SA0296	Ndaro	Top Soil	Sasenyi-X0469081,Y9595739	1.53	0.51
CW019SA0297	Ndaro	Sub Soil	Sasenyi-X0469081,Y9595739	1.38	0.17
CW019SA0298	Ngome	Top Soil	Sasenyi-X0469081,Y9595739	1.57	0.32
CW019SA0299	Ngome	Sub Soil	Sasenyi-X0469081,Y9595739	1.36	0.27

CW019SA0300	Maziko	Top Soil	Sasenyi-X0468799,Y9595759	1.45	0.36
CW019SA0301	Maziko	Sub Soil	Sasenyi-X0468799,Y9595759	1.41	0.22
CW019SA0302	Jira M	Top Soil	Sasenyi-X0468945,Y9595976	1.43	0.62
CW019SA0303	Jira M	Sub Soil	Sasenyi-X0468945,Y9595976	1.38	0.19
CW019SA0304	Kazungu	Top Soil	Sasenyi-X0468945,Y9596807	1.43	0.81
CW019SA0305	Kazungu	Sub Soil	Sasenyi-X0468945,Y9596807	1.31	0.62
CW019SA0306	Kamau	Top Soil	Itinyi-X0469173,Y9598109	1.69	0.20
CW019SA0307	Kamau	Sub Soil	Itinyi-X0469173,Y9598109	1.52	0.34
CW019SA0308	Walter	Top Soil	Marungu-X0469162,Y9598058	1.5	0.41
CW019SA0309	Walter	Sub Soil	Marungu-X0469162,Y9598058	1.47	0.37
CW019SA0310	Kivuva	Top Soil	Itinyi-X04770177,Y9601415	1.51	0.40
CW019SA0311	Kivuva	Sub Soil	Itinyi-X04770177,Y9601415	1.37	0.25
CW019SA0312	Mwanjila	Top Soil	Itinyi-X0470931,Y9602306	1.5	0.78
CW019SA0313	Mwanjila	Sub Soil	Itinyi-X0470931,Y9602306	1.43	0.30
CW019SA0314	Marungu Primary	Top Soil	Marungu-X0469404,Y95988891	1.52	0.26
CW019SA0315	Marungu Primary	Sub Soil	Marungu-X0469404,Y95988891	1.42	0.19
CW019SA0316	J Mkala	Top Soil	Sasenyi-X0469046,Y9597012	1.58	0.24
CW019SA0317	J Mkala	Sub Soil	Sasenyi-X0469046,Y9597012	1.46	0.35
CW019SA0318	Alima	Top Soil	Marungu-X0469173,Y9598113	1.48	0.64
CW019SA0319	Alima	Sub Soil	Marungu-X0469173,Y9598113	1.42	0.51
CW019SA0320	Mwikali	Top Soil	Lokichiqio-X0472927,Y9606132	1.53	0.69
CW019SA0321	Mwikali	Sub Soil	Lokichiqio-X0472927,Y9606132	1.39	0.34
CW019SA0322	Nicholus	Top Soil	Lokichiqio-X0473454,Y9605990	1.56	0.50
CW019SA0323	Nicholus	Sub Soil	Lokichiqio-	1.41	0.38

			X0473454,Y9605990		
CW019SA0324	M Ngele	Top Soil	Itinyi-X0471145,Y9601747	1.33	0.47
CW019SA0325	M Ngele	Sub Soil	Itinyi-X0471145,Y9601747	1.57	0.15
CW019SA0326	Kibarangoma	Top Soil	Marungu-X0469975,Y9600174	1.57	0.56
CW019SA0327	Kibarangoma	Sub Soil	Marungu-X0469975,Y9600174	1.5	0.28
CW019SA0328	F Kamau	Top Soil	Itinyi-X0470939,Y9603447	1.59	0.51
CW019SA0329	F Kamau	Sub Soil	Itinyi-X0470939,Y9603447	1.5	0.26
CW019SA0330	Mwanyuma	Top Soil	Marungu-X0468862,Y9598289	1.54	0.42
CW019SA0331	Mwanyuma	Sub Soil	Marungu-X0468862,Y9598289	1.29	0.51
CW019SA0332	Chimanga	Top Soil	Mwaqwede-X0465293,Y9589662	1.56	0.52
CW019SA0333	Chimanga	Sub Soil	Mwaqwede-X0465293,Y9589662	1.38	0.55
CW019SA0334	Mwadule	Top Soil	Mwaqwede-X0465633,Y9589944	1.34	0.91
CW019SA0335	Mwadule	Sub Soil	Mwaqwede-X0465633,Y9589944	1.28	0.76
CW019SA0336	Lomitir	Top Soil	Lokichogio-X0473367,Y9605797	1.51	0.44
CW019SA0337	Lomitir	Sub Soil	Lokichogio-X0473367,Y9605797	1.45	0.35
CW019SA0338	M Mtima	Top Soil	Marungu-X0469238,Y9598850	1.55	0.43
CW019SA0339	M Mtima	Sub Soil	Marungu-X0469238,Y9598850	1.44	0.35

Sample Number	Farm	Field	Comments	Bulk Density	Carbon
CW019SA0239	Rukinga Ranch	Rukinga 75	0-30cm-X0477067, Y9578494	1.38	0.59
CW019SA0240	Rukinga Ranch	Rukinga 75	31-100cm- X0477067, Y9578494	1.21	1.70
CW019SA0241	Rukinga Ranch	Rukinga 53	0-30cm- X473061, Y9584563	1.23	1.47
CW019SA0242	Rukinga Ranch	Rukinga 53	31-100cm- X0473061, Y9584563	1.33	0.74
CW019SA0243	Rukinga Ranch	Rukinga 40	0-30cm- X0465557, Y9587046	1.34	1.09
CW019SA0244	Rukinga Ranch	Rukinga 40	31-100cm- Xx0465557, Y9587046	1.13	1.90
CW019SA0245	Rukinga Ranch	Rukinga 45	0-30cm- X0475045, Y9586570	1.22	1.49
CW019SA0246	Rukinga Ranch	Rukinga 45	31-100cm- X0475045, Y9586570	1.35	0.69
CW019SA0247	Rukinga Ranch	Rukinga 54	0-30cm- X0475063, Y9584564	1.3	0.59
CW019SA0248	Rukinga Ranch	Rukinga 54	31-100cm- X0475063, Y9584564	1.33	0.83
CW019SA0249	Rukinga Ranch	Rukinga 81	0-30cm- X0473772, Y9575089	1.39	0.61
CW019SA0250	Rukinga Ranch	Rukinga 81	31-100cm- X0473772, Y9575089	1.38	1.10
CW019SA0251	Rukinga Ranch	Rukinga 63	0-30cm- X0477066, Y9582559	1.39	0.38
CW019SA0252	Rukinga Ranch	Rukinga 63	31-100cm- X0477066, Y9582559	1.25	0.72
CW019SA0253	Rukinga Ranch	Rukinga 71	0-31cm- X0479067, Y9580518	1.2	0.52
CW019SA0254	Rukinga Ranch	Rukinga 71	31-100cm- X0479067, Y9580518	1.36	0.60
CW019SA0255	Rukinga Ranch	Rukinga 19	0-30cm- X0477062, Y9592623	1.38	0.44
CW019SA0256	Rukinga Ranch	Rukinga 19	31-100cm- X0477062, Y9592623	1.4	0.80
CW019SA0257	Rukinga Ranch	Rukinga 3	0-30cm-X0475059, Y9599984	1.33	0.40
CW019SA0258	Rukinga Ranch	Rukinga 3	31-100cm- X0475059, Y9599984	1.42	0.85
CW019SA0259	Rukinga Ranch	Rukinga 56	0-30cm- X0479048, Y9584582	1.37	0.65
CW019SA0260	Rukinga Ranch	Rukinga 56	31-100cm- X0479048, Y9584582	1.21	1.28
CW019SA0261	Rukinga Ranch	Rukinga 23	0-30cm- X0471146, Y9590615	1.3	0.65
CW019SA0262	Rukinga Ranch	Rukinga 23	31-100cm- X0471146, Y9590615	1.25	1.05
CW019SA0263	Rukinga Ranch	Rukinga 24	0-30cm- X0472402, Y9590858	1.25	0.69
CW019SA0264	Rukinga Ranch	Rukinga 24	31-100cm- X0472402, Y9590858	1.35	0.98
CW019SA0265	Rukinga Ranch	Rukinga 10	0-30cm- X0475077, Y9596669	1.34	0.52
CW019SA0266	Rukinga Ranch	Rukinga 10	31-100cm- X0475077, Y9596669	1.4	0.72
CW019SA0267	Rukinga Ranch	Rukinga 48	0-30cm- X481050, Y9586554	1.31	0.87

CW019SA0268	Rukinga Ranch	Rukinga 48	31-100cm- X481050, Y9586554	1.34	0.65
CW019SA0269	Rukinga Ranch	Rukinga 22	0-30cm- X0469113, Y9590709	1.38	1.13
CW019SA0270	Rukinga Ranch	Rukinga 22	31-100cm- X0469113, Y9590709	1.52	0.55
CW019SA0271	Rukinga Ranch	Rukinga 112	0-30cm- X0471958, Y9600245	1.44	0.35
CW019SA0272	Rukinga Ranch	Rukinga 112	31-100cm- X0471958, Y9600245	1.33	0.78
CW019SA0273	Rukinga Ranch	Rukinga 76	0-30cm- X0479067, Y9578494	1.22	0.54
CW019SA0274	Rukinga Ranch	Rukinga 76	31-100cm- X0479067, Y958494	1.26	1.39
CW019SA0275	Rukinga Ranch	Rukinga 35	0-30cm-X0477031, Y9588676	1.21	1.19
CW019SA0276	Rukinga Ranch	Rukinga 35	31-100cm- X0477031, Y9588576	1.29	1.12
CW019SA0277	Rukinga Ranch	Rukinga 82	0-30cm- X0475085, y9574499	1.34	0.54
CW019SA0278	Rukinga Ranch	Rukinga 82	31-100cm- X0475085, Y9574499	1.45	0.73
CW019SA0279	Rukinga Ranch	Rukinga 66	0-30cm- X0469494, Y9580862	1.3	0.67
CW019SA0280	Rukinga Ranch	Rukinga 66	31-100cm- X0469494, Y9580862	1.59	0.59
CW019SA0281	Rukinga Ranch	Rukinga 59	0-30cm- X046129, Y9582521	1.5	0.48
CW019SA0282	Rukinga Ranch	Rukinga 59	31-100cm- X0469129, Y9582521	1.36	1.07
CW019SA0283	Rukinga Ranch	Rukinga 9	0-30cm- X0473253, Y9596819	1.39	0.62
CW019SA0284	Rukinga Ranch	Rukinga 9	31-100cm- X0473253, Y9596819	1.45	0.47
CW019SA0285	Rukinga Ranch	Rukinga 84	0-30cm- X0472093. Y9600367	1.36	0.44
CW019SA0286	Rukinga Ranch	Rukinga 84	31-100cm- X0472093, Y9600367	1.28	0.81
CW019SA0287	Rukinga Ranch	Rukinga 63	0-30cm- X0476903, Y9586364	1.24	0.51
CW019SA0288	Rukinga Ranch	Rukinga 46	31-100cm- X0476903, Y9586364	1.26	0.98

Description of Soil Types

The dominant soil type within the Project Area is Red Laterite typical of this region of Kenya. There are small bands of black cotton soil that occur randomly within the project area but account for a tiny - and we believe insignificant - element from the standpoint of the Project soil carbon pool. There are also areas within the Project Boundary where Gneiss Islands, or rocky outcrops penetrate the soils to form small rocky hills. These outcrops also represent a tiny and we believe insignificant portion of the land and therefore were ignored from the standpoint of the Project soil carbon pool. A soil classification map was obtained for the whole of Kenya[4] from which the soil classification map for the Reference Area, and the supporting data below, was produced:

[4] Sombroek, W.G., Braun, H.M.H. and van der Pouw, B.J.A. (1982). Exploratory Soil Map and Agro-Climatic Zone Map of Kenya, 1980. Scale: 1:1,000,000. Exploratory Soil Survey Report No. E1. Kenya Soil Survey Ministry of Agriculture - National Agricultural Laboratories, Nairobi, Kenya.

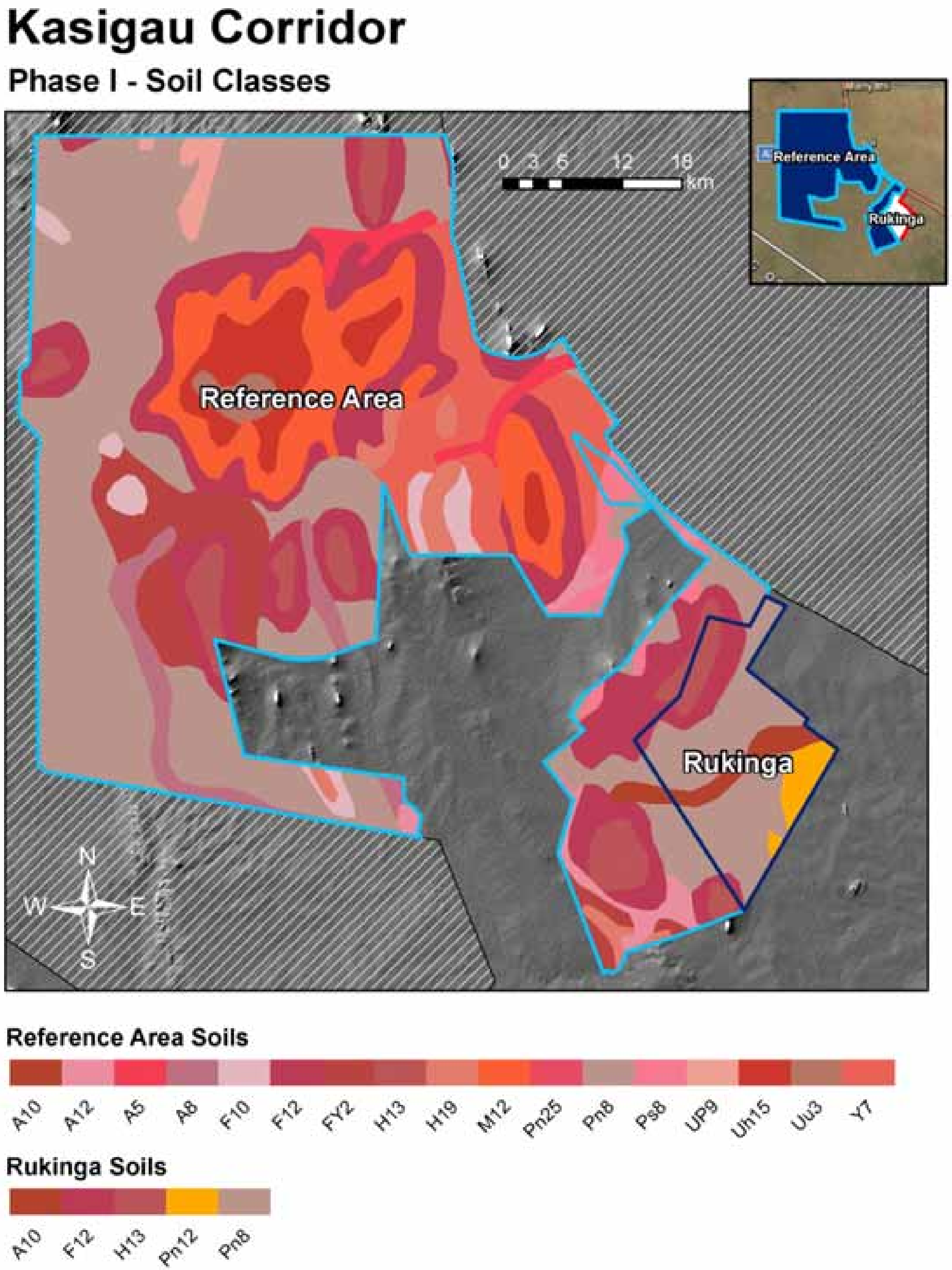


Figure 10. Soil classes in the reference and project areas.

2 Soil Classes:

Reference	Area (ha)	Contrib area (ha)	Soil Unit(s)	Soil Sub Type	Soil Type	contrib (%)	Lithology	Area (ha)	Contrib area (ha)	Rukinga
A10	3,174	3,174	BK	Calcic Cambi	Cambisols	100	I	3,198	3,198	A10
A12	5,722	5,722	VC	Chromic Vert	Vertisols	100	UE			
A5	5,534	5,934	JE	Eutric Fluvisc	Fluvisols	100	UF			
A8	10,101	10,101	JC	Calcaric Fluvi	Fluvisols	100	SC2			
F10	6,848	6,848	LC	Chromic Luvi	Luvisols	100	SO1			
F12	61,357	30,684	FR	Rodic Ferrals	Ferralsols	50	MA2	3,571	1,786	F12
		18,410	QF	Ferralic Aren	Arenosols	30			1,071	
		12,273	LIC	Ferralo-chror	Luvisols	20			714	
FY2	18,239	10,944	LC	Chromic Luvi	Luvisols	60	MA2			
		7,296	KH	Haplic Kastar	Kastanozems	40				
H13	14,083	8,450	RE	Eutric Regosc	Regosols	60	IA1	1,919	1,151	H13
		1,408	DK	Calcic Chernc	Chernozems	10			192	
		1,408	OK	Distric Histos	Histosols	10			192	
		2,817	ROCK	Eutric Regosc	Regosols	20			384	
H19	8,272	6,272	EC	Cambic Rend	Rendzinas	100	SC3			
M12	30,348	21,244	BH	Humic Cambi	Cambisols	70	MA			
		6,070	RD	Dystric Regos	Regosols	20				
		3,035	ROCK	Eutric Regosc	Regosols	10				
Pn25	37	37	DC	Calcic Chernc	Chernozems	100	SO1			
Pn8	122,681	122,681	FR	Rodic Ferrals	Ferralsols	100	MA2	18,522	18,522	Pn8
Ps8	6,036	6,036	LF	Ferric Luvisol	Luvisols	100	MB3			
UP9	2,914	2,914			Other	100				
Uh15	14,188	8,513	AC	Chromic Acri	Acrisols	60	MA2			
		2,838	B	Cambisols	Cambisols	20				
		2,838	F	Ferralsols	Ferralsols	20				
Uu3	2,893	1,447	U	Rankers	Rankers	50	MA			
		1,447	DH	Calcic Chernc	Chernozems	50				
Y7	20,184	20,184	LIC	Ferralo-chror	Luvisols	100				
			FR	Rodic Ferrals	Ferralsols	50	MA2	2,958	1,479	Pn12
			FO	Orthic Ferrals	Ferralsols	50			1,479	
total:		329,021							30,168	

	Reference	Rukinga
Cambisols	7.68%	10.60%
Vertisols	1.74%	0.00%
Fluvisols	4.87%	0.00%
Regosols	6.19%	5.09%
Ferralsols	47.47%	77.12%
Chernozem	0.88%	0.64%
Histosols	0.43%	0.64%
Luvisols	17.11%	2.37%
Kastanozem	2.22%	0.00%
Acrisols	2.59%	0.00%
Rankers	0.44%	0.00%
Rendzinas	1.91%	0.00%
Arenosols	5.60%	3.55%
Other	0.89%	0.00%
total:	100.00%	100.00%

Figure 11. Soil type comparison between Rukinga and the reference area

Minimizing Uncertainty

Wildlife Works has developed a field protocol for sampling soil carbon and that document "Standard Operating Procedure – Soils" was provided to the Validator.

The same team has been collecting soil samples for over one year in the project area and has collected well over 100 soil samples during that time. Our VP African Field Operations, Rob Dodson, trained the teams in the proper procedures and conducts periodic audits. Wildlife Works has the utmost confidence in our soil sampling team, and they have produce consistently accurate results. Ultimately, provided accuracy in field measurements, soil carbon uncertainty lies in the variance between plots and the quality of the soil laboratory used to determine soil organic carbon levels. Wildlife Works has, and will continue to use, Crop Nutritional Services in Nairobi. "Cropnuts" is run by Jeremy Cordingley, who has extensive training and experience in soil science and laboratory procedures. Jeremy conducts periodic calibration exercises with his equipment, and has offered to speak to the Validators should the so desire.

Fitting the Soil Carbon Loss Model

The soil carbon loss model was fit by first estimating the asymptotic proportion of soil carbon loss. Per equation 12 of the MED, the estimated asymptotic proportion is

$$\hat{\ell}_{max} = 1 - \left[\frac{C_{SOIL}^{[0]}}{a_{project}}\right]^{-1} \times \frac{1}{\#(\mathcal{A})} \sum_{i \in \mathcal{A}} y_i$$

$$\hat{\ell}_{max} = 1 - \frac{224.01}{411.53}$$

$$\hat{\ell}_{max} = \mathbf{0.456}$$

where 224.01 is the estimated mean carbon stock (tonnes CO2e/ha) of shambas in the reference area and 411.53 is the same for the project area. The default of 20% was selected for the mean rate of soil carbon loss (based on a conservative value derived from Davidson and Ackerman, 1993). A mean rate of 20% decay is achieved by $\lambda = 0.55$, and the final model is

$$S(t_1, t_2, \lambda, \ell_{max}) = \ell_{max}[G(t_2, \lambda) - G(t_1, \lambda)]$$

$$= \ell_{max}[1 - \exp(-\lambda t_2) - 1 - \exp(-\lambda t_1)]$$

$$\boldsymbol{S(t_1, t_2, \lambda, \ell_{max}) = 0.456\{[1 - \exp(-0.55 t_2)] - [1 - \exp(-0.55 t_1)]\}}$$

Predicting Soil Carbon Loss

The final soil model is displayed by equations 11 and 13 below. These equations show that upon deforestation in the project area, soil carbon gradually decays from the stocks in the deforested areas. Most soil carbon is lost in the 5 years after deforestation and the proportion of soil carbon lost asymptotes at 0.456.

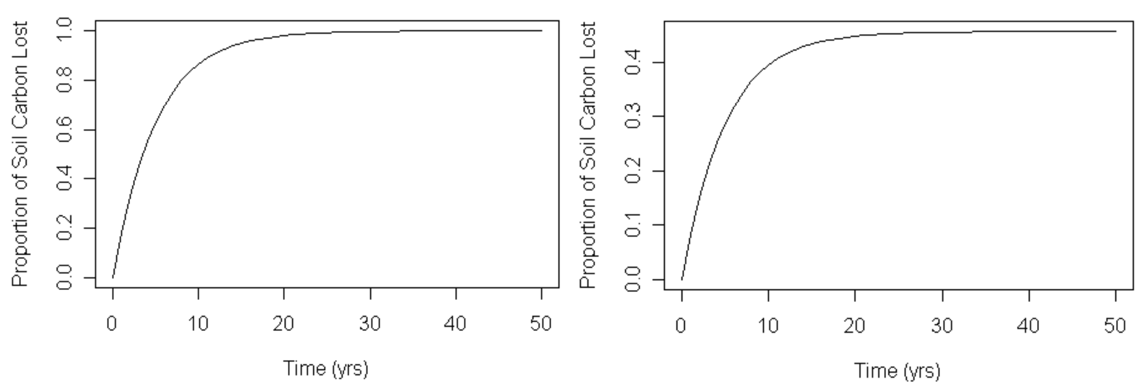


Figure 12. Equation 11 (general soil loss form) and Equation 13 (general carbon loss form applied at Rukinga)

Estimating Uncertainty in the Soil Carbon Loss Model

Per equation 19, the total estimated uncertainty in the soil carbon loss model is

$$U_{SCL} = 1.96 \times \hat{\sigma}_{SCL} \times \left[\sqrt{n_{SCL}} \times \frac{1}{n_{SCL}} \sum_{i \in \mathcal{A}} y_i\right]^{-1}$$

$$U_{SCL} = 1.96 \times 79.48 \times \left[\sqrt{25} \times 224.01\right]^{-1}$$

$$\boldsymbol{U_{SCL} = 0.1391}$$

where 79.48 is the estimated standard deviation of soil carbon stocks (tonnes CO2e/ha) from the sampled shambas, 25 is the sample size and 224.01 is the estimated sample mean (tonnes CO2e/ha).

Section 6.6 Baseline Scenario for Selected Carbon Pools

Selecting the Proportion of Below Ground Biomass Removed from Large Trees

The Kasigau Corridor is semi-arid, and due to very low average annual rain fall, the Dryland Forest on Rukinga Ranch and in the surrounding reference region is characterized by small to medium sized trees, mostly Acacia ssp and Commiphora ssp. When farmers clear the forest for agriculture, stumps are always removed if the cleared land is to be used for growing crops such as maize. This is because the land is usually tilled by ox-plough and stumps can present an impediment. Commiphora stumps rot away quite quickly after the tree has been cut down but the acacia are often too hard to be cut with an axe or panga, so the farmers fell them by making a fire around the base of the tree. This eventually topples the tree and the fire smolders into the stump and burns it down to below the surface of the soil. Stumps are correspondingly not visible from the cleared farm.

Our site management team and the majority shareholder of Rukinga Ranching Company Ltd, Mike Korchinsky, have been in the area for almost 15 years and have not seen a single stump in a maize farm. As a result we contend that it is common practice in this region to burn the stumps out, and therefore we select 100% as the Proportion of below ground biomass removed from large trees.

Selecting the Proportion of Wood Products

There is no harvest of commercial timber from the project area in the Baseline, nor for wood carving, furniture etc. The only potential harvest of wood products under the baseline would be for building materials for local village huts, e.g. the farmer might cut one or two trees for poles to build his home prior to slash and burn of the remaining biomass for cropland preparation. There are approximately 200-300 trees per hectare in the dryland forest, and a typical small farm or “shamba” is 5 acres or 2.5 hectares, representing 500-750 trees, so the one or two poles taken for hut construction per farm represent a deminimus amount of the above ground biomass of less than .5%. As not all farmers use locally harvested poles for hut construction, and even for those that do, the poles represent a tiny amount of biomass as the huts are very small and grass thatched, we feel it is reasonable to ignore the sequestration of carbon in long lived wood products in the baseline scenario, and therefore suggest the proportion of baseline emissions that are stored in long-lived wood products can be zero.

Figure 13. Local farmers house - Rukinga boundary

Section 6.7 Baseline Reevaluation

This PD was written at the time of initial validation and first monitoring period at the beginning of the project. This section is not yet applicable. Wildlife Works understands that under certain circumstances in the future as specified in VCS 2008a there may be reason to perform a Baseline Reevaluation before the mandatory time frame of 10 years.

Section 7 Additionality

Within the Project Area, none of the proposed Project activities violate any law.

1. Identification of alternative land use scenarios

    a. Continuation of the pre-project land use as private wildlife sanctuary:

    Prior to the implementation of the REDD project on Rukinga, the Project proponents had spent a significant and unsustainable amount of money over the last ten years financing activities to attempt to protect the forest from destruction. Those activities provided no significant sources of income from the land to offset the land protection costs, and therefore this project would eventually have failed financially if carbon funding were not made available.

    b. Uses a in the ten years prior to Project start date:

    Cattle Ranching - When the current majority landowners acquired their interest in Rukinga Sanctuary in 2000, the previous owners were operating a financially unsuccessful cattle ranching operation on the land. The area is too dry with no permanent water for successful cattle ranching, and there was predation by lions on the cattle at a rate that lead to the financial failure of the operation, and eventual sale of the land to the majority shareholder of Wildlife Works.

    Ecotourism - The prior owners also had an ecotourism facility on the Project area, but as evidence that these activities were not financially viable on the land, the slash and burn clearing had reached within 200 meters of the ecotourism facility, causing it to fail and move away.

    c. Slash and Burn Agriculture by subsistence farmers:

    Prior to the Project Proponent taking over management of the land in 2005, local people had begun to clear part of the Project area, and have systematically cleared the dryland forest from a majority of the Reference area in order to provide land for annual crops. This is evidently the most likely Baseline scenario, as it had been carried out routinely throughout the Reference region, in clear violation of land laws.

2. Consistency of credible land uses with enforced mandatory laws and regulations:

    All of the alternative land use scenarios above represent legal land uses, with the exception of slash and burn agriculture, which essentially consists of squatting on privately owned land; illegal under Kenyan law. However, there is overwhelming evidence that this law had been systematically unenforced, as greater than 30% of the area of the administrative unit that encompasses the project area had been deforested in the ten years prior to the Project start date. Thus, all the land uses above are credible.

3. Investment Analysis – Simple Cost Analysis:

    Physical protection of the Project area, and provision of deforestation mitigation activities, such as school building, scholarships, ranger patrols, reforestation of deforested indigenous forests etc. for the community cost the Project Proponent approximately $300-400,000 per year in the years prior to implementation of the VCS AFOLU project. There exists no significant income to offset these costs. In the absence of active protection, both physical and that created by partnering with the communities to create economic alternatives, it is clear the land in the Project area would be cleared aggressively for subsistence agriculture, as that was in fact what was already happening prior to our arrival. Slash and burn agriculture faces no economic barriers, and is therefore once again the most likely Baseline scenario.

4. Common Practice Analysis

   It is common practice to protect wilderness in Africa, and to provide sustainable development support for rural African communities, but that common practice is typically funded by governments or donor agencies, and not by financial return from the project activities. It is NOT common practice for private companies that are not donor funded, such as the Project proponent to protect forested wilderness in Africa for financial return, in the absence of AFOLU revenues. The Project proponent's Rukinga Sanctuary project is the first AFOLU Project Activity of its type in Kenya, and one of the very first in Africa.

Summary of Additionality Test

In summary;

- the Kasigau Corridor REDD project is not the only credible alternative land use consistent with enforced mandatory applicable laws,
- one of those alternative land uses, that of Slash and Burn Agriculture is by far the most likely baseline land use,
- the Kasigau Corridor project passes the Investment Analysis Test as it is not a financially viable land use without the AFOLU VCS project revenues
- and the project activities are NOT common practice.

therefore it is additional under the rules of VT0001 Tool for the Demonstration of Additionality in VCS AFOLU Project Activities.

Section 8 Baseline Emissions

Baseline emissions are calculated as the carbon pools measured in the project area, which are applied to the cumulative deforestation model (determined by sampling historical imagery). The estimated emissions (tonnes CO2e) for each selected carbon pool in the project area for each year since the project start date are shown in the following table. The total estimated baseline emissions for the first monitoring period are 1,450,329 tonnes CO2e. These emissions are based on the selected linear predictor of cumulative deforestation. It should be noted that it is not mandatory to measure ex-ante carbon stocks in the project area according to VCS standards. However, Wildlife Works chose to verify the project at the same time as project validation, and therefore performed a full ex-ante carbon inventory. The spreadsheet 'NER Analysis v4, 01/25/2011' provides complete GHG emission analysis for the entire project crediting period, and was provided to the Validator.

	2005	2006	2007	2008	2009	2010
Linear Model (%)	3.16%	6.33%	9.49%	12.66%	15.82%	18.99%
AGLT	50,776	50,776	50,776	50,776	50,776	50,776
BGLT	20,310	20,310	20,310	20,310	20,310	20,310
AGST	0	0	0	0	0	0
BGST	0	0	0	0	0	0
AGNT	8,556	8,556	8,556	8,556	8,556	8,556
BGNT	3,422	3,422	3,422	3,422	3,422	3,422
SDW	0	0	0	0	0	0
LDW	0	0	0	0	0	0
WP	0	0	0	0	0	0
SOIL	119,709	155,515	166,225	169,429	170,387	170,674
Total Emissions	**202,774**	**238,580**	**249,290**	**252,494**	**253,452**	**253,739**

Table 5. Baseline emissions by carbon pool and year.

8.1 Estimating Emissions from Above Ground Large Tree Biomass

See above summary table.

8.2 Estimating Emissions from Above Ground Small Tree Biomass

See above summary table – no distinction is made in this project between large and small trees; small tree biomass is therefore included in the large tree pool.

8.3 Estimating Emissions from Above Ground Non-Tree Biomass

See above summary table – non-tree includes shrubs and grasses.

8.4 Estimating Emissions from Below Ground Large Tree Biomass

See above summary table.

8.5 Estimating Emissions from Below Ground Small Tree Biomass

See above summary table – no distinction is made in this project between large and small trees; small tree biomass is therefore included in the large tree pool.

8.6 Estimating Emissions from Below Ground Non-Tree Biomass

See above summary table – non-tree includes shrubs and grasses.

8.7 Estimating Emissions from Standing Dead Wood

See above summary table – standing dead wood was included in the large tree numbers. Lying dead wood was conservatively ignored (see below)

8.8 Estimating Emissions from Lying Dead Wood

While there are many lying dead trees in the ecosystem, termites are very active in this ecosystem. To provide a conservative estimate of total aboveground biomass from trees, we have excluded this pool, although in some plots the weight of lying dead wood is significant as a result of elephant damage.

8.9 Estimating Emissions from Soil

See above summary table

8.10 Estimating Emissions from Wood Products

The proportion of long lived wood products defined in section 6.6.10 was zero. Therefore, there are no measured negative emissions (sequestration) from this pool.

Section 9 Project Emissions

9.0 Forest Fires

There have been no significant forest fires in the Project area during the first monitoring period. The Project proponent understands that should significant forest fires occur in the future during the Project crediting period, that we would be required to produce a map of the boundaries of the fire prior to the subsequent monitoring period.

9.1 Emissions from Burning

There have been no events of woody biomass burning within the Project area. Wildlife Works' sustainable charcoal project activity uses fingerling wood, sustainably harvested from indigenous trees outside the Project Area.

Section 10 Leakage

Section 10.1 Leakage Mitigation Strategies

- Providing economic alternatives to the slash and burn agricultural practices that have devastated so much of sub-saharan Africa:

  a) we built a factory on the edge of our project area where we train the local women how to sew. We have employed many local people over the years, producing organic cotton fashion which we sell locally and internationally. A pact with the community exists: if they value the jobs, they agree to stop clearing the forest and damaging biodiversity, or we will not be able to sell products, and they will lose their jobs. Our factory uses a small amount of electricity generated from the National Grid, which in Kenya is 40% hydroelectric. We believe the emissions created by this power use are more than offset by the reduction in emissions gained from our greenhouse and tree nurseries and replanting schemes discussed below.

  b) we established an organic greenhouse and nursery program to grow a variety of trees, providing fuelwood, cash crops and medicinal/agroforestry species to the community. Increasing agricultural productivity on existing farmland is viewed as the best way to stop additional conversion. We plan to expand this activity to sponsor nurseries in each of the main villages surrounding our project upon receipt of carbon revenue from this project. We havfe already initiated a reforestation activity with native hardwoods grown in our nursery, and outplanted into previously deforested areas on community lands. We are claiming no additional carbon emissions credits for this activity; it is simply an element of our leakage mitigation strategy.

  c) we have been working with the Kenyan Agricultural Research Institute (KARI) to explore the potential of growing jojoba as a dryland cash crop that can withstand drought and poor agricultural practices and still generate a cash crop on a high value per hectare basis, again to improve food security by increasing agricultural productivity on existing ag lands to reduce conversion pressure. We have completed a two year study and are ready to roll out a farmer outreach model.

- Providing planned Farm land

  The local population's need for additional farm land was addressed by the establishment of a land cooperative on 5000 acres of what was still at that time Rukinga Ranch. This Sasenyi Valley land cooperative on land that had been cleared of forest prior to our arrival gave the community area to expand into without needing to clear more forest. They were able to receive legal title for their farms, a first in this area of Kenya. This program has been fully implemented.

- Expansion of our ranger patrols and implementation of community ranger groups to patrol the leakage area

  Unlike most REDD projects, Wildlife Works directly employs its own rangers to protect the forest from illegal incursion, deforestation and even damage to biodiversity. We have a 10 year track record of physically protecting the land from all potential deforestation agents. Our success, where many other projects have failed in this regard, is due to our providing economic alternatives to the community, preventing the requirement to clear more forest for agriculture. This has created a partnering relationship with the community, and increased the effectiveness of our rangers, even though they are not armed. They can draw heavily on support from the influential members of the local community. We believe that our presence in daily protection of the forest has significantly reduced, if not completely eliminated, the threat of immigrant populations from non forested areas of the Coast province in Kenya coming to the area in search of unprotected land for slash and burn agriculture. Therefore, in addition to stopping the specific deforestation of the project area, the project activities have reduced the population pressure that would have been seen under the baseline / without project scenario. We have more than doubled our ranger force since the beginning of the REDD project.

- Phase II:

  We plan to implement a second phase of the Kasigau Corridor project, in which we will extend our monitoring and protection to ALL of the remaining dryland forest in this region of Kenya, nearly 500,000 acres, to prevent slash and burn agriculture from moving into any of the adjacent forested lands privately owned by members of the community. We have entered into Carbon Rights Agreements / Easements with the neighboring community land owners to execute this component of the strategy, and have already begun protection of their forests with additional rangers and ranger posts. This program has been fully implemented.

- Fuelwood and sustainable charcoal:

  a) We are establishing 5 organic greenhouse extensions within the Project area to produce fuelwood and other agriforestry species for the local community. We aim to assist them in becoming self-sufficient in fuelwood, without having to extract from any of the Project area or other private dryland forest in the region. This activity is currently being established.

  b) A study carried out by Matthew Owen of the University of North Carolina, “Adaptation to Rural Domestic Fuelwood Scarcity in Embu District, Kenya" showed that when fuelwood is an abundant and free resource, it is used at a level far above necessity, and that when it becomes a constrained resource, consumption can drop by as much as 50% without loss of function to the community. This indicates that the amount of wood being harvested for fuelwood from Rukinga can probably be replaced with far less fuelwood grown in woodlots and community farms.

  c) We have been developing a sustainable charcoal alternative to destructive bush charcoal. We currently employ 12 people in the production of charcoal briquettes from fingerling charcoal harvested from indigenous trees and shrubs, and using a cassava flour binder. We believe we can substitute this carbon neutral charcoal into the local economy with minimal subsidy to provide for the community’s fuel needs, with zero leakage. Production testing has been completed for this activity. Sales tests are ongoing.

  d) Our baseline analysis shows that the without project scenario would have seen the Project area eventually cleared completely for farm land. As such, wood resources the community may have extracted from the Project area would have been transient at best.

Section 10.2 Delineation of the Leakage Area

The leakage area, depicted in the map in section 10.3.2 below, was selected from forested areas as close as possible to the Project area which are subject to the same agents and drivers of deforestation as the project area, and that exhibit similar geographic characteristics (such as elevation, proximity to villages or towns, forest type etc.) The MED requires that the leakage area be forested at the project start date. Tsavo National Parks were excluded, as they fall under a different legal protection status. The most obvious area with a high potential for leakage are the group-owned ranches with identical land ownership system to the Project area. They are immediately adjacent to the project area, but were not selected for inclusion in the leakage area, as they are now being protected by Wildlife Works under Phase II of the Kasigau Corridor REDD. The second criteria was accessibility by the agents of deforestation, as some of the remaining forested land in the reference region is very remote and unlikely to suffer leakage. Soil fertility or rainfall were not considered, as they are fairly constant across the Reference area.

Section 10.3 The Leakage Model

Sampling Deforestation and Degradation to Build the Leakage Model

Per the requirements of the MED, the leakage area was sampled prior to the first monitoring period, to estimate the lag period for the leakage model.

Equation [10], dependent on the standard deviation of the forested state observations, was used to calculate the number of sample point locations required, and yielded a result of 38 locations within the leakage area

$$\hat{m}_{LE} \geq \left(\frac{\hat{\sigma}_{DF}1.96}{0.1}\right)^2$$

$$\hat{m}_{LE} \geq \left(\frac{(.3126)(1.96)}{0.1}\right)^2$$

$$\hat{m}_{LE} \geq \mathbf{38}$$

38 equal sized 2 hectare square plots were then randomly located within the Leakage area, and coordinates of the NE corner of each Leakage plot was given to the leakage plot sampling team. A number of extra plots were generated to allow for inaccessibility in the field of certain plots. The rationale behind the extra plots is that in this ecosystem, inaccessibility is limited to thick bush, where vehicles cannot approach to a safe distance for the sampling teams to reach the location on foot to perform the sampling exercise. At Wildlife Works, safety for our employees is of primary concern, and if sampling teams walk too far in thick bush, they run the risk of encountering elephant or buffalo. As inaccessibility always corresponds with thick primary vegetation, it can be assumed that the exclusion of the inaccessible points is a conservative measure of leakage, as they would undoubtedly have a factor of 0. Note that the field leakage sampling done by Wildlife Works personnel was done prior to the MED being finally validated, and at the time the Leakage Plot samples were taken, a 0% leakage factor was not encountered; the lowest factor was 0-20%. Again, we believe this leads to a conservative measure of average leakage factor, and a conservative leakage lag period. Maps of the leakage area, showing the permanent Leakage plots are shown below.

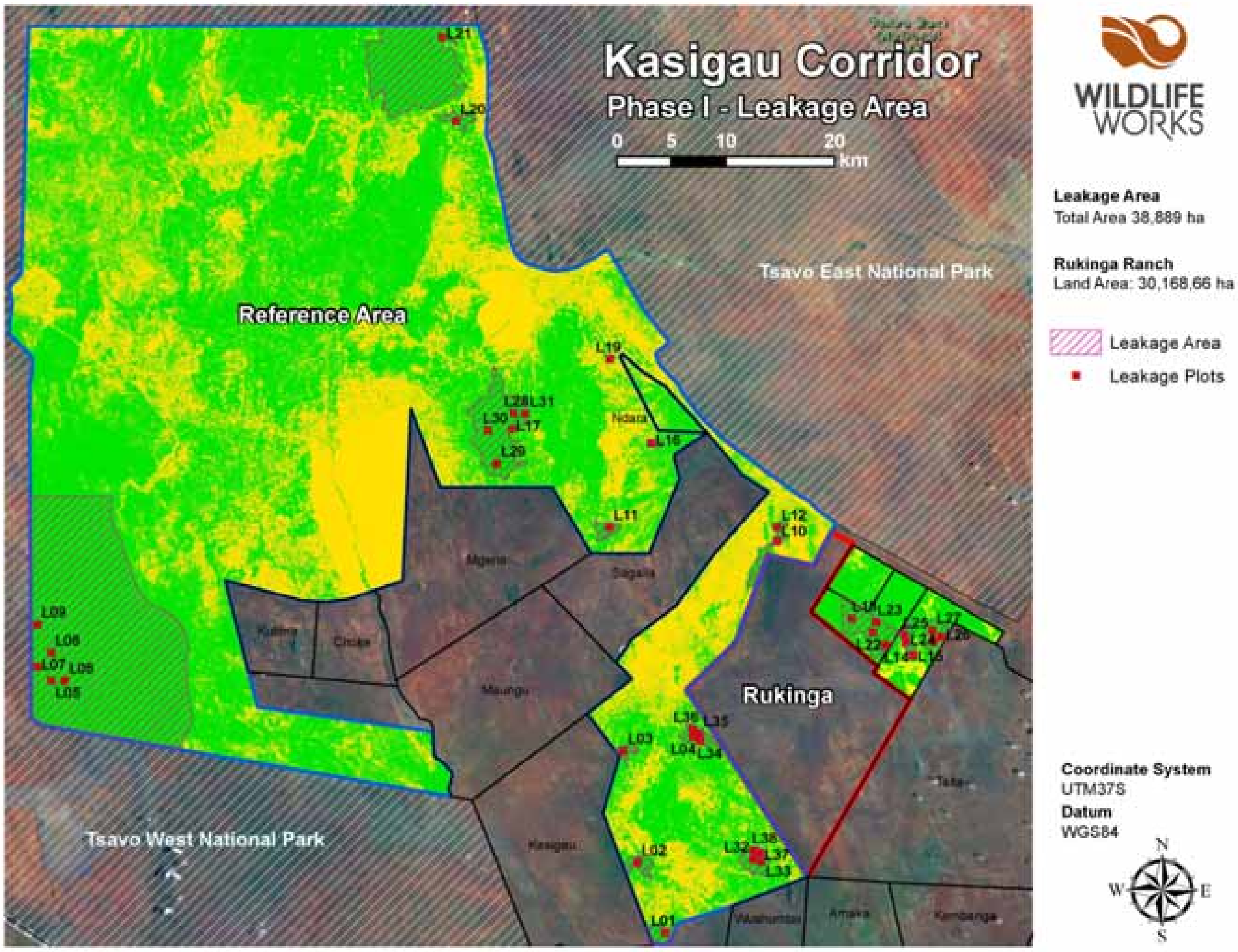
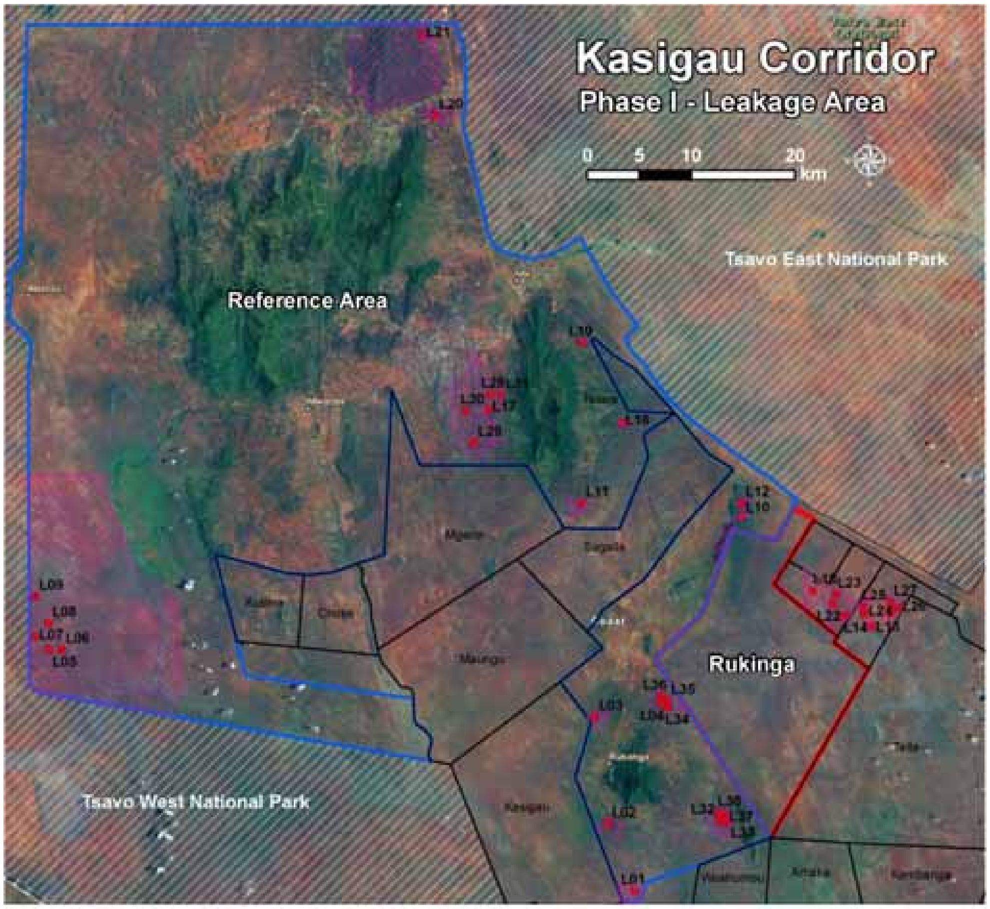


Figure 14. Leakage plots overlaid on a forest/non-forest map



Leakage Plot Coordinates

Plots	Point X	Point Y
L01	462290.6	9566407.4
L02	459730.6	9572807.4
L03	458450.6	9583047.4
L04	464850.6	9584327.4
L05	405970.6	9589447.4
L06	407250.6	9589447.4
L07	404690.6	9590727.4
L08	405970.6	9592007.4
L09	404690.6	9594567.4
L10	472530.6	9602247.4
L11	457170.6	9603527.4
L12	472530.6	9603527.4
L13	486859.7	9593065.8
L14	482453.6	9592769.8
L15	485034.1	9591786.5
L16	461010.6	9611207.4
L17	448210.6	9612487.4
L18	479344.8	9595139.2
L19	457170.6	9618887.4
L20	443090.6	9640647.4
L21	441810.6	9648327.4
L22	481307.2	9593867.3
L23	481598.5	9594812.8
L24	484344.9	9592969.2
L25	484231.9	9593633.8
L26	487579.8	9593521.9
L27	486771.0	9594064.8
L28	448401.6	9613947.0
L29	446810.4	9609307.4
L30	446012.1	9612379.7
L31	449457.4	9613888.1
L32	470359.3	9573125.2
L33	471130.8	9572882.0
L34	465491.1	9583961.7
L35	465407.2	9584618.5
L36	464821.6	9585006.8
L37	470989.6	9573694.4
L38	470380.8	9573910.4

Figure 15. Leakage plots and corresponding coordinates

The Leakage Sampling team performed estimates of deforestation and degradation according to 'Standard Operating Procedure Leakage', a copy of which was provided for the Validator. They made no permanent marking of plots, and will simply return to the same NE corner coordinate each monitoring period, and repeat the procedure in each subsequent period. Sampling results are summarized in the table below. Leakage sampling was lead by Operations Manager Jamie Hendriksen, and supervised by Rob Dodson, VP African Field Operations, our two most experienced staff members, as this was our first ever leakage area plot sampling effort. They will now be responsible for training other members of our field plot sampling team to perform this activity each required monitoring period, and for performing QA on a selected sample of the Leakage Plots each monitoring period to ensure consistency in their evaluation of degradation for this first monitoring period.

Leakage Plot Coordinates				
Plots	Point X	Point Y	Degradation % Dec, 2010	value
L01	462290.6	9566407.4	0-20	1
L02	459730.6	9572807.4	41-60	3
L03	458450.6	9583047.4	21-40	2
L04	464850.6	9584327.4	0	0
L05	405970.6	9589447.4	0-20	1
L06	407250.6	9589447.4	0-20	1
L07	404690.6	9590727.4	0-20	1
L08	405970.6	9592007.4	21-40	2
L09	404690.6	9594567.4	21-40	2
L10	472530.6	9602247.4	0-20	1
L11	457170.6	9603527.4	61-80	4
L12	472530.6	9603527.4	0-20	1
L13	486859.7	9593065.8	0-20	1
L14	482453.6	9592769.8	21-40	2
L15	485034.1	9591786.5	41-60	3
L16	461010.6	9611207.4	41-60	3
L17	448210.6	9612487.4	21-40	2
L18	479344.8	9595139.2	20-40	2
L19	457170.6	9618887.4	0-20	1
L20	443090.6	9640647.4	0	0
L21	441810.6	9648327.4	0	0
L22	481307.2	9593867.3	0-20	1
L23	481598.5	9594812.8	21-40	2
L24	484344.9	9592969.2	0-20	1
L25	484231.9	9593633.8	21-40	2
L26	487579.8	9593521.9	0-20	1
L27	486771.0	9594064.8	0-20	1
L28	448401.6	9613947.0	61-80	4
L29	446810.4	9609307.4	61-80	4
L30	446012.1	9612379.7	41-60	3
L31	449457.4	9613888.1	21-40	2
L32	470359.3	9573125.2	61-80	4
L33	471130.8	9572882.0	41-60	3
L34	465491.1	9583961.7	21-40	2
L35	465407.2	9584618.5	21-40	2
L36	464821.6	9585006.8	0-20	1
L37	470989.6	9573694.4	41-60	3
L38	470380.8	9573910.4	21-40	2

Leakage Area Polygons	
perimeter (m)	area (m^2)
10394.51227	2622654.416
2046.461795	221164.6479
4547.836483	522040.3724
7837.745452	2487550.251
17675.17905	3713644.272
8279.920827	1626170.571
10307.97126	3942253.055
9726.982167	2795240.98
18021.21369	13467407.77
7857.944337	2567239.308
8822.613995	4934017.422
68042.63615	255753249.1
32587.05298	29928113.67
38283.42394	56169524.54
8619.378165	3420972.65
9174.509654	4721327.05
Total Leakage area (ha)	**38,889**
Rukinga forested area (ha)	**27,844**

deg	value
0	0
0-20	1
21-40	2
41-60	3
61-80	4
81-100	5

Table 6. Leakage plot evaluation results

Fitting the Leakage Model

The leakage model was fit by first computing the proportion of cumulative deforestation and degradation in the leakage area as the average of observed factors. This proportion $\hat{d}_0$ is 0.3789, applied to equation 9 to compute the lag period as

$$\hat{\delta}_{LE} = \log(\hat{d}_t) + \log(1 - \hat{d}_t) + \hat{\alpha} + \widehat{\boldsymbol{\theta}}\boldsymbol{x}^T$$

$$\hat{\delta}_{LE} = \log(0.3737) + \log(1 - 0.3737) + 1.08804558$$

$$\hat{\delta}_{LE} = \mathbf{0.4498}$$

And the final leakage model per equation 8 is then

$$F_{LE}(t, \hat{\eta}, \hat{\delta}_{LE}) = \frac{1}{1 + \exp(-(-1.08804558 + 0.0003792x) - 0.4498)}$$

The following is a plot of the leakage model for the leakage area compared to the cumulative deforestation model.

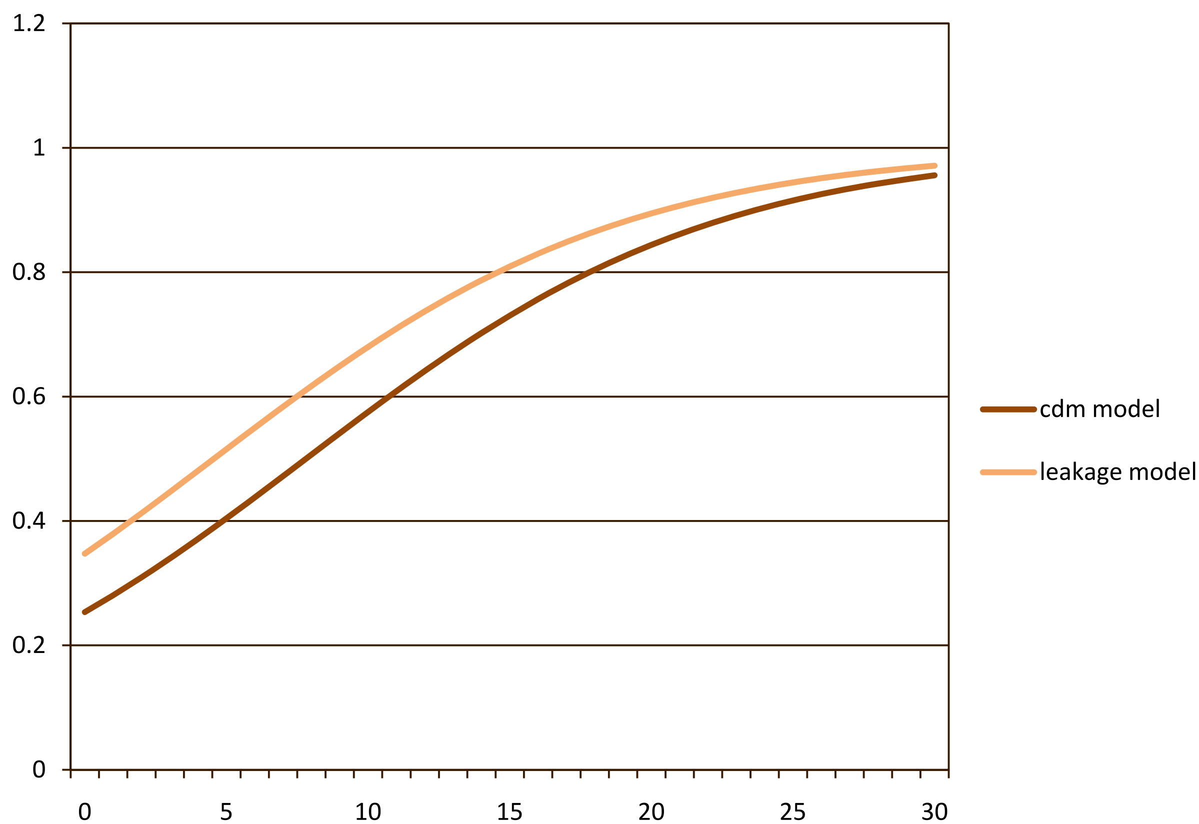


Figure 16. Plot of the leakage model compared to the cumulative deforestation model over time (years).

Section 10.4 Estimating the Leakage Factor and Emissions from Leakage

The estimated cumulative degradation and deforestation predicted by the leakage model is 0.343 which necessarily matches that observed in the leakage area for the first monitoring period. Since this is the first monitoring period and the leakage model was parameterized after the project start date, the leakage factor is zero. Likewise, for this monitoring period, the estimated emissions from leakage are zero.

During subsequent monitoring periods, the Leakage Plot Sampling teams will revisit the 38 two-square hectare plots and perform the same SOP to determine the Leakage Factor evident at that time, and that will be used to determine whether or not Leakage has occurred during that monitoring period, per the requirements of the MED.Leakage measured for each monitoring period will be applied to net emission reduction figures for that same period (i.e. adjustment for leakage is applied at the point of each verification event following the first, which is used to only determine the leakage lag factor).

Section 11 Quantification of NERs

Net Emissions Reductions (NERs) to date are quantified from the following components (tonnes CO2e) with 290,066 and 1,160,263 tonnes CO2e to buffer pool and issuance, respectively.

Component	Value
Estimated Baseline Emissions	1,450,329
Uncertainty Deduction	0
Project Emissions	0
Emissions from Leakage	0
Gross Total NERs	1,450,329
NERs to Buffer Pool (20%)	290,066
Net Total NERs	**1,160,263**

Table 7. Components of NER calculations, allocation to buffer pool and total NERs to date.

Section 11.1 Determining Deductions for Uncertainty

Given the calculated, weighted quadratic average using equation 36, no confidence deduction is applied, as total uncertainty falls below 0.15. The weighted quadratic average of quantified uncertainty, per equation 36, is

$$U^{[m]} = \sqrt{\left[C_{TOTAL}^{[1]} U_{DF}^2 + C_{TOTAL}^{[1]} \left(U_{TOTAL}^{[1]}\right)^2 + C_{SOIL}^{[1]} U_{SCL}^2\right] \left(2C_{TOTAL}^{[1]} + C_{SOIL}^{[1]}\right)^{-1}}$$

$$U^{[m]} = \sqrt{\frac{[2624568.9 \cdot 0.05941298^2 + 2624568.9 \cdot 0.0851^2 + 11842347.78 \cdot 0.1391^2]}{(2 \cdot 2624568.9) + 11842347.78}}$$

$$\boldsymbol{U^{[m]} = 0.124}$$

where the inputs are presented below.

Variable	Description	Value
$\boldsymbol{C_{TOTAL}^{[1]}}$	Total forest carbon stock at monitoring period [1]	2,624,568.9
$\boldsymbol{C_{SOIL}^{[1]}}$	Soil carbon stock within the project area at monitoring period [1]	1,1842,347.8
$\boldsymbol{U_{DF}}$	Estimated uncertainty in the CDM at monitoring period [1]	0.05941298
$\boldsymbol{U_{TOTAL}^{[1]}}$	Estimated uncertainty of total carbon stocks at monitoring period [1]	0.0851
$\boldsymbol{U_{SCL}}$	Estimated uncertainty in the soil carbon model at monitoring period [1]	0.1391

Table 8. Variables and values used to calculate the weighted quadratic average of uncertainty.

Section 11.3 Ex-Ante Estimation of NERs

Baseline emissions were projected over the life of the project to estimate net carbon benefit. An ex-ante estimate of the total *gross* NERs generated by the project is 7,542,945 tonnes CO2e.

The project activities described in detail in Section 10 Leakage and Section 6.1 Baseline Scenario Overview, were specifically designed to mitigate deforestation and human-wildlife conflict, and therefore by default serve to mitigate leakage and uphold project permanence. Wildlife Works is of the opinion that the project will suffer little to no leakage, due to our exceptional attention to leakage mitigation. However, in the absence of precedent for estimating ex-ante leakage emissions, Wildlife Works chose to use a conservative value of 20%. Applying this factor to gross NERs yields an estimate of total net NERs over the project lifetime of:

$$\text{Ex} - \text{Ante NERs} = 7{,}542{,}945 - (7{,}542{,}945 * 0.20)$$

$$\text{Ex} - \text{Ante NERs} = \mathbf{6,034,356}$$

This analysis is available as a spreadsheet and accounts for an estimate of 20% leakage from 2011 onwards, according to the MED. It includes project emissions and a total confidence deduction. A chart of the projected NERs over the life of the project is presented below. Actual leakage values will be measured empirically at each monitoring period, and will vary from these conservative ex-ante estimates.

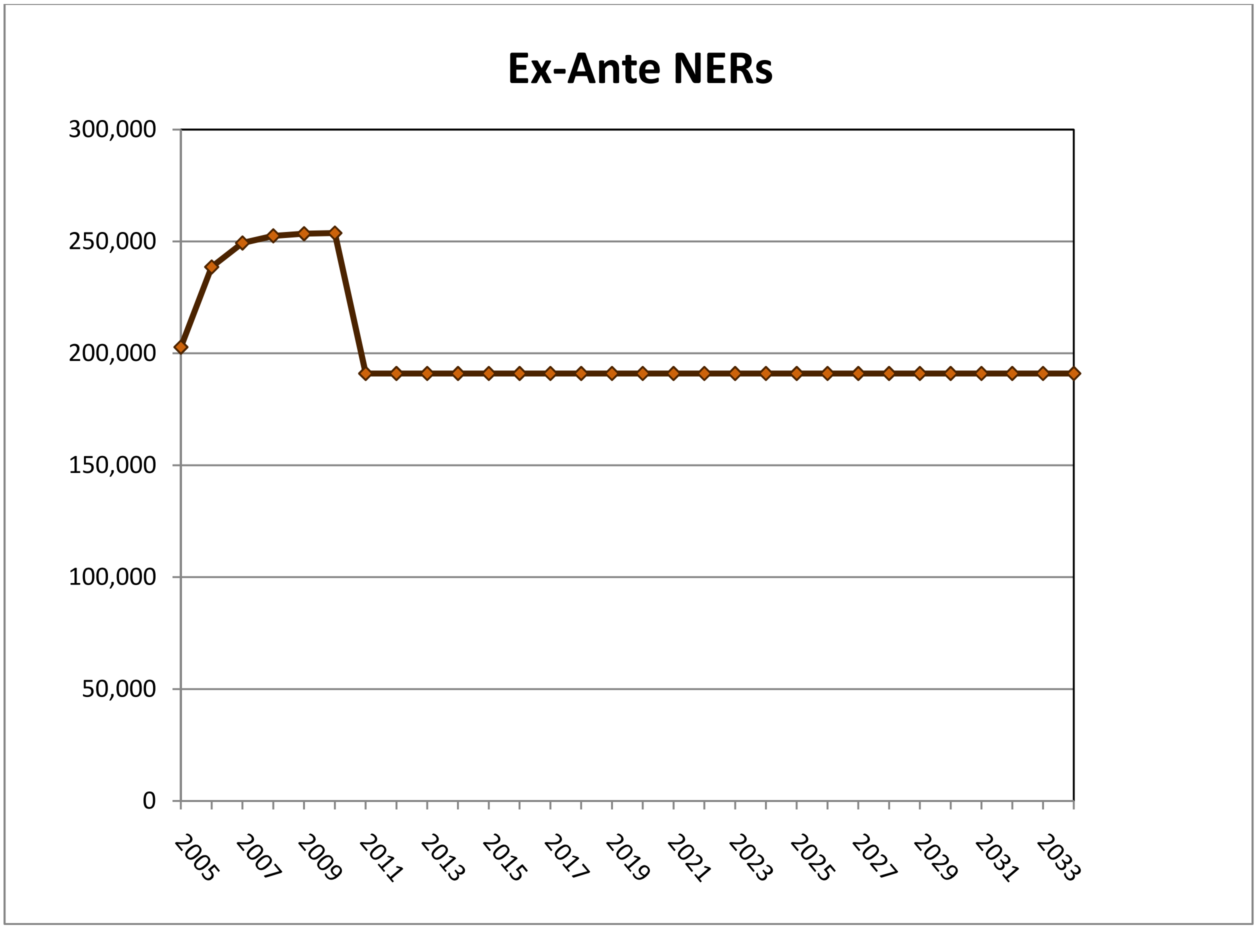


Figure 17. Ex-Ante Calculation of NERs for the Project lifetime.

Section 13 Monitoring

Please also refer to the document entitled 'Section 13 Monitoring' (01/14/2011)

Section 13.14 Monitoring of Carbon Stocks in the Project Area

Summary of sampling procedures

(See Standard Operating Procedure Biomass, 1/10/2011 and Standard Operating Procedure Soils, 1/1/2011 provided to the Validator for detailed procedures)

Rukinga Sanctuary is 30,169 hectares of varying density Acacia-Commiphora woodland/forest located in the SE of Kenya. Altitudes on the sanctuary range from approximately 450m to 1,000m and the ecosystem encompasses montane forest on the slopes of the higher elevations, through Acacia-Commiphora dryland forest at mid elevations and down to grassland dominated savannah at the lowest elevations. In order to most accurately estimate the biomass of the sanctuary, with reasonable time and expense, we divided the sanctuary into three major strata based on ecosystem type, as there is a high perceived variation in average biomass across the three strata pools, with larger trees in high density in the montane forest strata, medium to large trees and lots of shrubs in the dryland forest strata and scattered trees, very few shrubs and heavy grass cover in the savannah grassland strata. Overall, we used 9 strata, summing to the total land area, to depict landcover in Rukinga.

In order to most accurately estimate biomass in the sanctuary, with reasonable time and expense, we divided the sanctuary into three major ecosystem types, as there is a high perceived variation in average biomass across these pools, with larger trees in high density in the montane forest strata, medium to large trees and lots of shrubs in the dryland forest strata and scattered trees, very few shrubs and heavy grass cover in the savannah grassland areas. We ultimately used 9 strata, summing to the total land area, to depict homogeneous patches of landcover in Rukinga.

It should be noted that our ex-ante monitoring was conducted in February and March 2009, the dry season in this area. We believe this will yield an extremely conservative biomass estimates, as the dominant tree species enter into estervation to preserve moisture. During this season, the trees lose all leaf mass, and the perennial grasses senesce. Wildlife Works executive management supervised the data collection teams at the initial plots, to ensure proper adherence to procedure.

It was determined that a systematic random plot sampling technique would best capture variability in landcover, due to the high degree of perceived variation of type and density of trees and shrubs. A systematic sampling method was used to overlay a 2km x 2km grid over the sanctuary and select sample plot centers at the center point of each square (see figure 18 below). The upper left corner of the grid was randomly positioned within its UTM 1km x 1km grid.

To sample soil, coordinates were provided to the soil plot sampling teams by our GIS team, at random forest plot locations, and they sampled using the method illustrated in the 'Standard Operating Procedure Soils' document provided to the validator. The following is an excerpt from the soil sampling procedure:

Step1 For a plot inside Rukinga, coordinates are provided to the soil plot sampling teams by our GIS team, at random plot locations. The plot teams use their GPS to find the plot center.

Step 2. A one meter square is marked out on the ground, and digging commences.

Step 3. The soil from the top 30cms is piled together and the larger lumps are smashed with the back of a hoe.

Step 4. Whilst the soil is being dug from the sample pit, the tailings are thoroughly mixed so that the various layers are interspersed.

Step 5. The lower layer taken from 31cm-100cm is then piled on the other side of the pit and it too is mixed thoroughly.

Step 6. A sample is then taken from each of the mixed piles, bagged, and sent to the independent testing lab – CROP NUTRITION SERVICES, Nairobi Kenya.

If outside Rukinga, the location and name of the farm and any comments are recorded on the bag and in the sampling notes, and Top Soil(0-30) and Sub Soil(31-100) are recorded for the respective samples. Care should be taken not to include any large rocks or roots or other obvious organic matter in the samples; mineral soil only.

Crop Nutrition Services performs standard bulk density and organic matter analysis of the soil samples and returns the results in excel spreadsheets. The Bulk Density method used by the outside laboratory (Crop Nutrition Services) that performed the soil testing for the PD is an official FAO methodology for measuring Bulk Density of disturbed soil samples. A copy of the FAO approved protocol was provided to the Validators.

Field training

Field training was conducted in February, 2009 for the first tree plot sampling team. This team consisted of;

- a local tree expert who was able to identify all the different acacia and commiphora species encountered in the sampling - Joel Mwandiga
- Mike Korchinsky – CEO Wildlife Works
- Rob Dodson – VP African Field Operations
- Mwololo Muasa a Wildlife Works employee who would be the permanent team lead and data recorder
- Three casuals to assist with carrying equipment into the field and marking the plots
- A driver
- A ranger for security

The Standard Operating Procedures for Biomass and Soils were produced following refinement of the field techniques by this initial team and two other teams have been trained using the procedure and by accompanying our permanent team on their work, to ensure consistency in method.

Documentation of data quality assessment such as the results from a check cruise

Quality Control (QC) for Biomass plots was conducting using the following protocol;

1. An independent QC team not involved in the original plot sampling of each plot is given coordinates for the plot centers for 5% of the original plots. The Independent QC team is also given blank plot data recording sheets, plot radius for each carbon pool, a copy of the plot sampling “Standard Operating Procedure – Biomass”, dbh tape, compass and long tape, and sent out to measure the plots as though they were doing it for the first time.

2. The QC team returns to headquarters with data sheets which are given to a third party analyst, who are neither on the original nor the QC plot team, for comparison against the original plot data sheets.

3. Any discrepancies are noted, and when all sheets have been compared, the two plot teams are brought together with the VP African Field Operations or his deputy the Operations Manager to discuss and explain any significant variances (±15%)

4. The monitoring team lead is informed if more than 1 QC plot contains significant discrepancies from the original data sheets, and further QC plots may be required to establish the extent of the quality errors.

5. The Monitoring Team Lead and/or senior carbon staff makes a determination as to whether a plot needs to be revisited:

   For a given plot, the number of trees that fall outside the ±15% threshold for change since original measurement is counted. If greater than 10% of trees in that plot fall outside the threshold, and QC has been performed on the plot within 1 year from original measurement, the plot must be re-measured. If QC has been performed on a plot greater than 1 year after original measurement, the threshold described above shall be relaxed to 15%.

Map Showing Strata Boundaries and Plot Locations

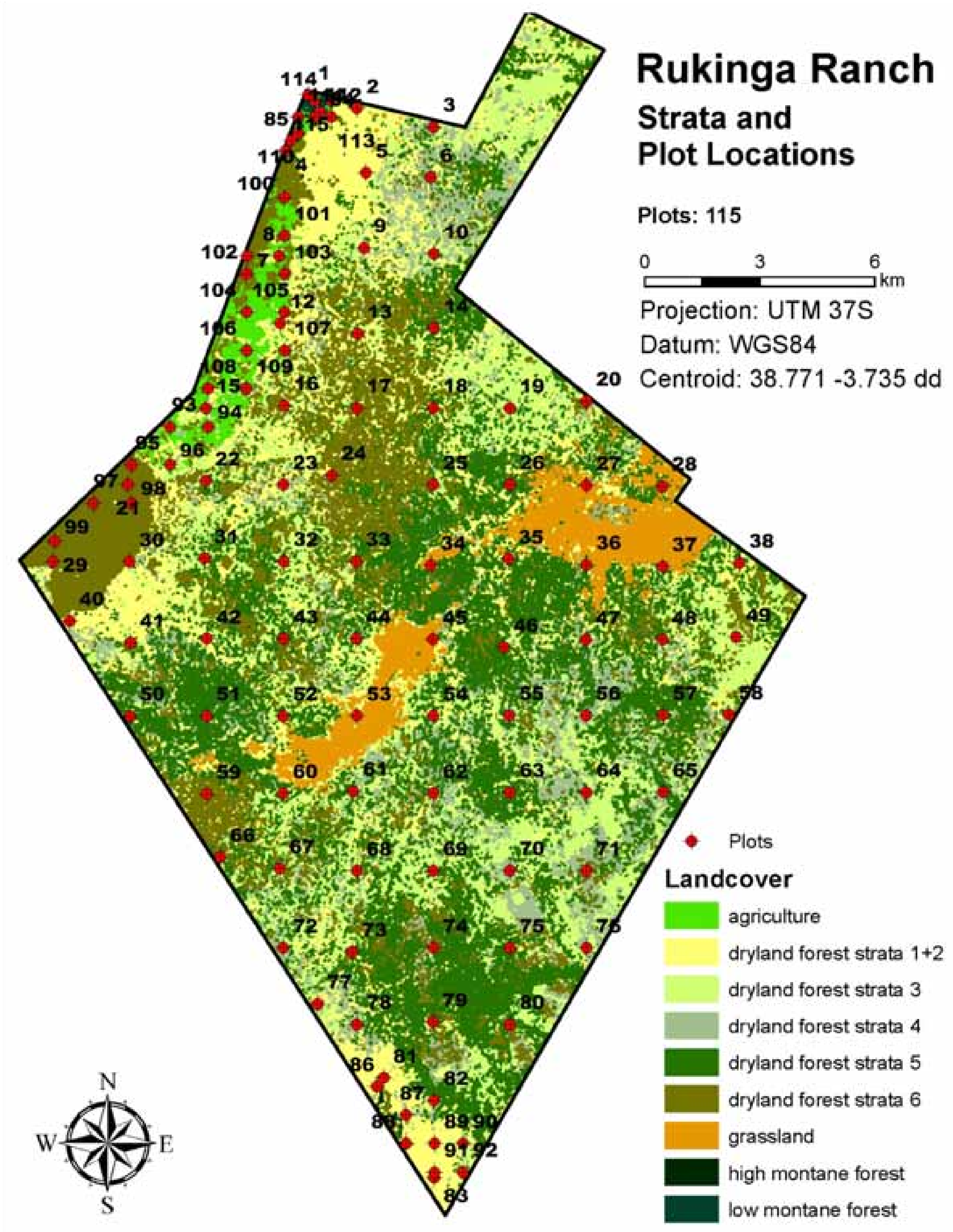


Figure 18. Stratification of the project area and carbon inventory plots

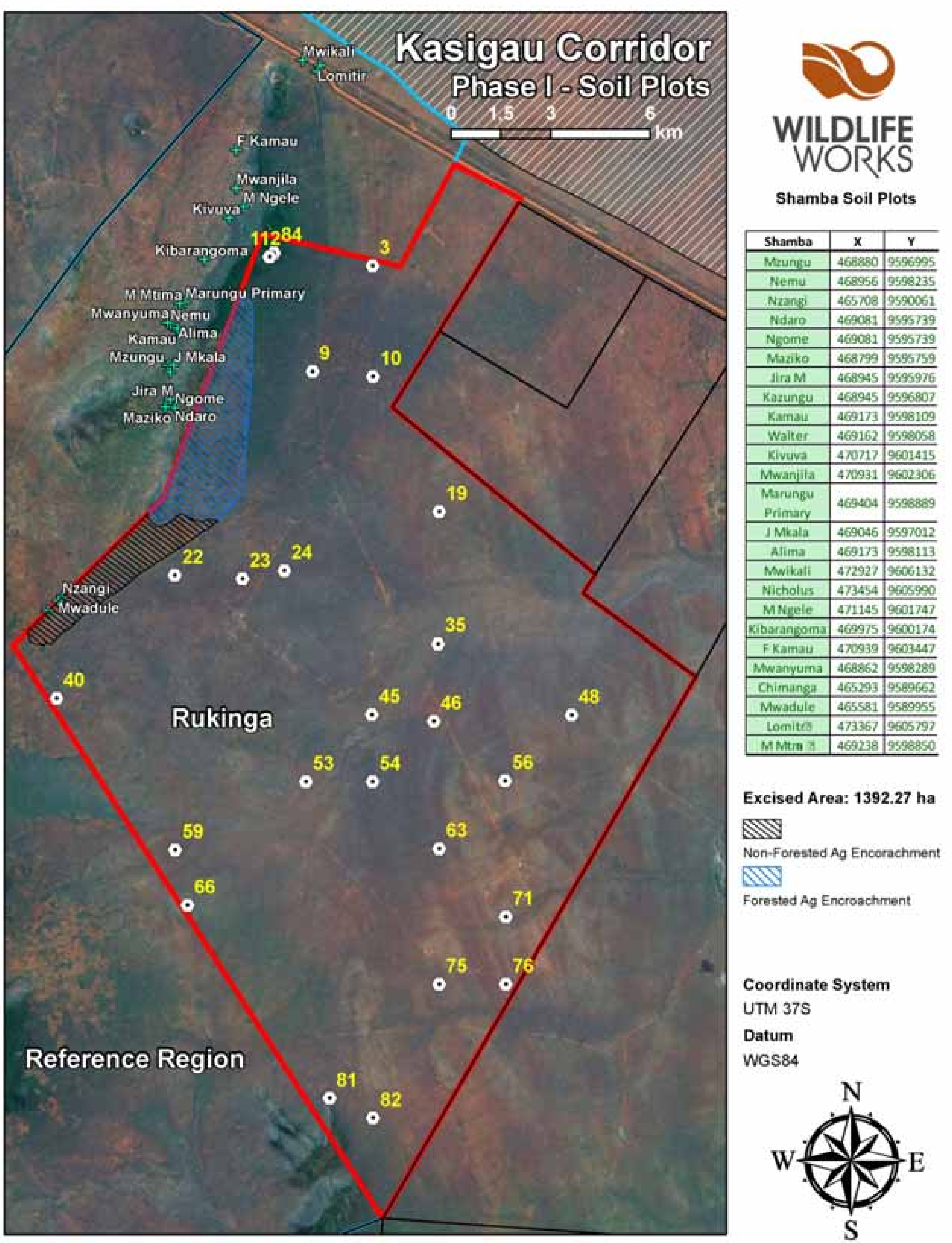


Figure 18. Stratification of the project area and carbon inventory plots

List of Plot Coordinates

A list of plots and corresponding coordinates was provided to Validator, as it was determined to be inappropriately large for this document.

Description of Plot size

The following describe the biomass plots on Rukinga;

- 25m radius circle for large and small trees in Dryland Forest
- 8m radius circle for large and small trees in Montane Forest
- 15m radius circle for shrubs in Dryland forest
- 4m radius circle for shrubs in Montane Forest
- 1m x 1m x 4 square plots at each tree plot location for grasses

Documentation of Allometry

Living Trees

As this is the first project we have encountered calculating aboveground biomass for the species of tree found in Acacia-Commiphora woodland, there exist no allometric equations available for calculating ABB from DBH. As a result we were forced to develop our own method to determine appropriate allometry.

Select trees from dominant species found in repeated plots were harvested from test areas outside of the Project area, and cut into pieces and weighed, for a range of dbh equating to the dominant ranges of dbh found within the project area. This provided a wet weight total aboveground biomass for a range of tree sizes from 10cm to 50cm dbh. A green to dry weight ratio was used to convert to dry weights.

A graph of dbh vs. wet weight was then plotted, as described in the spreadsheet 'AllometricFormulasPower, 01/14/2011 ' provided to the validator.

Shrubs

For dominant shrub species a test plot was created from which two separate methods were produced;

For shrubs/small trees that can become very large, e.g. Cordia, Acacia ruficiens where the shrub is multi stemmed from the ground, with between 2 and 15 stems, average stem diameter was calculated for a range of shrub sizes, by measuring all the stem diameters on the shrub and dividing by number of stems, and then harvesting, bundling and weighing one representative stem of the average diameter from each size class. These classes are small, medium, and large, providing a standard stem weight by shrub size class. The number of stems and size class for each shrub in the sample plot were then recorded, and a shrub total aboveground biomass determined from multiplying the number of stems by the stem weight for that class.

For Grewia, and others where the shrub has many stems, and is non-uniform in distribution of biomass per stem, conservative weight averages were obtained for each size class through destructive harvesting, which was then applied to live sample plots without destructive harvesting requirements. A green to dry weight ratio was then used to convert to dry weights.

Shrub Species	Size Class (S/M/L)	Crown Diameter Range	Crown Height Range	Average Stem Diameter (cm)	Standard Weight/Weight/stem (kg)
Cordia sinensis	S				3
Cordia sinensis	M				15
Cordia sinensis	L				33
Grewia sp.	S	<1m	<1m		1.5
Grewia sp.	M	>1m <2m	>1m <2m		4.3
Grewia sp.	L	>2m	>2m		9
Acacia ruficiens	S			5	23
Acacia ruficiens	M			9	43
Acacia ruficiens	L			12	131

Table 9. List of dominant shrub species and standard weights

Development of Allometry

The allometric equations for the project area, based on the aforementioned, field-collected destructive harvest data, were produced for Wildlife Works by Ryan Anderson of EcoPartners. These equations predict green weight(kg) as a function of DBH(cm), based on the data provided by Wildlife Works in the "AllometricFormulasEXP" spreadsheet. All equations have the form :

$$Biomass = a[DBH]^b$$

The evaluation of goodness of fit is based on a cross-validation statistic, not R^2. We reporting R^2 as well because people are used to seeing it, but we believe the cross validation statistic is a better indicator of fit.

Destructive harvest in a wildlife conservation area is philosophically problematic, especially for trees of large diameter which are many decades if not hundreds of years old. As a result we harvested only a few trees at large diameter. A consequence of this sample size is a tendency for the few large trees we sampled to have an overly large influence on the shape of the regression curve. When only one or two large trees are sampled, and they exhibit biomass much larger than the smaller trees, regression fit by least squares tends to be highly influenced by those trees. This tends to lead to over estimation of biomass for the smaller trees. For model fitting reasons, it is additionally problematic because (a) the uncertainty in measuring the mass of a large tree is larger than a small, easily weighed tree, and (b) the diameter-biomass relationship for large trees is inherently more variable than it is for small trees. The consequence is that the model is heavily influenced by a few points whose response variable values are known with little certainty.

To deal with the highly influential large points that have large variance, we used a weighted regression. A discussion of this technique should be in any regression text, but we used "Applied Regression Including Computing and Graphics" (Cook and Weisber g 1999, Wiley and Sons). The idea is that higher weight in fitting the model should be given to those points that are known with greater certainty. We evaluated weights individually for each model, and only used them in cases where the model residuals demonstrated strong trends in variance. Weights were assumed to be proportional to either 1/BA or $1/BA^2$, where BA is basal area. In one unusual case (*Lannea alata*), the variance appeared higher for small trees than large trees, so we weighted this regression with weights proportional to DBH. We note that the weighting considerably reduced the cross-validated estimate of bias ($\bar{E}$).

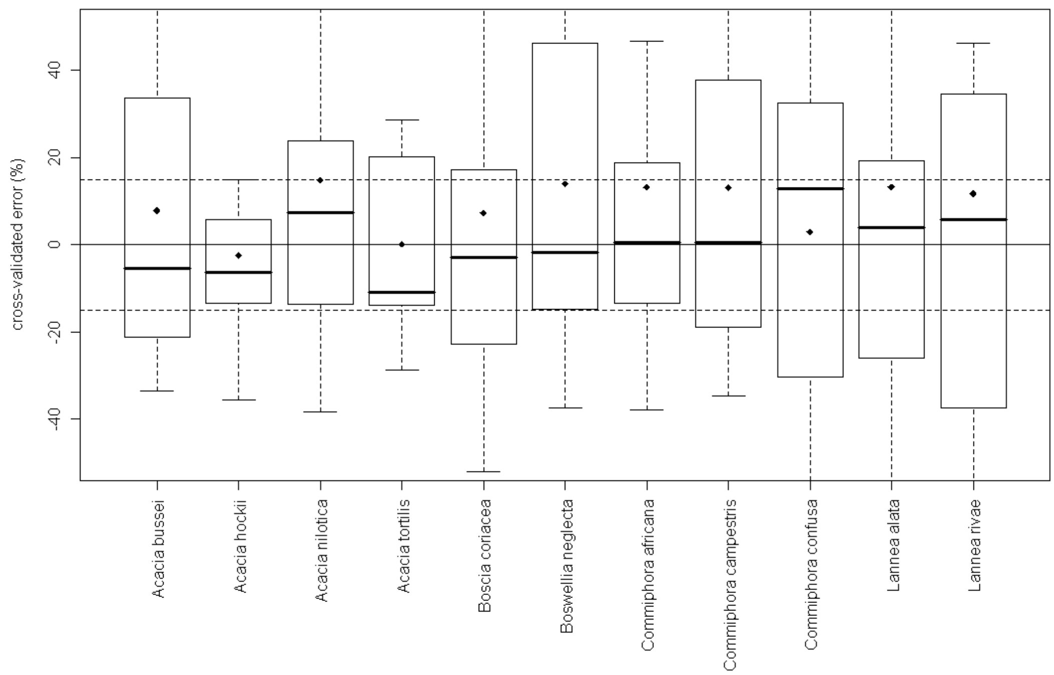
Coefficients for each equation are below:

Species	Weight Type	a	b	N	Max DBH	R^2	$\bar{E}$
Acacia bussei	None	3.3796	1.6416	8	18	.80	7.82
Acacia hockii	None	0.6850	2.1820	17	23	.93	-2.46
Acacia nilotica	None	1.3615	1.9513	10	23	.86	14.83
Acacia tortilis	None	2.6060	1.6175	9	20	.85	0.13
Boscia coriacea	1/BA	0.2033	2.3647	15	34.2	.77	7.30
Boswellia neglecta	$1/BA^2$	1.3025	1.8332	18	37	.40	13.87
Commiphora africana	$1/BA^2$	0.6293	1.9456	17	24	.75	13.17
Commiphora campestris	$1/BA^2$	0.06774	2.8156	17	40	.83	13.072
Commiphora confusa	None	0.1147	2.6634	18	23	.77	2.912
Lannea alata	DBH	0.5603	2.1027	17	17	.85	13.216
Lannea rivae	None	0.1488	2.6421	22	16	.54	11.7
Acacia sp.	None	1.1421	1.9954	44	23	.85	1.99
Boscia sp.	1/BA	0.2033	2.3647	15	34.2	.77	7.30
Boswellia sp.	$1/BA^2$	1.3025	1.8332	18	37	.40	13.87
Commiphora sp.	1/BA	0.10527	2.66544	52	40	.87	11.26
Lannea sp.	None	0.3288	2.3233	39	17	.62	11.18
All species (<35 cm DBH)	None	0.3411	2.3016	166	34.2	.74	9.50

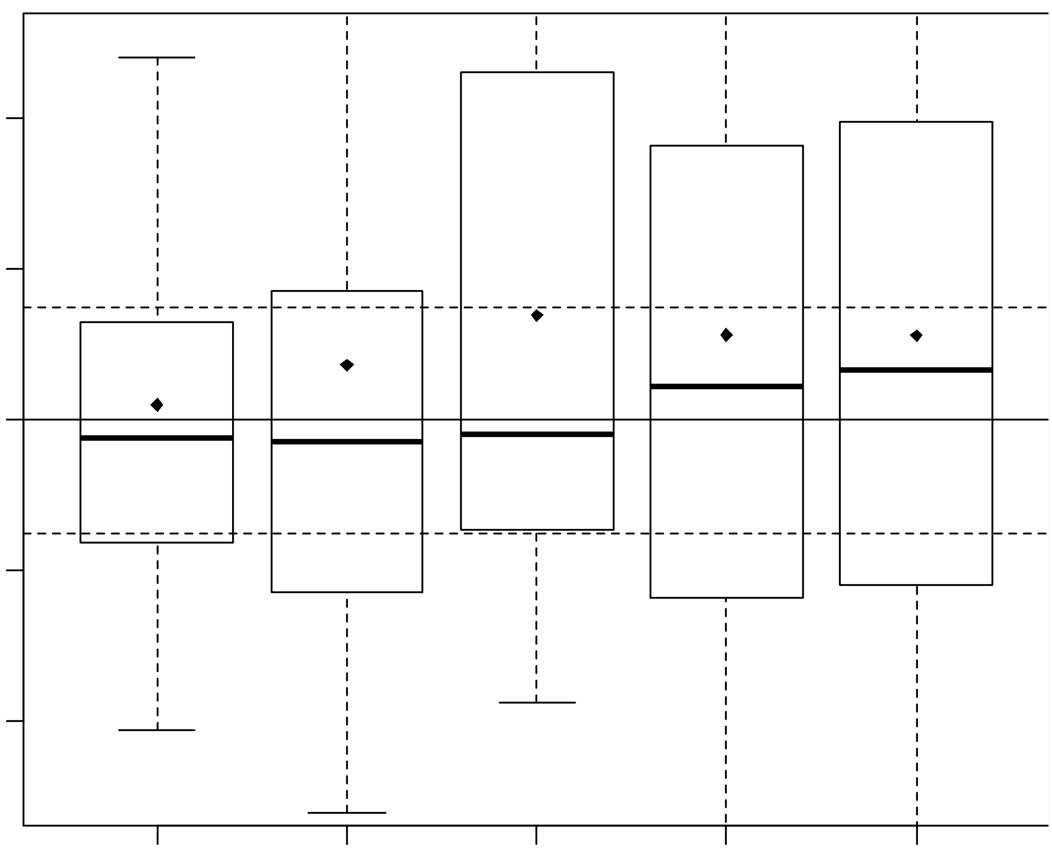
Table 10. Accuracy allometry coefficients for dominant species in Rukinga.

A summary of the cross validation statistics for species appears below. The black diamond is the mean cross validated residual, expressed as a percent. The boxplots show the quartiles (.25, median, .75), and maximum of the cross-validated residuals. The dashed lines indicate +/- 15%, the bias threshold allowed by the MED.

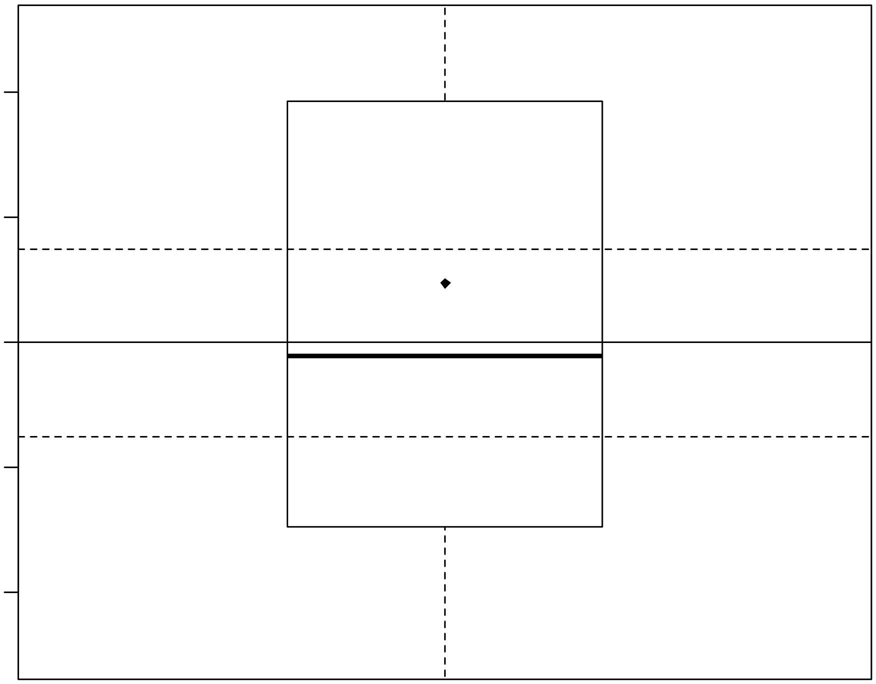
Species level:



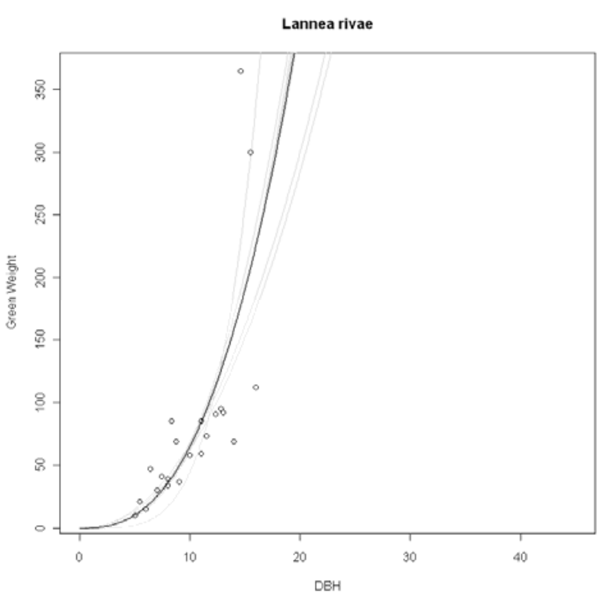
Genus Level:

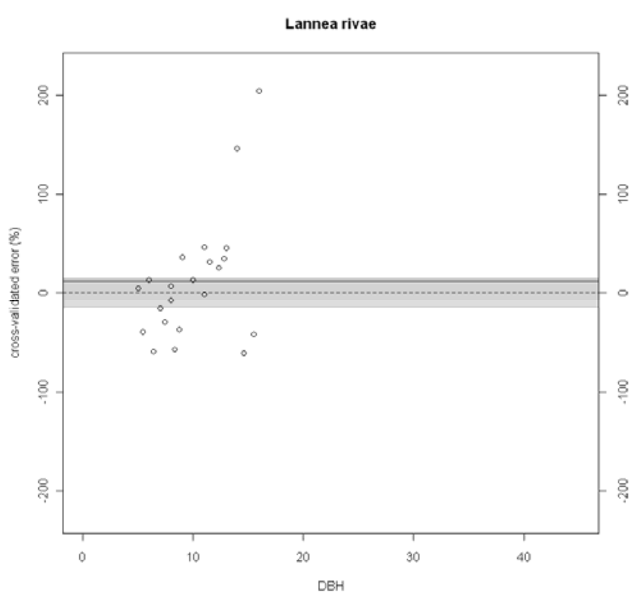


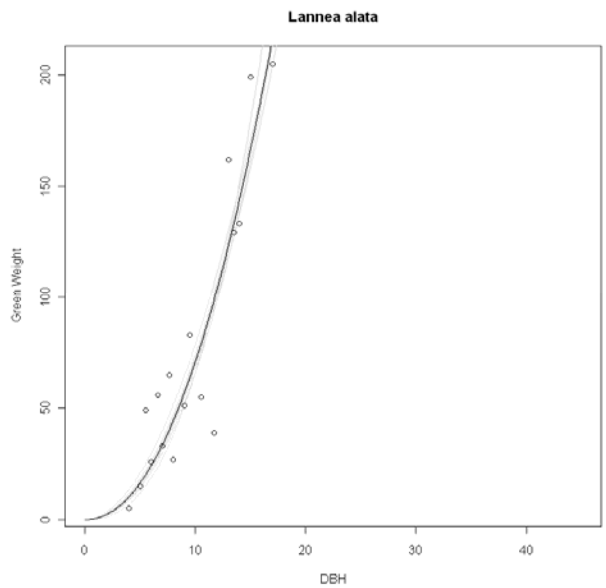
All species combined (<35 cm):

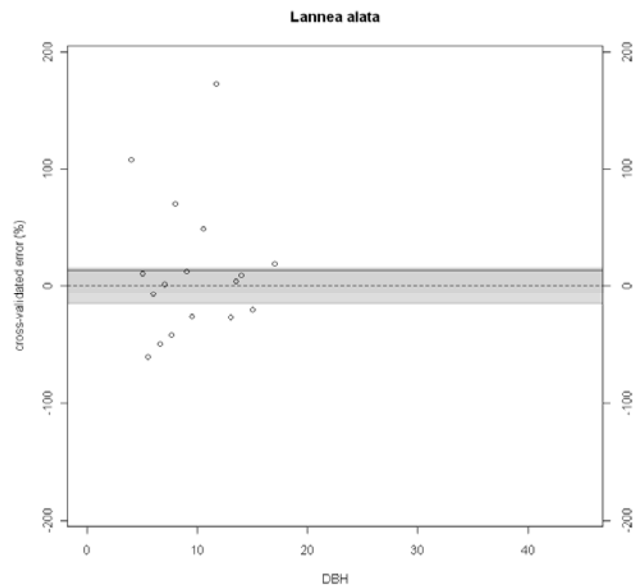


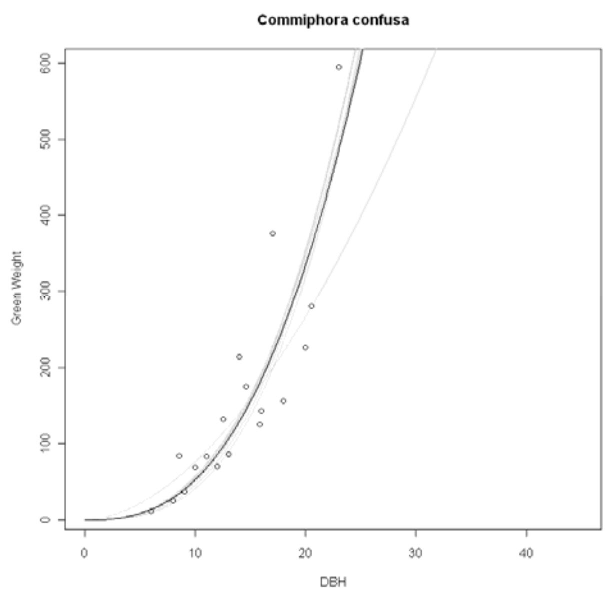
The figures below show the fitted model plotted for each species and the cross validated residuals plotted as a function of DBH. In the plot of fitted models, light grey curves show the f(-i) models fit during cross validation.

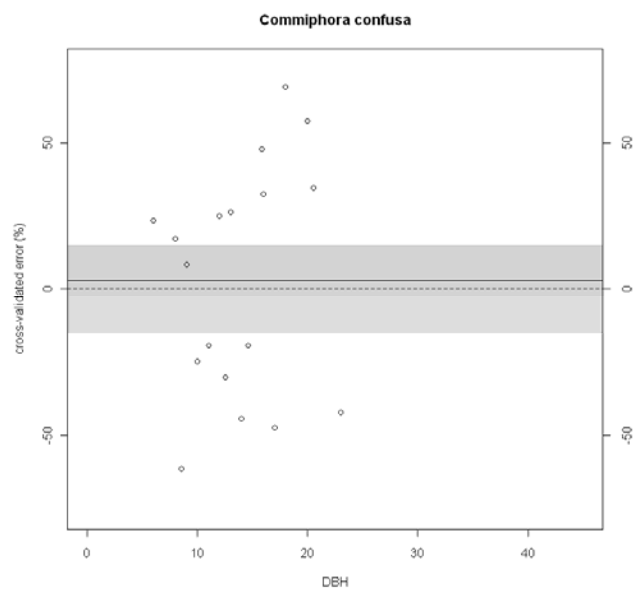


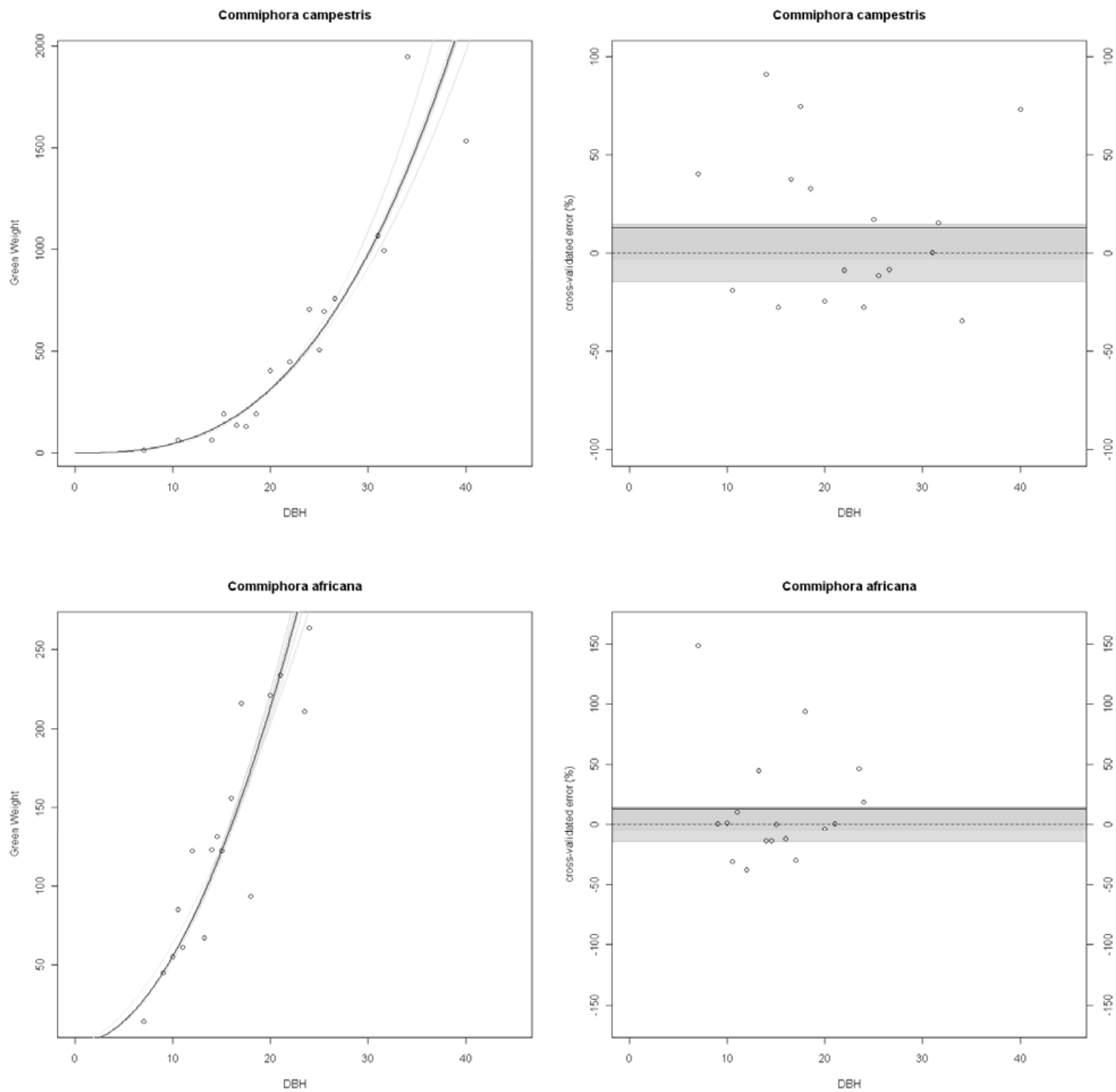


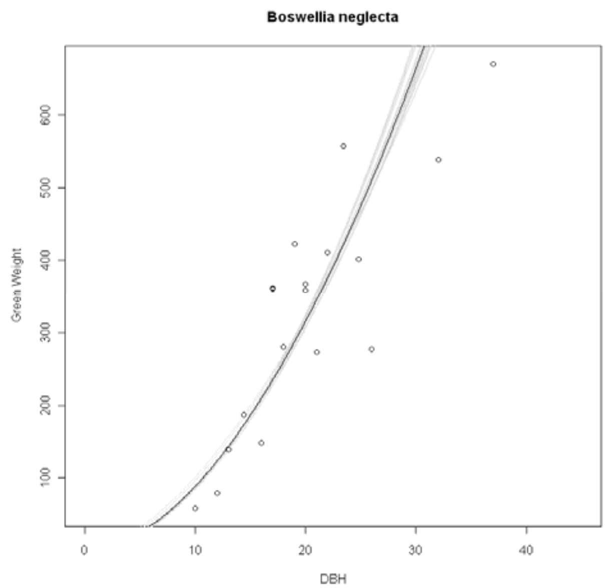

Lannea alata
Green Weight
0
50
100
150
200
DBH
0
10
20
30
40

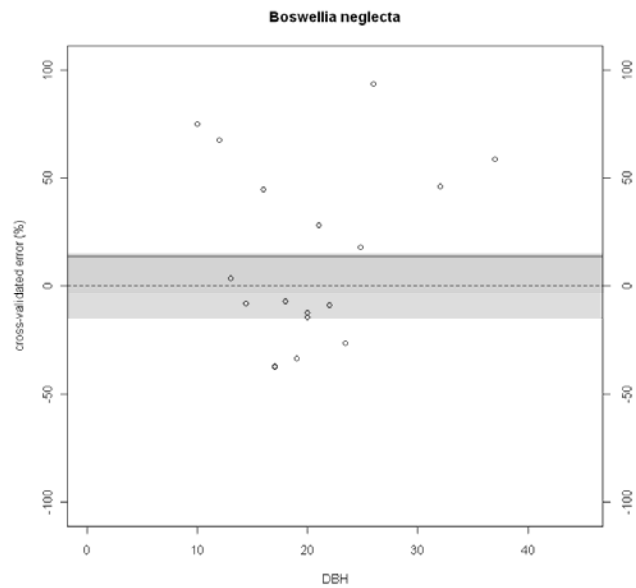

Lannea alata
cross-validated error (%)
-200
-100
0
100
200
DBH
0
10
20
30
40

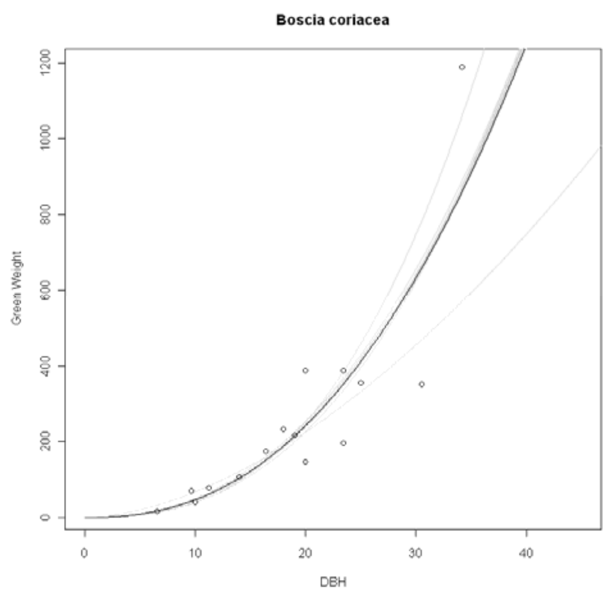

Commiphora confusa
Green Weight
0
100
200
300
400
500
600
DBH
0
10
20
30
40

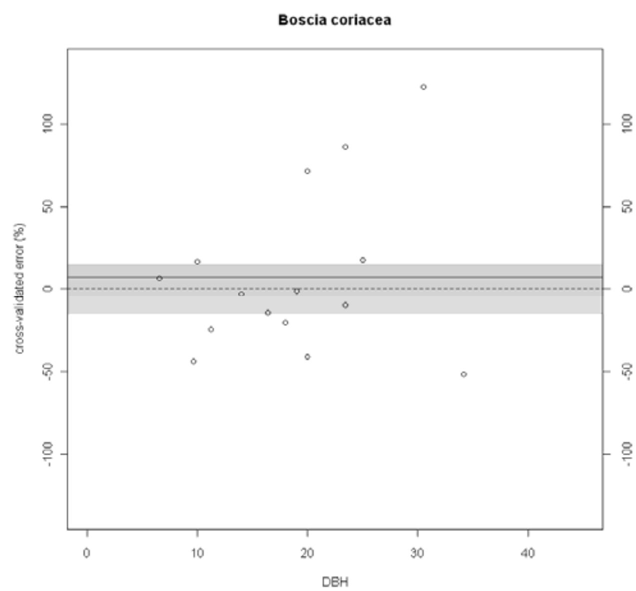

Commiphora confusa
cross-validated error (%)
-50
0
50
DBH
0
10
20
30
40

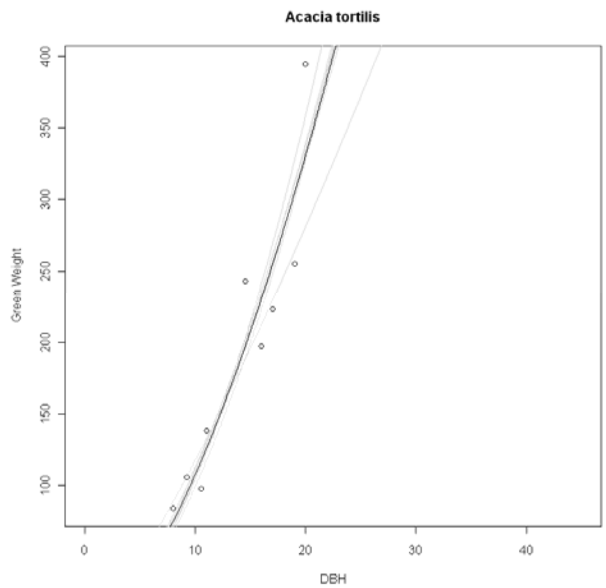

Commiphora campestris
Green Weight
DBH
Commiphora campestris
cross-validated error (%)
DBH
Commiphora africana
Green Weight
DBH
Commiphora africana
cross-validated error (%)
DBH

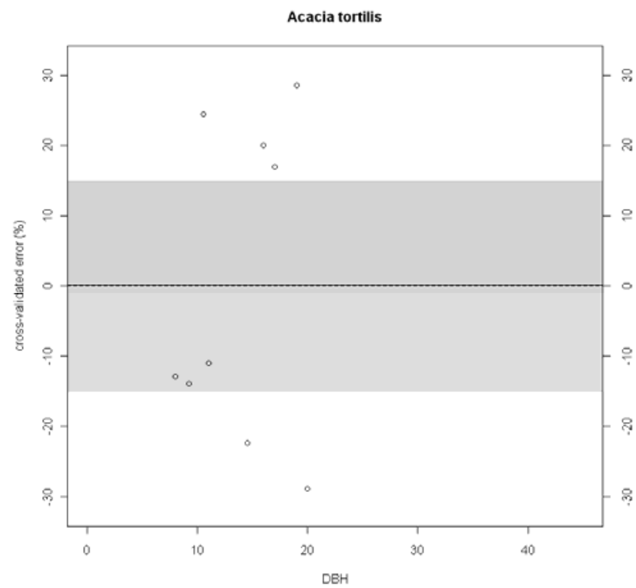

Boswellia neglecta
Green Weight
DBH

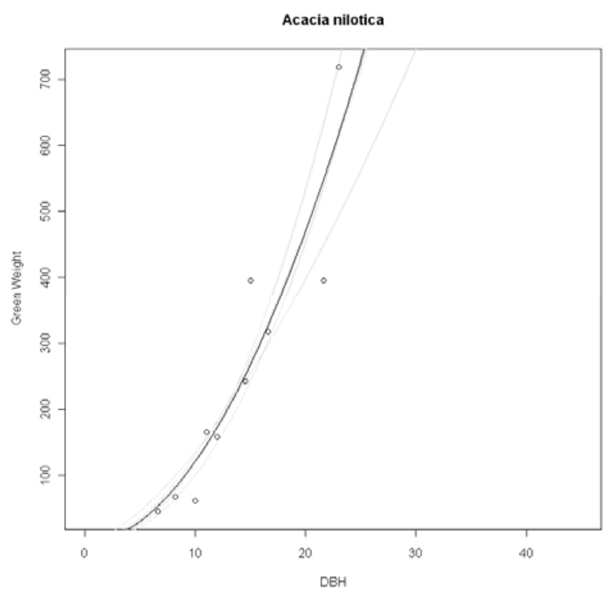

Boswellia neglecta
cross-validated error (%)
DBH

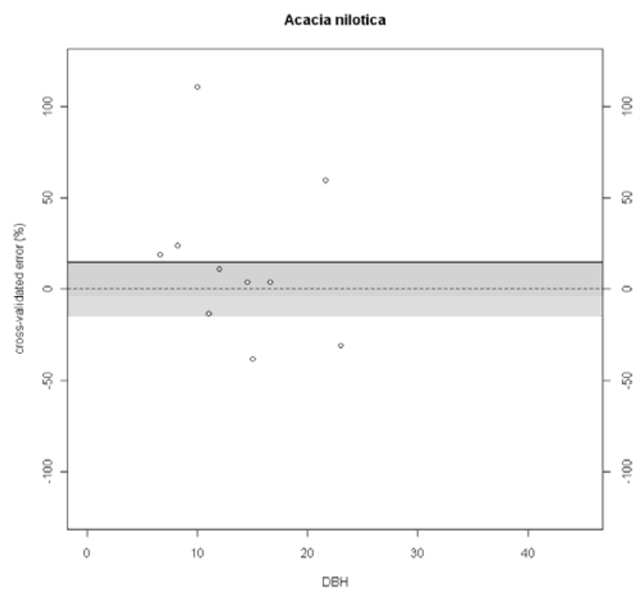

Boscia coriacea
Green Weight
DBH

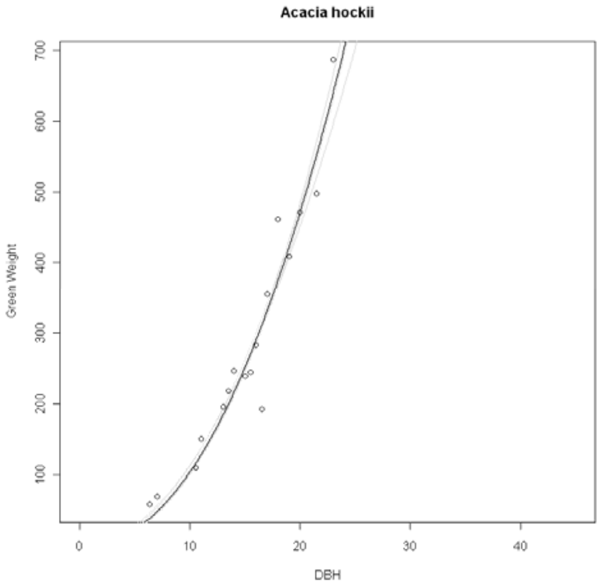

Boscia coriacea
cross-validated error (%)
DBH

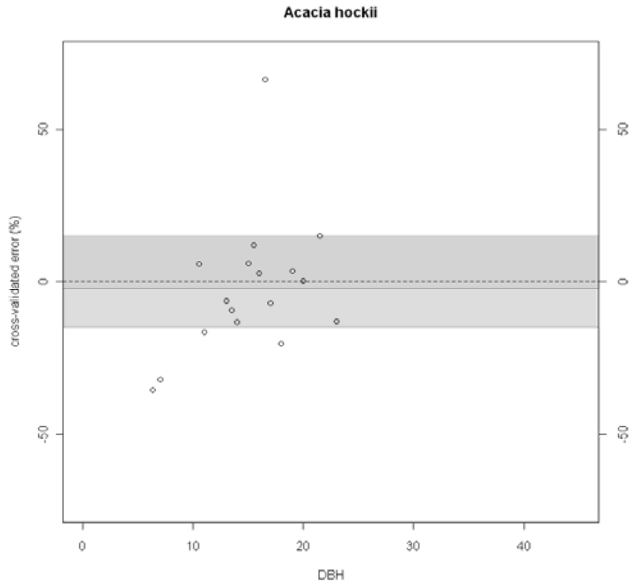

Acacia tortilis
Green Weight
DBH

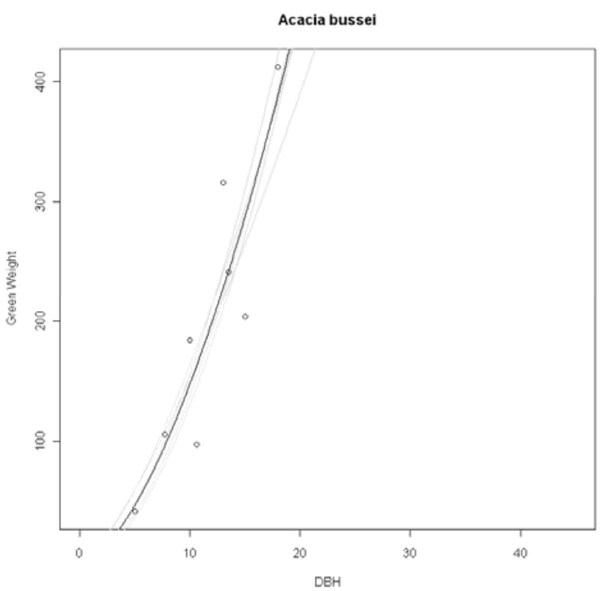

Acacia tortilis
cross-validated error (%)
DBH

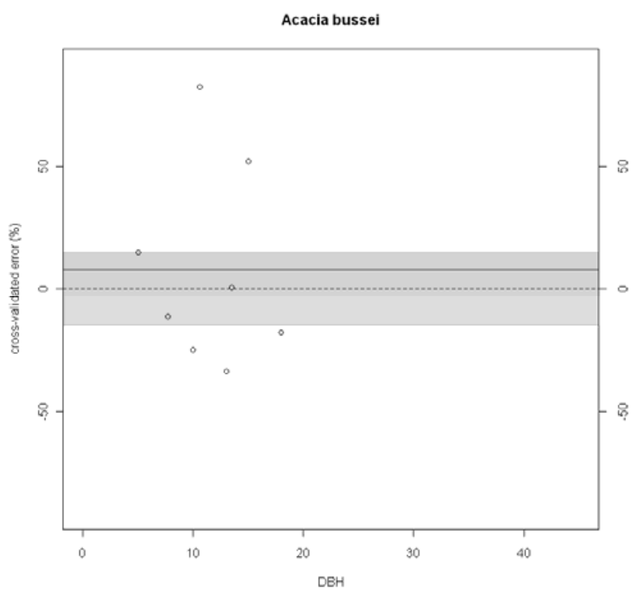

Acacia nilotica
Green Weight
DBH


Acacia nilotica
cross-validated error (%)
DBH

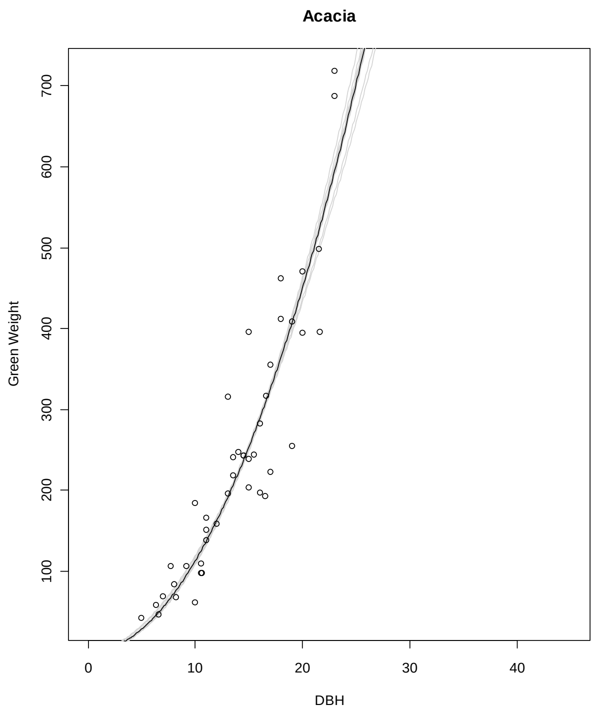

Acacia hockii
Green Weight
100
200
300
400
500
600
700
DBH
0
10
20
30
40

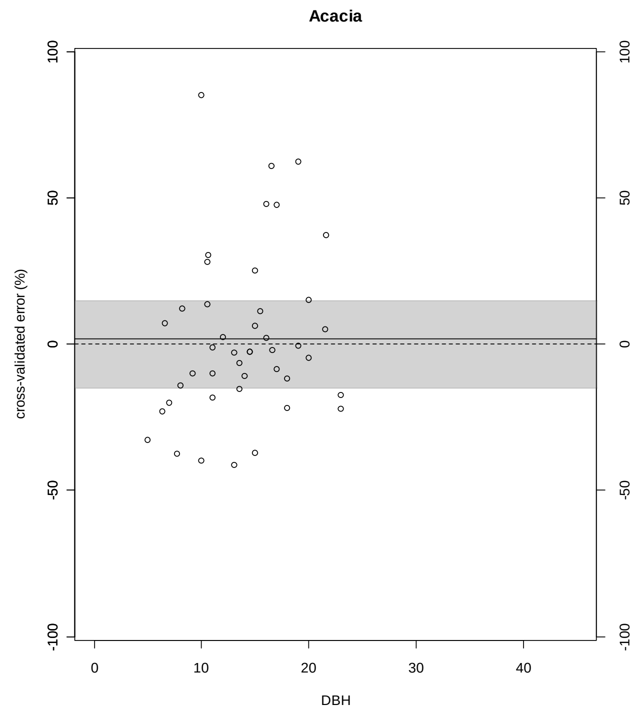

Acacia hockii
cross-validated error (%)
-50
0
50
DBH
0
10
20
30
40

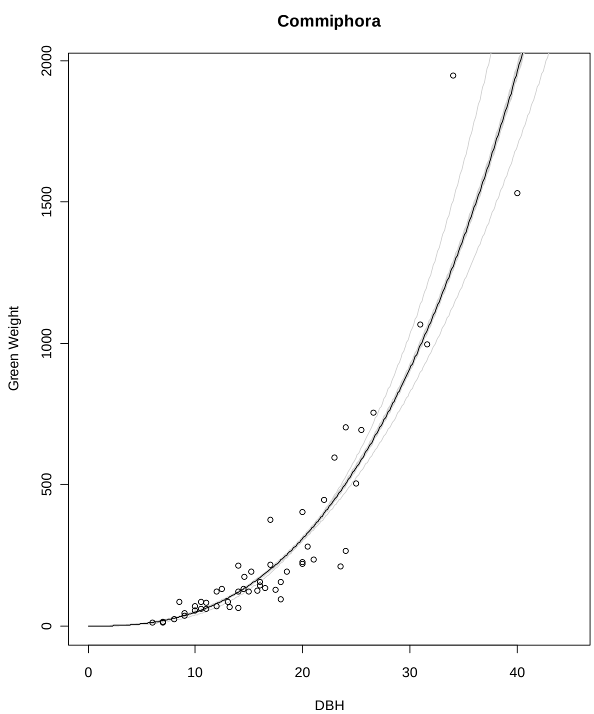

Acacia bussei
Green Weight
100
200
300
400
DBH
0
10
20
30
40

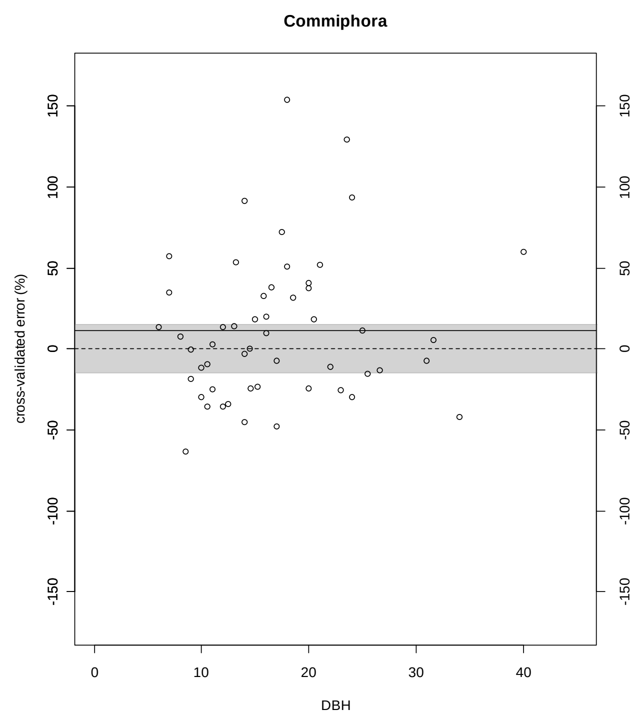

Acacia bussei
cross-validated error (%)
-50
0
50
DBH
0
10
20
30
40

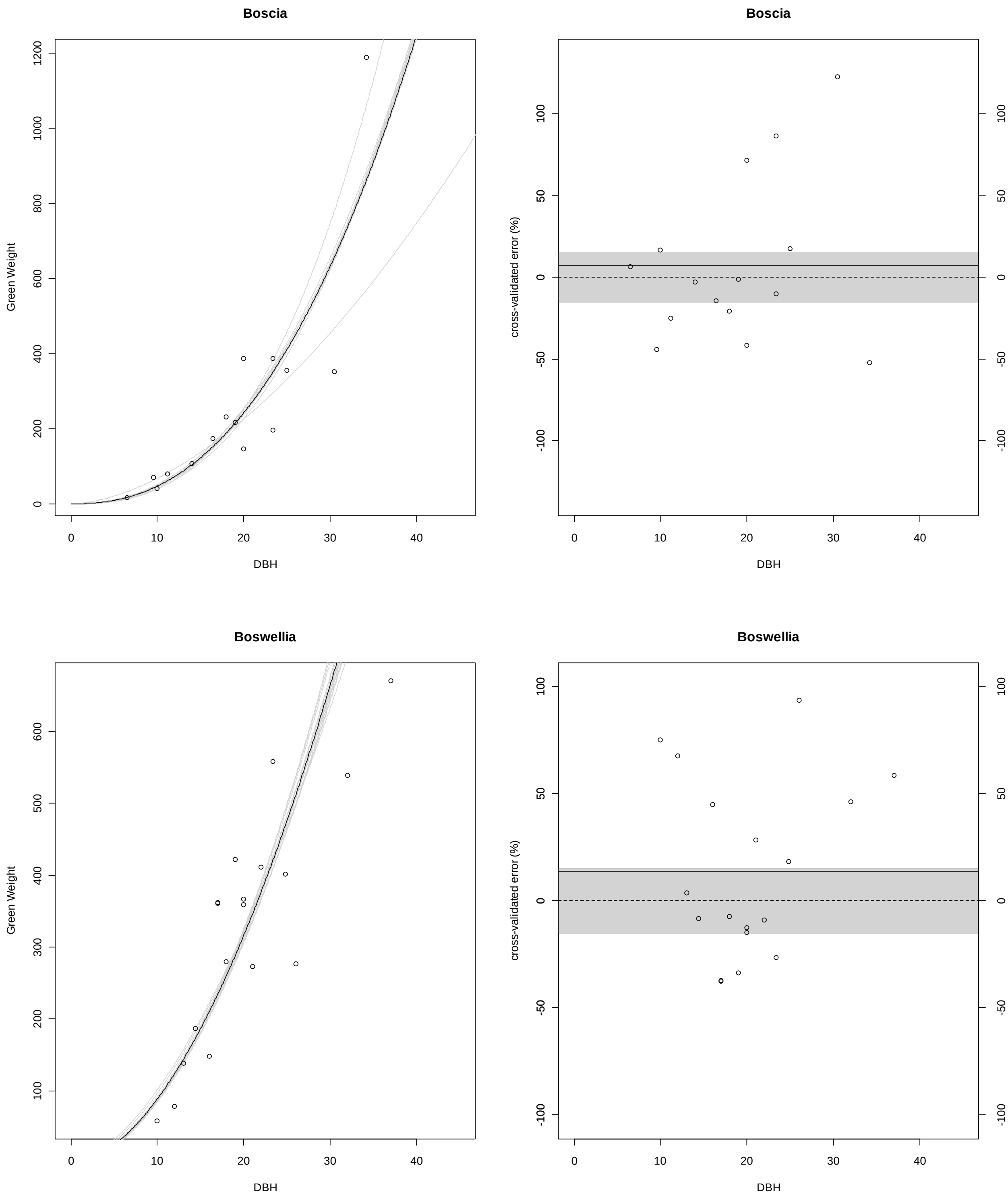
Genus Level:

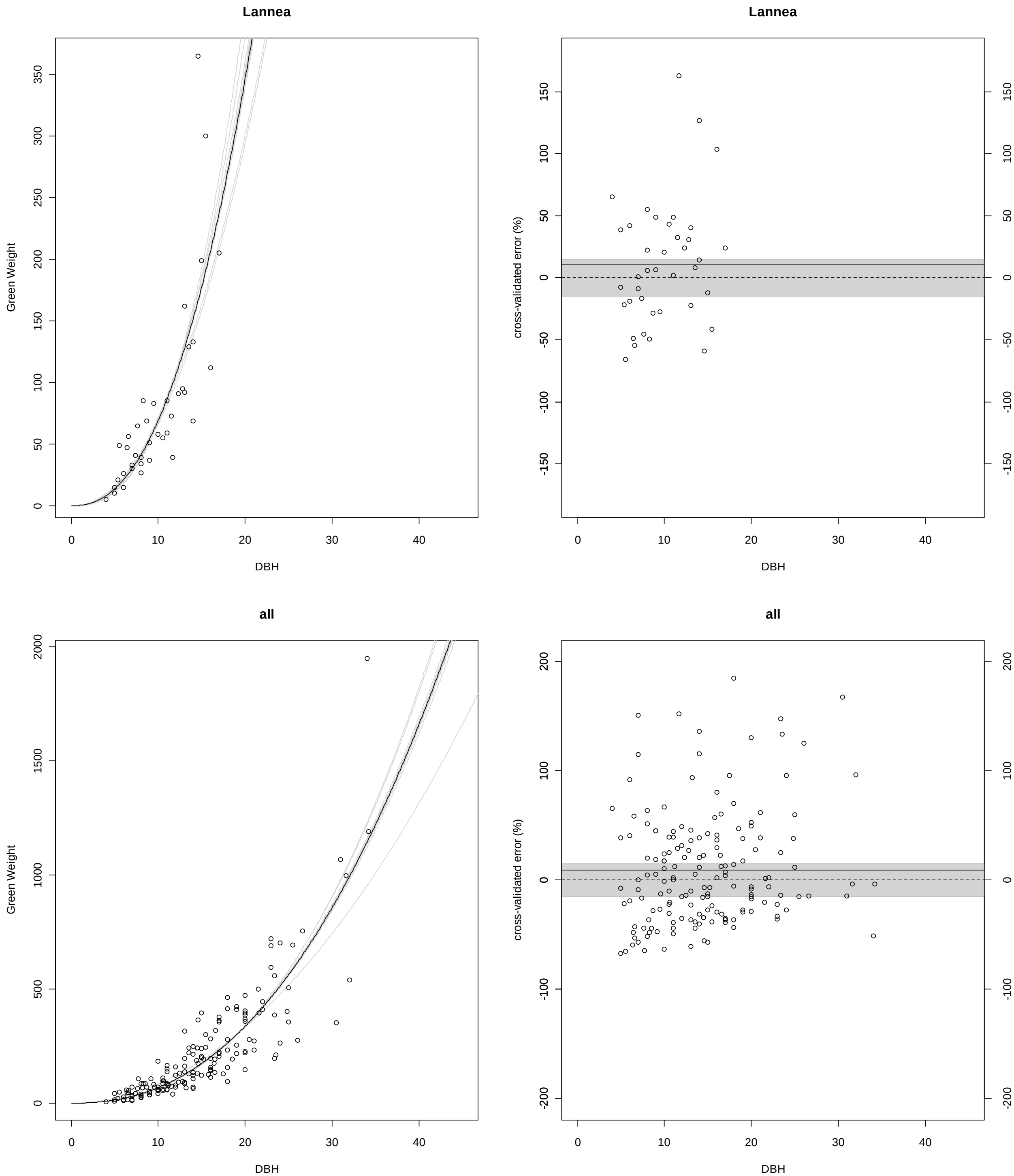

Acacia
Green Weight
DBH
0 10 20 30 40
100 200 300 400 500 600 700


Acacia
cross-validated error (%)
DBH
0 10 20 30 40
-100 -50 0 50 100


Commiphora
Green Weight
DBH
0 10 20 30 40
0 500 1000 1500 2000


Commiphora
cross-validated error (%)
DBH
0 10 20 30 40
-150 -100 -50 0 50 100 150


Boscia
Green Weight
DBH
Boscia
cross-validated error (%)
DBH
Boswellia
Green Weight
DBH
Boswellia
cross-validated error (%)
DBH


Lannea
Green Weight
DBH
Lannea
cross-validated error (%)
DBH
all
Green Weight
DBH
all
cross-validated error (%)
DBH

Estimated Total Carbon Stock, Standard Error and Sample Size for each Stratum and Pool

The estimated total carbon stock, standard error and sample size for each stratum and each carbon pool is shown in the table below. This summary is based on the exhaustive field sampling procedures explained in '*Standard Operating Procedure Biomass, 01/11/2011*' and '*Standard Operating Procedure Soils, 01/02/2011*'.

Stratum	n	Area (ha)	Trees Carbon Mean (tCO^2e / ha)	Shrubs Carbon Mean (tCO^2e / ha)	Herbaceous Carbon Mean (tCO^2e / ha)	Total Strata Mean (tCO^2e / ha)	Total Strata Carbon Stock (t C02-e)
ag active	12	713.7	67.98	23.08	2.88	172.24	122,925.5
dryland forest strata 1+2	26	6883.6	39.98	8.48	1.41	91.42	629,289.1
dryland forest strata 3	16	5651.1	40.75	2.45	0.99	81.01	457,776.5
dryland forest strata 4	11	2773.4	47.51	3.04	0.77	94.09	260,949.1
dryland forest strata 5	18	8133.4	46.23	2.30	2.14	92.89	755,520.4
dryland forest strata 6	23	4345.5	35.87	7.26	2.36	83.39	362,368.4
grassland	4	1610.9	3.05	1.40	4.85	17.06	27,474.3
montane forest	3	57.1	45.56	33.45	0.00	144.86	8,265.6
Total:		**30,168.66**					**2,624,568.9**

Table 11. Total carbon stocks for trees, shrubs and herbaceous material for Rukinga Ranch

A detailed biometric database containing all carbon pool measurements for all plots for the project are available to the validators for perusal upon request in the '*Rukinga Carbon Trees Shrubs Grass v7, 01/14/2011*' carbon pool database.

Standard errors of the total for each stratum is listed in the table below:

Strata	Sample Size	Mean Stock	Variance	FPC	FPC * a^2 * var / n	Standard Error
ag active	12	172.24	106559.66	0.997	4508238095.9	67143.41
dryland forest strata 1+2	26	91.42	4726.31	0.999	8607012582.3	92773.99
dryland forest strata 3	16	81.01	1348.43	0.999	2689881737.7	51864.07
dryland forest strata 4	11	94.09	1132.37	0.999	791212498.2	28128.5
dryland forest strata 5	18	92.89	752.86	1.000	2765646392.8	52589.41
dryland forest strata 6	23	83.39	3772.49	0.999	3094010378.6	55623.83
grassland	4	17.06	18.72	1.000	12139791.7	3484.22
montane forest	3	144.86	13667.31	0.990	14679751.0	3831.416

Table 12. Standard Errors for each stratum for all carbon pools for Rukinga Ranch

Trees, shrubs, grass (forest)	
Standard Error	149942.73
95% interval	293887.74
Error percentage	**11.20%**

Table 13. Combined standard error percentage for trees, shrubs and grass

A detailed standard error analysis for each carbon pool by stratum is available in the database '*Rukinga Carbon Trees Shrubs Grass v7, 01/14/2011*'

Soil Carbon measurements were not stratified, as test measurements were made using the strata found in figure 10, and it was concluded that stratification did not improve measurement accuracy. Soil samples were measured both inside Rukinga (the project area) and in the reference region at shambas (farms). The table below shows a summary (means) for the soil organic carbon measured inside Rukinga Ranch and in the shambas in the reference region.

	0-30cm				31-100cm				total (1m)	
	bulk density (g/cm^3)	**Carbon (%)**	**Soil Carbon (t/ha)**	**Soil GHG equiv. (t/ha)**	**bulk density (g/cm^3)**	**Carbon (%)**	**Soil Carbon (t/ha)**	**Soil GHG equiv. (t/ha)**	**Soil Carbon (t/ha)**	**Soil GHG equiv. (t/ha)**
Reference	1.50	0.55	24.44	89.63	1.41	0.38	36.65	134.38	61.09	224.01
Rukinga	1.32	0.70	27.38	100.40	1.34	0.92	84.85	311.13	112.24	411.53

Table 14. Mean Soil Carbon Stocks measured inside Rukinga and in the Reference Region

The % soil loss was determined as **0.456** (see section 6.5.5 - *fitting the soil carbon loss model*), and the corresponding total carbon loss is determined by multiplying this percentage loss by the total carbon stock measured inside Rukinga Ranch:

Rukinga Ranch	
Mean Carbon Stock measured in Rukinga	411.53 t CO2e
Standard Error of mean carbon stock	21.21 t CO2e
Percent Error at 95% confidence	0.10
Soil Crediting Area (conservatively reduced)	28,776.39 ha
Total soil carbon stock measured in Rukinga	11,842,347.78 t CO2e
Total Soil "loss"	**5,396,221.82 tonnes**

Table 15. Summary for soil carbon stocks in Rukinga Ranch

Standard error for soil stocks measured inside Rukinga Ranch are as follows:

Soil - Rukinga	
total stocks	11,842,347.78
Se total	610,218.21
95% interval	1,196,027.68
Error percentage	**10.10%**

Table 16. Standard error percentage for soil

Details for the soil carbon loss model, including standard error analysis are available in the 'Rukinga 1m Soil Analysis, 01/14/2011' spreadsheet.

Estimated Total Carbon Stock and Standard Error for Entire Project Area

The total carbon stocks for trees, shrubs and grass for Rukinga Ranch, above and below ground, is **2,624,569 tonnes CO2e**.

As it is assumed that soil carbon is not 100% depleted during the deforestation process, soil carbon values are measured inside Rukinga Ranch as well as outside the ranch in the reference region at deforested locations. The percentage soil carbon loss is multiplied by the total carbon stock inside Rukinga to yield the carbon "loss" value, and is **5,396,222 tonnes CO2e**.

The total monitored carbon stock for the Kasigau Corridor Phase I Project is:

8,020,791 tonnes CO2e

The total carbon inventory standard error across all pools is the quadratic sum of errors for all pools for all strata:

Total inventory error	
total stocks	14,466,916.7
Se total	628,370.1775
95% interval	1,231,605.548
Error percent	**8.51%**

Table 17. Total Carbon inventory error

Monitoring of Deforestation in the Project Area

For future monitoring periods, Wildlife Works will measure any deforestation within the project area either through intensification of biomass plots, or assessment of remotely sensed imagery. Any measured deforestation will be directly applied to the project's net emissions totals (i.e. subtracted from emissions reductions) for the with-project scenario. If the level of deforestation within the project area falls below the *de minimus* level as stated in IPCC 2006, it shall be excluded.

応用講習 b　グループ別実習の課題

【手順】

①　受講生をＡとＢ、2 つのグループに分ける。

②　グループごとに、配布したベリーズとケニヤの PDD を読み、下表に示す項目ごとに、2 つのプロジェクトの概要を記載し、それぞれの違いについてコメントする（下表参照）。

③　グループ別実習終了までに、模造紙や付箋紙等を用いて、下表を取り纏める（下図参照）。

③　グループ別実習後の総合討論で、各グループの代表者が、取り纏め内容を発表する。

【課題表】

項　　目	ベリーズ PDD	ケニヤ PDD	コメント欄
・プロジェクト概要			
・ベースライン・シナリオ			
・GHG 削減方策 （プロジェクト・アクティビティ）			
・モニタリング手法			
・その他			

※　「プロジェクト概要」については、PDD の「1. Project Description」の中から、面積、プロジェクト期間、クレジット期間と推定総排出量、森林の概要等、比較できる項目について概要を記載する。

※　「ベースライン・シナリオ」、「GHG 削減方策」、「モニタリング手法」については、記載されているページを探して概要を記載する。

※　「その他」については、時間が余った場合、項目を自由に選択して概要を記載する。

※　箇条書きで簡潔に記載すること（概要のみで OK）。

作業イメージ（H24 の実習より）