Establishment of a Reference Level (FRL) for forest land and development of a System for Monitoring, Reporting and Verifying (MRV) carbon emission reductions from forests in FIJI

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D1 Inception Report and Situational Analysis

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Executive Summary

This report presents the situational analysis and reflects the existing forest data, gaps, stakeholder identification and alternative options for a way forward related to the establishment of Forest Reference Level (FRL) for forest land, and development of National Forest Monitoring System (NFMS) and Monitoring, Reporting and Verification (MRV) System. The report also contains the final work plan and budget for consultancy and the capacity development plan within consultancy period which were agreed and validated by national REDD+ Steering Committee. Moreover, the report presents the resolutions adopted by the Inception Workshop (2-3 May 2017) held in Suva.

To prepare this situational report the consultant team performed the following activities:

- Review of the documents and available information including those indicated in the Terms of Reference;
- Meeting with Senior Carbon Finance Specialist, World Bank Group;
- Meeting with officials of Fiji government line agencies;
- Meeting and consultations with relevant REDD+ stakeholders (state and non-state) at national, divisional (provincial) and local levels;
- Field visits (plantations, grassland and mangrove ecosystems, forestation and forest restoration sites, natural forests, areas damaged by Winston, forest fires and invaded by invasive tree species, logging sites); and
- Visit Emalu REDD+ piloting and consultation with Emalu Mataqli land owners; and
- Inception Workshop.

The following section summarizes the main outcomes of the situational analysis. The major outcomes are:

- The time frame considered for the construction of a FRL will extend from 2007 to 2017. Data and information needed to construct a FRL are partially available. A wall-to-wall remote sensing based land-use classification is available for 2007. However, forest cover change assessment of 2007-2012 is not available. This has major implications on the development of the FRL, as it hinders the derivation of the historic development. Moreover, the land use map 2017 is needed which still has to be processed; its production involves considerable resources (cost, time, and human resource).

- The data of the National Forest Inventory (NFI) 2006 and the Permanent Sample Plot (PSP) 2010 and 2012 were analyzed in order to get an approximate figure of the development of carbon stocks in Fiji. The results are preliminary, as they are based on field observations only and do not reflect area changes. According to the preliminary results, the carbon stocks have slightly increased between 2006 and 2010. Between 2010 and 2012, an even more pronounced increase was found. The 95% - Confidence Interval (CI) indicates that the changes are not significant. In addition, the data set used for estimating the 2010 - 2012 changes has not been validated.

- The information available on Activity Data (AD) does not qualify for establishing a FRL, as no spatially explicit land-use change information can be derived.

- FRL construction takes into account; enhancement of carbon stocks, avoided deforestation through establishment of conservation areas and land use planning, and avoided forest degradation through sustainable management of forests.

- FRL construction will consider above ground tree biomass, and below ground biomass. There is no information on litter and deadwood biomass pools in the NFI 2006, but the information is available in the PSPs measurement for 2010 onwards. Therefore, litter and deadwood biomass cannot be included in the FRL construction, but will be considered in later periods. A decision on soil organic matter will be made only after reviewing the documents on soil of Fiji.

- Fiji will not go for national adjustment for FRL considering the complexity of adjustment method and amount of carbon gained using the adjustment.

- No biomass species-specific equations are available for Fiji. The development of species-specific biomass functions involves a substantial amount of resources. Therefore, the development of biomass functions tailored for Fiji should be postponed to a later phase – which would be possible in a stepwise approach. However, for this assignment available allometric equations developed for tropical countries will be applied.

- The current NFI (2006) system is not fully consistent with the PSPs. The PSPs are mainly established for monitoring tree growth to estimate annual allowable cuts. For example, although soil samples are not collected, the PSP design allows for the inclusion of soil carbon samples. The sampling design of the PSPs differs substantially from the design of the NFI 2006. Plots of the NFI 2006 have not been remeasured. However, both assessments can be treated as independent assessments of current state (i.e. in 2006 and 2010/2012) and be combined to facilitate the assessment of changes.

- No statistical analysis was employed to estimate the number of PSP needed to obtain results with a desired precision/ accuracy. Hence, based on sample design optimization, which has to include cost-efficiency, an increase in the number of permanent sample plot for robust estimate of carbon stock change is likely. Current frequency of measurement is 2 years, which is relatively short for forest crop; therefore an increase in time frame is essential to accommodate more measurement and plots without losing significance of results.

- The PSPs are visibly marked. Therefore it is very likely that they will be managed differently than the rest of the forests. Over time this will result in a lack of representability of the PSP for the remaining forest area. The consultant team urgently recommends enhancing the current PSP network incorporating additional new PSPs and use sampling with partial replacement (SPR) estimators for statistical analyses.

- Since the sample plot size used in PSP does not fit for the mangrove forest, a separate study is essential to design the appropriate sample plot and to assess the mangrove forests using the suitable sample plot.

- Management Service Division of Department of Forests has established a database of the measurement of NFI 2006 and PSPs (2010, 2012, 2014 and 2016). The database is well maintained, however, data validation as well as analysis of the measurement, assessment of errors and uncertainty, reporting and dissemination of the results still yet to be done.

- The consultant team observed inadequate capacities regarding establishing the FRL, NFMS, MRV and Database; and to continuously measure forest area changes, conduct forest inventory, and report forest carbon stock changes on the IPCC Tier 2 level. The country faces high remote sensing technical challenges to adopt IPCC Approach 3. Like most of the other developing countries, Fiji needs to improve capacity at technical, political and institutional levels to provide a complete, consistent, comprehensive and accurate estimation of forest area change and to attribute emissions and removals to these changes.

- The consultancy focuses mostly on on-the-job trainings for the core teams involved in the FRL, MRV and Database and forest inventory. A couple of workshops to enhance the knowledge on UNFCCC REDD+ and FCPF mechanisms are proposed. Since the existing forest inventory crew is well trained, the consultant team identified a limited need for field practices. Instead it is suggested to extend the field training from a mere field assessment exercise to a holistic training of all steps along the processing chain, ranging from data assessment in the field and remote sensing imagery, statistical estimation procedures to the construction of reporting tables. This includes QA/QC procedures and uncertainty analyses.

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Acronym

A/R	Afforestation/Reforestation
AFOLU	Agriculture, Forestry, and Other Land Use
AGB	Above Ground Biomass
BAU	Business as Usual
BGB	Below Ground Biomass
CFMF	Carbon Fund Methodological Framework
CO_2	Carbon dioxide
COP	Conference of Parties
DBH	Diameter at Breast Height
DOM	Dead Organic Matter
ER	Emission Reductions
EU	European Union
ER-PIN	Emission Reductions Program Idea Note (term used by FCPF)
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FRA	FAO's Forest Resource Assessment
FRL	Forest Reference Level
FREL	Forest Reference Emission Level
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
GIZ	German Development Agency
GPG	Good Practice Guidance
GOFC GOLD	Global Observation of Forest and Land Cover Dynamics
Ha	Hectare
IPCC	Intergovernmental Panel on Climate Change
MRV	Measurement, Reporting, and Verification
MMR	Measurement, Monitoring and Reporting
MSD	Management Service Division of Forestry Department, Fiji
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
NGO	Nongovernmental Organization
NTFP	Non-timber Forest Products
OAR	Options Assessment Report
PAMs	Policy and Measures
PSP	Permanent Sample Plot
QA/QC	Quality Assurance and Quality Control
REDD+	Reducing Emissions from Deforestation and Forest Degradation, and the Role of Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Enhancement of Carbon Stocks
RPP	Readiness Preparation Proposal
RL	Reference Level
RS	Remote Sensing

RSIA	Remote Sensing Image Analysis
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIS	Safeguard Information System
SLMS	Satellite Land Monitoring System
SOM	Soil Organic Matter
SPC	South Pacific Community
SPR	Sampling with Partial Replacement
TCCCA	Transparency, Consistency, Comparability, Completeness, and Accuracy principles included in UNFCCC and IPCC guidelines
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

Fiji has been actively engaged in the UNFCCC REDD+ process and advancing in its national REDD+ readiness process since 2009. In December 2013, Fiji was invited to join the World Bank's Forest Carbon Partnership Facility (FCPF). The country is receiving a grant of USD 3.8 million to support the implementation of activities outlined in the country's Readiness Preparation Proposal (R-PP). The FCPF Readiness Fund supports the following components: 1) Institutional strengthening for REDD+ (including the establishment and operationalization of the National REDD+ Unit), 2) Developing of a National REDD+ Strategy or Action Plan (includes analytical studies), 3) Designing and developing a Forest Reference Emission Level, establishing a Measurement, Reporting and Verification (MRV) system, and a Safeguard Information System (SIS).

As a part of National REDD+ Readiness programme, Fiji is establishing a Forest Reference Level (FRL) for forest land, developing a system for monitoring, reporting and verifying carbon emission reductions from forests, and establishing a functional Database in compliance with national and international requirements. In this regard, the Government of Fiji has commissioned a team of consultants for establishment of the FRL, development of the MRV system and establishment of the Database. The team of the consultants is led by the Institute for World Forestry, University of Hamburg, Germany. The contract of the assignment between the Ministry of Fisheries and Forests, Fiji and the University of Hamburg was established on the 7th day of April, 2017. The consultancy began on 18th April, 2017 and the assignment will be accomplished in 12 months. The consultant team is situated in Management Service Division of the Forestry Department, Colo-I-Suva.

The work program of the consultancy will be carried out in close cooperation with the REDD+ Steering Committee (RSC), RSC Working Group on MRV (WG MRV), Forestry Department and its Management Service Division (MSD). Part of the mission involves capacity building/development of government institutions and that of other key stakeholders to estimate forest carbon stocks, to measure and quantify C-stock changes as well as to identify future trends of the C-stocks. Moreover, the assignment involves developing a system of monitoring, storing information and data through database system and reporting of carbon emissions and removals in compliance with relevant Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and guidelines, the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) REDD+ source book, and the five principles included in the UNFCCC and IPCC guidelines: transparency, consistency, comparability, completeness, and accuracy (TCCCA).

As indicated in the TOR of the assignment and in the technical proposal submitted to the Fiji Government by the consultant, this situational analysis report presents preliminary assessment of existing relevant forest data, gaps and alternatives, and the final work plan.

2 A summary of the TOR

In accordance with the TOR and the scope of work for the consultancy, the consultants' understanding of the activities and suggestions are provided in the following sections. Three main

tasks envisaged under the TOR are establishment of a Reference Level (FRL) for forest land and development of a National Forest Monitoring system for Monitoring, Reporting and Verifying carbon emission reductions from forests of Fiji, and development of database system. Besides, the assignment includes capacity building of relevant stakeholders in forest inventory, data analysis, and reporting and maintaining the database.

3 Methodology

The situational analysis was conducted in close consultation with the REDD+ Steering Committee (RSC), RSC Working Group on MRV (WG MRV), REDD+ Unit, and Management Service Division (MSD). In the beginning, a meeting with REDD+ Unit and the MSD (See **Annex A**) was organised to ascertain that all information needs are considered. The team commenced their work conducting a half-day meeting with Dr Rama Chandra Reddy, Senior Carbon Finance Specialist, World Bank Group and discussed on the Forest Carbon Partnership Facility, Carbon Fund Methodological Framework (FCPF CF MF). Following the meeting, the consultant team joined the meeting with the RSC WG MRV (see **Annex B**).

The consultant team advanced their tasks by conducting series of workshops and consultation meetings with multiple stakeholders at central, divisional and local levels. The stakeholders consulted, among many, includes: Ministry of Fisheries and Forests; MSD of the Forestry Department; REDD+ WG MRV; Divisional Forest Office, Western Division; Reforest Fiji; Conservation International, Rakiraki; SPC-GIZ; University of South Pacific, Fiji National University and SESA team. The consultant team visited forest harvesting sites and the area damaged by Tropical Cyclone Winston in Nadarivatu; commercial tree plantation assisted by natural regeneration of native tree species in Rakiraki, mangrove and grassland ecosystems across Viti Levu, and areas invaded by the African Tulip Tree. The team visited different forest types (open, close, cloud, upland, lowland, mangrove, and plantations) to understand the structure and status of the forests. The team members visited Fiji Pine Limited at Lautoka. The team organized a half-day consultation meeting with Emalu Mataqli land owners and visited Emalu REDD pilot site. **Annex C** illustrates the area visited, stakeholders consulted and issues discussed.

Moreover, the consultant team reviewed the documents and data as suggested in the TOR. **Table 1** shows the list of important documents and data reviewed.

The workshops, consultation meetings, field visits and the rigorous documents, data and archival reviews contributed substantially to perform the situational analysis on existing relevant forest data, gaps and to design alternative options for a way forward. The consultants carried out an initial stakeholder gap analysis to consolidate earlier stakeholder assessments and identify the most relevant stakeholders for the FRL and NFMS.

An Inception Workshop was held on 02-03 May 2017 at Suva. Forty-three participants representing the Ministry of Fisheries and Forests, Ministry of Finance, REDD+ RSC, WG MRV and other stakeholders participated in the workshop (see **Annex D**). In the workshop, the team presented the

data/information gaps to develop and establish the FRL, NFMS and the Database; and the alternative design options of the elements. The workshop adopted several resolutions regarding the gaps and alternative options. Moreover, the team presented final work plan, budget for the consultancy and the capacity development plan within the consultancy period; which were validated by the REDD+ RSC. The situational analysis, stakeholder analysis, validated consultancy work plan and the workshop resolutions are presented in this Situational Analysis Report.

Table 1. List of documents and data reviewed

SN	Data/ Documents	Status of data/ documents
1	National Forest Inventories (NFIs): 1969, 1991 and 2006 (**data**)	• NFI 1969 data is not available and the assessment of NFI 1991 is not relevant. • Hence, NFI 2006 data is used to assess the carbon stocks of forests.
2	100 Permanent Sample Plots (PSP) (**data**)	• PSPs were established in 2010, and were assessed. • Specified tree, stand and plot attributes/information were measured/recorded. • The PSPs were periodically (2010, 2012, 2014 and 2016) assessed to record changes in specified stand and tree attributes. • PSP measurement data of year 2010 and 2012 are available and are used to estimate carbon stocks of forests
3	Forest cover change assessment for the period of 1991-2001, 2001-2007 and 2007-2012	• Report 1991-2001 and 2001-2007 are reviewed. • Report 2007-2012 is not available.
4	Fiji National Forest Carbon Stock Assessment of 2011 (Payton, 2011)	• Available and reviewed

The consultant team assessed the adequacy of Fiji's NFMS with respect to IPCC criteria. The UNFCCC REDD+ rules request developing country parties to establish a National Forest Monitoring System (NFMS) for monitoring and reporting of REDD+ activities and estimating anthropogenic forest-related GHG emission by sources and removals by sinks. As per the UNFCCC decision, the IPCC good practice guidance specifies that the NFMS should be robust, transparent, consistent, complete and accurate. **Table 2** illustrates the IPCC criteria for developing NFMS.

Table 2. IPCC criteria for the development of NFMS

IPCC Criteria	Sub-criteria
Robust	• Be based on the combination of Remote Sensing (RS) and ground-based forest carbon inventory approach

Transparent	• The results are available and suitable for review • Clear description of input data, methods and assumptions
Consistent	• Consistency in methodologies, definitions comprehensiveness

Accurate	• Use sampling methods
	  ○ Use of auxiliary data and stratification
	  ○ Systematic sampling
	  ○ Permanent sample plots (PSP) and time series data
	• Produce neither under nor over estimates
	• reduces uncertainties so far as practicable – this address both accuracy and precision

Completeness	• Quality Assurance (QA) and Quality Control (QC) • All relevant categories of emissions and removals are estimated and reported

4 Forest Reference Level development

Reference Levels are an essential component of an international REDD+ incentive framework under the UNFCCC and to participate in the FCPF Carbon Fund. The UNFCCC defined FRL as a benchmark for assessing REDD+ countries' performance in implementing REDD+ activities. According to the Cancun Agreements, developing country Parties aiming to undertake REDD+ activities need to develop forest reference emission levels and/or forest reference levels (Decision CP.16/1/Add. 1/par. 71). As an interim measure, subnational forest reference emission levels and/or forest reference levels can be developed.

FRLs provide the basis for measuring REDD+ success in the respective countries. They are expressed as tonnes of CO_2 equivalent per year for a Reference Period against which the emissions and removals from a results period will be compared.

Reference levels need to be transparent, taking into account historic data and be flexible so as to accommodate national circumstances and capabilities. They need to maintain environmental integrity and avoiding perverse incentives. A stepwise approach to construct reference levels can be used. This approach allows for incorporating better data, improved methodologies and, where appropriate, additional pools at later stages.

This section presents the situational analysis for the development of forest reference emission levels (FREL) and/or forest reference levels (FRL). As the FRL is closely connected to the MRV system, this chapter partially includes the situational analysis of the MRV-system as well.

4.1 Available reports and data

Situational analysis is the first and necessary step before making final decisions on the design of different (also complementary) tasks constituting a project. The tasks might operate independently or simultaneously. The analysis ensures the project addresses the right issue, and is implemented

with the right stakeholders. For the scoping and analysis of the broad context of REDD+ readiness process; to design the essential REDD+ elements, i.e., FR(E)L, MRV system and database; identification of major issues and trends; analysis of stakeholders; and finally to draw a basic picture of the bigger and complex REDD+ landscape in Fiji; the consultant team needs to use available information and data from credible assessment reports. The Terms of Reference of the project mentions several reports and data to be reviewed while performing the situational analysis. Those reports and data should serve as a basis for the development of the design elements. **Table 3** provides an overview over the reports and data mentioned in the ToR and their availability to the consultants.

Table 3. List of reports and data mentioned in TOR and their availability

Reference	Documents/information/data	Availability for consultants
	Reports	
1	Report on construction of an REL/RL in Fiji (Trines, 2012)	Yes
2	Forest data accuracy assessment from 2014 (SPC / GIZ)	Yes
3	Forest cover change analysis for 2001-2007	Yes
4	Forest cover change analysis for 2007-2012	No
5	Fiji National Forest Carbon Stock Assessment (Payton & Weaver, 2011)	Yes
6	Drivers of deforestation and forest degradation study	No
7	Current and planned policies that affect the land use in Fiji to be provided by the members of the REDD+ Steering Committee	No
	Data	
8	NFI 2006 data	Yes
9	PSP 2010 and 2012 data	Yes
10	Land use stratification	No
11	Forest cover change analysis currently being undertaken with support of UN-REDD (using Open Foris).	No

The consultants found, with the support of the MSD-team, additional reports and data that were found helpful for the situational analysis. **Table 4** presents a selection of those additional reports and data.

Table 4. List of additional reports

Reference	Reports (selection)	Availability for consultants
	Reports	
12	Blueprint for MRV and NFM systems for Fiji (Trines, 2012)	Yes
13	Forest change detection Fiji 2007-2017 as wall-to-wall mapping approach	No

14	PPP Construction of Biomass Allometric Models for Nabukelevu Forest, Fiji	Yes
15	Fiji National Forest Inventory (NFI) - Standard Operation Procedures (SOP)	Yes
16	Development of a National Forest Inventory Design for Fiji - NFI 2005 (Schade, 2005)	Yes
17	Concept for a reference database and the validation for RS-based forest cover change products in Fiji (Eberenz, 2014)	Yes
	Data	
18	Forest concessions 2000-2017, including GPS measurements of concession boundaries	No
19	Inventory data Fiji Pine Ltd.	No
20	Inventory data Mahogany Industries Fiji	No
21	Total tree biomass data for 30 trees from a study conducted by the Forestry Department	Partially
22	Data on Mangrove forest study	No

The available reports have been prepared under specific objectives, which may differ from the objectives of this assignment. Therefore, the consultant team elaborates only on the contribution of the reports to the objectives of the current study and present in the following a short summary of exploitable findings of reports 1, 3, 5, 12, 16 and 17.

(Report 1) In her report on the construction of an REL/RL in Fiji, Trines (2012) focuses on a national REL/RL. She does not take into account the possibilities of a stepwise approach, which allows for improvements over time. Her pessimistic assessment of the potential for constructing a FREL/ FRL for Fiji must be questioned. She uses a rather strict, standardized approach that does not always fit to the situation in Fiji. Especially, the consultant team does not entirely share her methodological advice on FREL/FRL and MRV-system development.

(Report 3) The report “Forest cover change analysis for 2001-2007” is split up in several sub-reports that cover different islands and regions of Fiji. The area change between 2001 and 2007 is given for the following strata:

- Staple natural forest
- Change of Forest Type Natural Forest
- Deforestation of Natural Forest
- Reforestation of Natural Forest
- Staple Plantation Area
- Deforestation of Plantation Area
- Reforestation of Plantation Area
- Change of Forest Type Related to Change of Plantation Status
- Staple Non-Forest Area

An accuracy assessment is not presented.

(Report 5) The report "Fiji National Forest Carbon Stock Assessment" prepared by Payton & Weaver in 2011 utilizes 33 PSP-plots for the estimation of carbon stocks. They elaborate on the measurement of height and height-DBH relationships. For estimating individual tree biomass, they utilize a biomass equation published by Chave et al., in 2005. The mean carbon stock reported is 47.8 tC/ha and – as stated by the authors – is substantially lower compared to the IPCC default values and results from other studies. A reason given is the allocation of the 33 plots in degraded areas. The report contains helpful information for the derivation of tree biomass and necessary future activities.

(Report 12) The report offers some helpful hints on the development of a MRV and NFMS. However, the consultant team does not share many of the methodological provisions and recommendations, as they fall short in terms of statistical theory and good practice for the design and implementation of forest inventories.

(Report 16) The report presented by Schade in 2005 on the development of a NFI Design for Fiji describes the inventory design applied for the NFI in 2005. The report does not provide the statistical background for the design of the field assessment units (i.e. cluster with 5 concentric plots) and the estimation procedures needed for the analysis of the data.

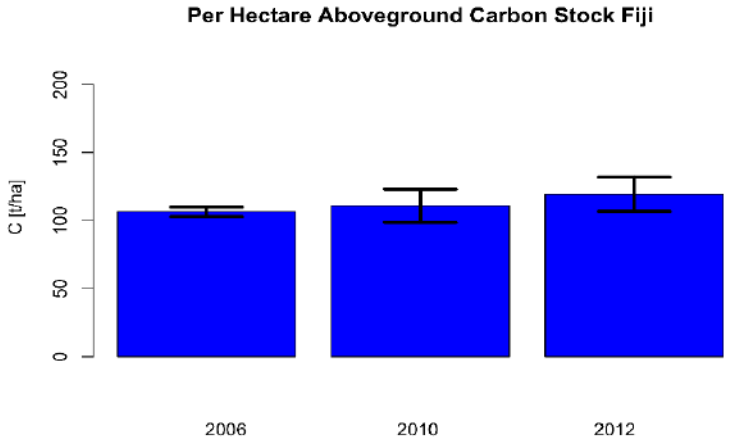
(Report 17) The report "Forest data accuracy assessment from 2014" as made available is entitled "Reference Database and Validation Concept for Remote Sensing based Forest Cover Change Products in Fiji". Concerning the current necessities, a major obstacle of the report is its limitation to a small test site in the North-West of Viti Levu. The test site has an area of 16,990 ha, of which 60% are stocked with pine (*Pinus caribea*) plantations. This calls transferability of results obtained for the test site to the entire forest area of Fiji into question.

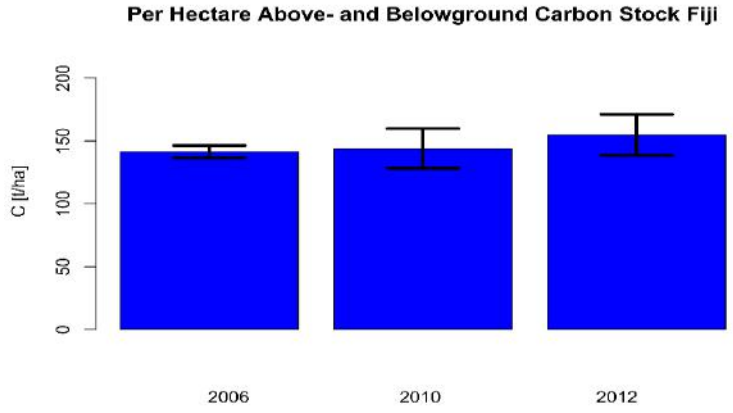
It is important to note that, for the 2007-2012 changes, neither data nor the report "forest cover change assessment 2007-2012" are available. This has major implications on the development of the RL, as it hinders the derivation of the historic development.

4.2 Preliminary results on carbon stocks assessment

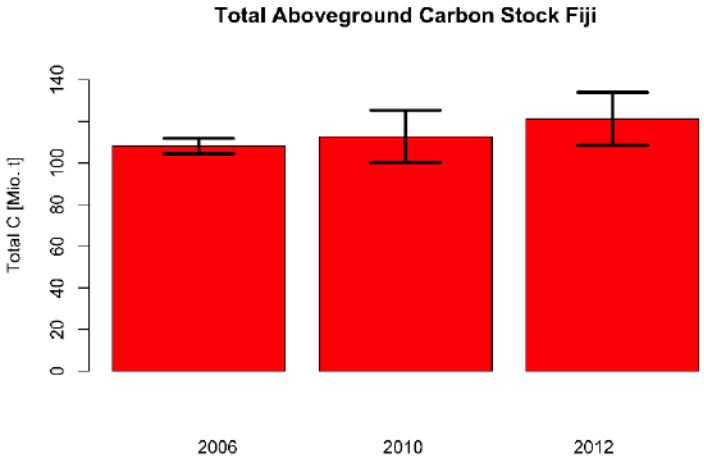
The data of the NFI 2006 and the PSP 2010 and 2012 have been analyzed in order to get an approximate picture of the development of C-stocks in Fiji. The results are preliminary, as they are based on field observations only, and do not reflect area changes. Individual above ground tree biomass has been calculated by a biomass function presented by Chave et al. (2015). For belowground biomass, a root: shoot ratio of 1:1.33 was used. **Figure 1** shows per hectare and total estimates for above ground as well as above and belowground biomass and the total CO_2e. The error bars indicate the 95% confidence intervals.

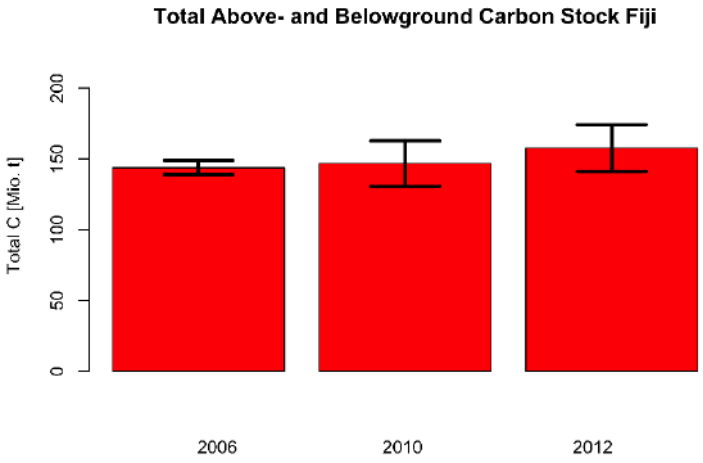
Figure 1. Graph showing per hectare and total estimates of above and below ground biomass and the total CO_2e.

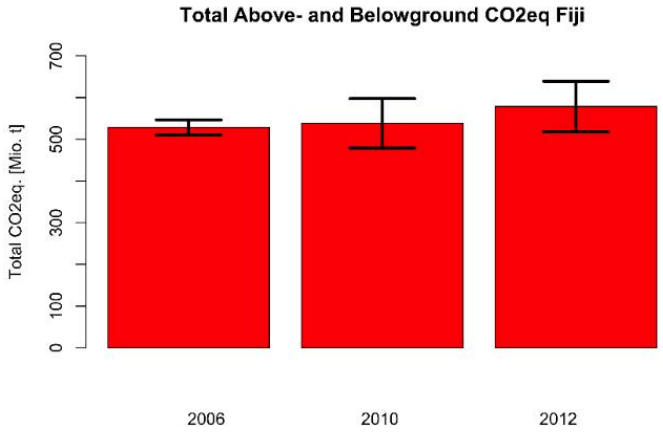




	2006	2010	2012
Aboveground C [t/ha]	106,4	110,9	119,2
95%-C.I. lower	102,8	98,7	106,7
95%-C.I. upper	110,0	123,1	131,7
Above-and belowground C [t/ha]	141,5	144,2	155,0
95%-C.I. lower	136,7	128,3	138,7
95%-C.I. upper	146,3	160,0	171,2


Total Aboveground Carbon Stock Fiji
Total C [Mio. t]
0
20
40
60
80
100
140
2006
2010
2012


Total Above- and Belowground Carbon Stock Fiji
Total C [Mio. t]
0
50
100
150
200
2006
2010
2012


Total Above- and Belowground CO2eq Fiji
Total CO2eq. [Mio. t]
0
100
300
500
700
2006
2010
2012

According to the preliminary results C-stock has slightly increased between 2006 and 2010. Between 2010 and 2012, an even more pronounced increase was found. The 95%-CI indicates that the changes are not significant. However, these results have to be interpreted and used with caution for several reasons:

i. They are related to field plots only and do not include area changes.
ii. The field data provided is likely subject to errors and needs to be validated.
iii. Change estimates need to be derived that include the errors at both occasions.
iv. The sampling frame covered by both surveys (NFI 2006/ PSPs) might be different.
v. Diameter thresholds may be different.

The major purpose of this analysis was to get a rough idea on carbon stocks and to demonstrate that the combination of both surveys, which implemented different statistical designs, is possible.

4.3 Gap analysis

Activity data

The time frame considered for the construction of a FRL will extend from 2007 to 2017. A wall-to-wall remote sensing based land-use classification is available for 2007. Forest lands are assigned the classes: (i) forests, (ii) pine plantations, (iii) hardwood plantations, and (iv) mangroves. The class "forests" is not further divided, e.g., in closed and open forests. A classification for a second point in time, i.e., 2017 is not available. In addition, the report on forest change analysis between 2007 and 2012 could not be provided to the consultants. For the 2007 assessment, no uncertainty analysis (e.g., confusion matrix) was conducted. The recently conducted Collect Earth Assessment on 10,000 points for estimating land use and land use change was not successful. Data analysis is performed and change in areas (ha.) is estimated. However, maps are not available. As a land-use classification is available only for one point in time, no change estimates can be derived.

Conclusion: The information available on Activity Data does not qualify for establishing a FRL, as no land-use change information can be derived.

Emission factors

The NFI 2006 and the PSP 2010 to 2016 provide sound data that can be used for individual tree biomass and C-stock estimates. Aggregating the individual tree data to plot levels and applying statistical estimation procedures allows for the estimation of total and per ha biomass and C values, including the respective sampling errors and confidence intervals. No biomass functions have been developed for Fijian tree species so far. However, the approximate estimates of CO_2e can be provided and the development of country-specific biomass functions can be postponed to later phases given a stepwise approach.

Reference period

Considering the submission date of the ER program document to the FCPF Carbon Fund, the reference period for FRL will be 2007-2017. Criteria and indicators related to reference period mentioned in Carbon Fund Methodological Framework is given in **Box 1** below.

Box 1
Criterion 11: A Reference Period is defined

Indicator 11.1: The end-date for the Reference Period is the most recent date prior to two years before the TAP starts the independent assessment of the draft ER Program Document and for which forest-cover data is available to enable IPCC Approach 3. An alternative end-date could be allowed only with convincing justification, e.g., to maintain consistency of dates with a Forest Reference Emission Level or Forest Reference Level, other relevant REDD+ programs, national communications, national ER program or climate change strategy.

Indicator 11.2: The start-date for the Reference Period is about 10 years before the end-date. An alternative start-date could be allowed only with convincing justification as in Indicator 11.1, and is not more than 15 years before the end-date.

Carbon Fund Methodological Framework (2016)

The reference period was decided after discussion with Dr. Rama Chandra Raddy, Senior Carbon Finance Specialist**,** Climate Change Policy and Finance Department, World Bank Group and REDD+ Unit, Fiji and was later endorsed by REDD+ Steering Committee in the inception workshop.

Forest area definition

The forest definition is independently decided by each country. Under the Kyoto Protocol in Decision 16/CMP.1, there is agreement on how forest is defined in terms of tree canopy cover, height and area thresholds (**Box 2**). Countries can select a canopy cover threshold of between 10% and 30%, with a height minimum of between 2 and 5 meters (of trees at maturity), and an area criterion with a minimum between 0.05 and 1 hectare. If an area of forest drops below the threshold and a conversion to other land use happens, then the land is considered deforested.

Box 2
Definition of Forest under the Kyoto Protocol (Decision 16/CMP. 1)

"Forest" is a minimum area of land of 0.05–1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

Fiji is developing FRL at the national level and, thus, need to have one consistent definition of a forest. Fiji chose a threshold of area, crown cover and height of tree to define a forest. Land having area more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent or trees able to reach these thresholds in situ, is considered as a forest (FAO Forest Assessment Report, 2010; RPP, 2014). This definition also includes the plantations and mangrove forests of any height in situ (RPP, 2014: 108).

Key activities

The CFMF criterion 3 states that "At a minimum, ER Programs must account for emissions from deforestation. Emissions from forest degradation also should be accounted for where such emissions are significant". Criterion 3 indicator 3.3 further states that emission from forest degradation should be taken into account if its contribution is more than 10 % of total forest-related emissions in the accounting area during the reference period.

Although no study has been done on drivers of deforestation and forest degradation, many study reports related to REDD+ in Fiji have identified that deforestation and forest degradation, and forest plantation are the major causes of emission and removals respectively associated with REDD+

activities (RPP, 2014; SPC & GIZ, 2015; ER-PIN; 2015). Hence FRL construction takes into account following key activities.

1. Enhancement of carbon stocks,
2. Avoided deforestation through establishment of conservation areas and land use planning, and
3. Avoided forest degradation through sustainable management of forests.

Forest classification

According to various study reports related to REDD + Fiji, land use of the country is divided into: Natural forest, Mangrove, Hardwood plantation, Pine plantation, Coconut, water bodies, and Other non-forest areas (MFF, SPC & GIZ, 2012). Forest land cover can be further divided into following strata provided it is clearly identifiable in Landsat images and carbon stock associates with the strata.

1. Open forest: Crown cover by trees and / or ferns 10 - 40% and ground coverage by palm and bamboo by 50 – 80%,
2. Closed forest: Crown cover by trees and / or ferns 40 - 100% and ground coverage by palm and bamboo over 20%,
3. Forests above 800 m msl, and
4. Forests below 800 m msl.

*Drivers of deforestation **and forest degradation***

Fiji intends to include avoided deforestation as a REDD+ activity. According to the Fiji's Readiness Preparation Proposal there are several drivers of deforestation. The main drivers include agriculture clearance, infrastructure development and settlement establishment. In Fiji, the prominent causes of forest degradation are destructive logging (or selective logging), firewood collection and burning or fire. According to the information provided, the extent of deforestation and forest degradation due to fire is not significant. An extent of effect of each driver of deforestation and forest degradation in Fiji's case has not been done but it is essential for constructing the FRL.

Pools/Gases

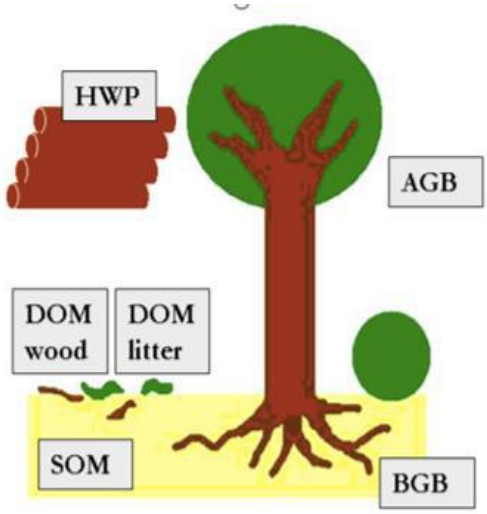
The Marrakesh Accords recognise five main carbon pools or reservoirs in forests: above-ground biomass, below-ground biomass, dead wood, litter and soil organic matter. **Figure 2** shows a schematic diagram of carbon pools in forests. The Carbon Fund Methodological Framework's (CFMF) Indicator 4.1 specifies that "The ER Program accounts for all Carbon Pools and greenhouse gases that are significant within the Accounting Area, both for Reference Level setting and Measurement, Monitoring and Reporting (MMR)". However, Carbon pools may be excluded in the following conditions.

(a) Emissions associated with excluded Carbon Pools are collectively estimated to amount to less than 10% of total forest-related emissions in the Accounting Area during the Reference Period; (CFMF Indicator 4.2 (i)), or

(b) The ER Program can demonstrate that excluding such Carbon Pools would underestimate total emission reductions (CFMF Indicator 4.2 (ii)).

Considering the provisions in CFMF and an assessment of carbon stock in the country, Fiji takes into account the above ground biomass and belowground biomass. Monitoring of harvested wood products is costly hence it will be excluded from the accounting. Deadwood and litter have been measured in permanent sample plots hence these two pools will be included. Decision to include Soil organic carbon in accounting pool will be made after literature review on whether this pool is significant in case of Fiji or not.

Figure 2. Main carbon pools in forest*s*



AGB: above-ground biomass; BGB: below-ground carbon biomass; SOM: soil organic matter; DOM: dead organic matter; HWPs: harvested wood products

Table 5 depicts the REDD+ activities and corresponding carbon pools to be include in the FRL. The selection of pools is based on the extent of magnitude of the change in stock in each pool as a result of all five REDD+ activities.

Table 5. REDD+ activities and their corresponding carbon pools to be included in the FRL

Activity	AG biomass	BG biomass	Deadwood	Litter	Soil organic
Deforestation	x	x			
Forest Degradation	x	x	x	x	
Enhancement	x	x	x	x	

Setting the reference level and its adjustments for national circumstances

FCPF Criterion 13.4 suggests that "The Reference Level does not exceed the average annual historical emissions over the Reference Period". However, the RL may be adjusted upward above average annual historical emissions (FCPF Indicator 13.2). For the purpose of the ER Programme, an adjustment of the RL is generally possible if the RL shows a clear upward trend. However, the adjustment may not exceed countries 0.1%/year of Carbon Stocks (FCPF Carbon Fund Methodological Framework Indicator 13.4, 2016). If no adjustment is applied, the development of the FRL is straightforward and uncontroversial. A preliminary carbon assessment demonstrates that carbon stock in the country is increasing hence adjustment 0.1 % while considering the 'national circumstances' is possible (and can be requested to the FCPF CF). However, considering the complexity of adjustment method and amount of carbon gained using the adjustment, the REDD+ Steering Committee decided not to apply the adjustment.

Land-use assessment/ activity data

1. An uncertainty analysis for the 2007 classification has to be conducted. The sampling plots of the NFI 2006 could be used as ground truth.
   Implications:
   - Requirement for the construction of a FRL
   - Additional funding is needed
   - Critical with respect to capacities of SPC

2. There are several options to address the problem of a missing 2nd land use assessment:
   a. Complete a land-use classification for 2016/2017 by August 2017
      Implications:
      - FRL are in compliance with ER-PIN.
      - Funding has to be provided.
      - Critical with respect to capacities of SPC.
   b. Complete a land-use classification for 2016/2017 for a reduced area by August 2017. The size of the area depends on available funds for the acquisition of remote sensing imagery and the capacities for image analysis and uncertainty assessment.
      Implications:
      - Renders negotiations with FCPF necessary, as stipulations of the ER-PIN (Scale of Carbon Accounting) are not met.
   c. Reanalyze the Collect Earth data, combine the data with the wall-to-wall land-use classification 2006, and derive the land-use and land-use change data. This means sampling within 2006 strata, where changes are not spatially explicit.
      Implications:
      - Renders negotiations with FCPF necessary, as stipulations of the ER-PIN (Approach 3) might not be met.
   d. Reanalyze the Collect Earth data, derive the land-use and land-use change data and move to Approach 2

Implications:

- Renders negotiations with FCPF necessary, as stipulations of the ER-PIN are not met.

All options include uncertainty assessments.

3. Stratification of forest land
   a. Further stratify forests into the following strata or a selection/ combination thereof:
      - open forest,
      - closed forest
      - forest above 800 m altitude,
      - forest below 800 m altitude

      Implications:
      - Is not feasible for 2006 NFI assessment.
      - Additional funds and capacities needed.
      - Might increase uncertainties.

   b. Include GPS-data for areas with harvesting licenses in the forest class as a proxy for degradation

      Implications:
      - Cost-effective approach to designate degradation areas

Field assessments/ emission factors

The in-situ inventory data from the NFI 2006 and the PSP 2010 to 2016 allow for estimating individual tree biomass by means of biomass functions. Thus higher-order methods are already available for Fiji and satisfying the requirements for Tier 2 and, thus, Tier 2 EF estimates should be possible without any problems.

Decisions to be taken are:

1. No biomass equations are available for Fiji, and therefore, need to be developed. The development of tree specific biomass functions involves a substantial amount of resources. Therefore, it needs to be decided, if the development of biomass functions tailored for Fiji, should be postponed to a later phase – which would be possible in a stepwise approach.

   Implications:
   - Uncertainties will be higher than with country-specific biomass functions

2. No sound methodology has been developed for the assessment of the C-stock of mangrove forests. The following decisions are to be made:
   i. Mangroves are excluded for the current phase. Assessment methods for mangroves are developed at a later phase.

      Implications:
      - Reliable estimates for forests excluding mangroves
      - Need to justify decision and discuss with FCPF

ii. C-stock/ ha of mangroves is assessed in a specific study that utilizes destructive sampling.

Implications:

- Resources required
- Uncertainty reduced

iii. Only biomass drain from mangroves is estimated by means of a specific study that addresses fuel wood and timber extractions.

Implications:

- Resources required
- Uncertainty reduced
- Need to justify approach

5 National Forest Monitoring System (NFMS)

The NFMS is one of the four Cancun Elements that Fiji should have in place to obtain and receive result-based finance. The information that becomes available through the NFMS/MRV may be used to develop the National Strategy or Action Plan. The NFMS serves two simultaneous functions: 'monitoring' function, and 'Measurement, Reporting and Verification (MRV)' function. A 'monitoring' function is primarily a domestic tool to assess the impacts and outcomes of REDD+ demonstration activities, and national policies and measures (PAMs) for REDD+. The MRV function refers to the estimation and international reporting of national-scale forest ERs. The MRV is based on three 'pillars'- i) Satellite Land Monitoring System, ii) NFI, and iii) the National GHG Inventory (GHGI).

Decision 4/CP. 15[1] which basically provides methodological guidance for REDD+ activities requests, in paragraph 1(d), developing country Parties "to establish … robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems, that:

i. Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;
ii. Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities; and
iii. Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties.

IPCC has classified the methodological approaches in three different Tiers to estimate EF, according to the quantity of information required, and the degree of analytical complexity. For the consistent assessment of land-use changes, i.e., Activity Data, three approaches are offered.

5.1 Desired Approach and Tier level

IPCC Guidelines suggests dividing the land of a country into six main categories: Forest land, Croplands, Grasslands, Wetlands, Settlements and Other Land. The categories can be stratified further according to country needs and circumstances.

IPCC GPG 2003 present three approaches for representing land areas using the six broad land categories (GPG, 2003).

Approach 1: Not spatially explicit and simply uses net areas associated with managed land use; requires national estimates of the areas of different land use at different times but does not require information on the proportions of each type of land that were converted to another type of land use.

[1] FCCC/CP/2009/11/Add.1

Approach 2: Provides the matrix of changes between land uses categories; indicates the area of each type of land use that was changed, and how this change was distributed amongst other land use types, but the explicit locations of change need not be provided

Approach 3: Fully spatially-explicit time series land-use and land use conversion data

Fiji decided to develop Approach 3 Activity Data and Tier 2 Emission Factors for the three key activities. In the following the available data will be analyzed with respect to their potential to meet the requirements of Approach 3 and Tier 2.

Approach 3 extends Approach 2 (tracking of land-use changes between categories) by allowing land-use changes to be tracked on a spatial basis. The approaches are not mutually exclusive; selecting a mix of approaches is possible and should reflect calculation needs and national circumstances. Different approaches may be applied to different regions or categories or in different time intervals.

The IPCC GPG 2003 specifies:
"Approach 3 requires spatially explicit observations of land use and land-use change. The data may be obtained either by sampling of geographically located points, a complete tally (wall-to-wall mapping), or a combination of the two."

In the following the specific requirements for Approach 3 as specified by IPCC GPG 2003 will be checked for compliance with the data availability for Fiji.

IPCC GPG 2003 requirements	**Compliance**	**Availability**
The target area is subdivided into spatial units such as grid cells or polygons appropriate to the scale of land-use variation and the unit size required for sampling or complete enumeration.	If remote sensing image analysis used, the requirement can be met.	✓
The spatial units must be used consistently over time or bias will be introduced into the sampling.	Remote sensing data with different spatial resolutions might require resampling	✓
The spatial units should be sampled using pre-existing map data (usually within a Geographic Information System (GIS)) and/or in the field and the land uses should be observed or inferred and recorded at the time intervals required by Chapter 3 or 4 methods.	This allows for including the boundaries from areas with logging permits.	✓
If wall-to-wall mapping is used, a polygon based approach can be used equivalently to a grid approach.	Standard remote sensing/ GIS technology	✓
Observations may be from remote sensing, site visits, oral interviews, or questionnaires. Sampling units may be points or areas from 0.1	This allows for including the boundaries from areas with logging permits.	✓

IPCC GPG 2003 requirements	Compliance	Availability
ha to a square kilometer or more, depending on the sample design.		
Units can be sampled statistically on a sparser interval than would be used for the complete coverage, chosen at regular or irregular intervals, and can be concentrated in areas where land-use change is expected.	Provides the option to use more dense grids of PSP in designated areas and utilize Collect Earth	✓
Recorded data could be of land use at a point or within a sampling unit on each occasion but could also include land-use change data within a sampling unit between the sampling years.	Remote sensing analysis allows for both	✓
For effective implementation of Approach 3, the sampling needs to be sufficient to allow spatial interpolation and thus production of a map of land use.	Renders the calculation of sample sizes necessary. Uncertainties will be reflected in the estimation of confidence intervals.	✓

The analysis shows that the envisaged methodology for the assessment of activity data allows for the implementation of Approach 3 in Fiji. However, a major obstacle is the currently absent land-use assessment for 2017.

Tier 2 applies emission factors and other parameters, which are specific to the country. Country-specific emission factors and parameters are those more appropriate to the forests, climatic regions and land use systems in that country. Compared to Tier 1 highly stratified activity data may be needed in Tier 2 to correspond with country-specific emission factors and parameters for specific regions and specialized land-use categories. Tiers 2 and 3 can also apply stock change methodologies that use plot data provided by the NFIs. At Tier 3, higher-order methods include models and can utilize plot data provided by the NFIs tailored to address national circumstances. Properly implemented, these methods can provide estimates of greater certainty than lower tiers.

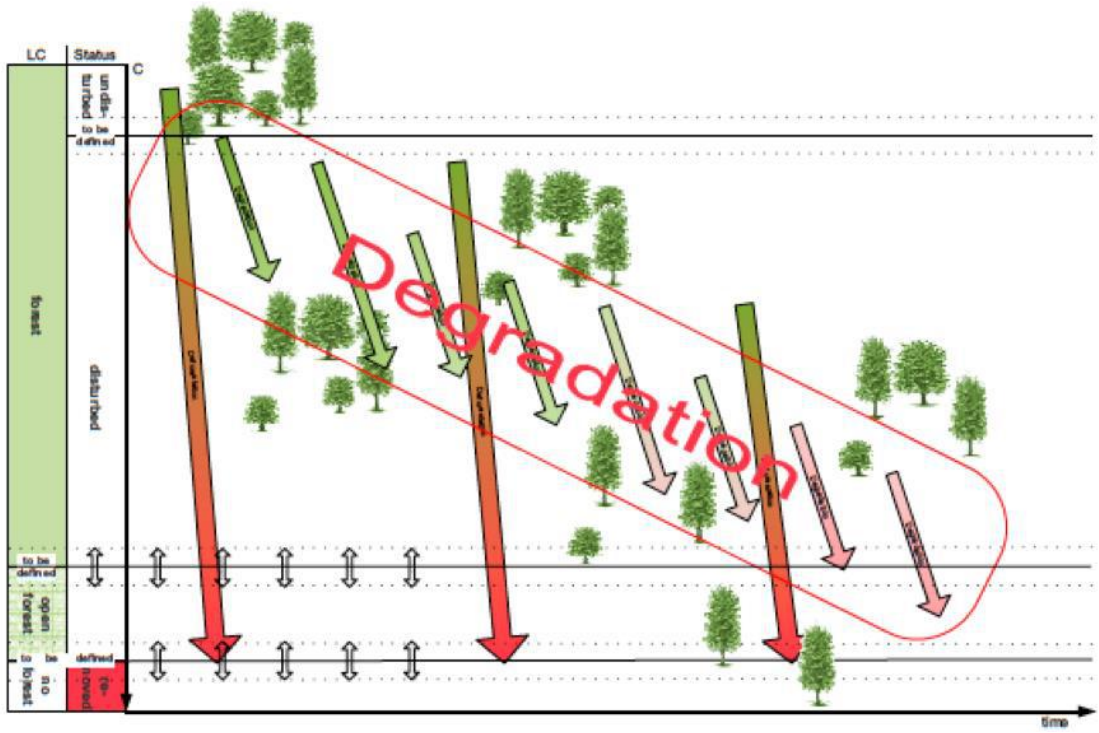
The in-situ inventory data from the NFI 2006 and the PSP 2010 to 2016 contains attributes assessed on individual trees and make available for the estimation of emission factors. Individual tree DBH can be expanded to individual tree biomass by means of biomass functions. Thus higher-order methods are already available for Fiji and **satisfying the requirements for Tier 2 and the use of Tier 2 should be possible without any problems**. Further comments on biomass assessments can be found below.

5.2 Degradation/ deforestation

While deforestation is generally understood as a removal of forest cover and an associated land-use change, the term degradation itself is ambiguous, not yet defined and far from being globally agreed. REDD+ has thrown a new spotlight on degradation, however only referring to carbon stocks.

The **Figure 3**[2] illustrates the differentiation of the processes of deforestation and forest degradation. In the left-most column the IPCC definitions (forest, open forest and no forest) are used as land-cover (LC) classes. In the right column, the Status is further classified into undisturbed, disturbed and removed. The graph on the right shows various processes of deforestation, i.e., change from forest to no forest, and of degradation, i.e. forest to forest/open forest over time.

Figure 3. Processes of deforestation and forest degradation



For the MRV a definition of degradation has to be developed.

5.3 Stratification

Stratification rules

Stratification is applied in order to provide information for sub-sets of the entire forests. It requires wall-to-wall coverage of the entire forest area under consideration (i.e., the sampling frame). Strata can either be formed by thematic or statistical considerations.

From a statistical point of view stratification reduces sampling errors by separating the total variance in the forest population into one component related to the variability within the strata and another component related to the variability between strata.

[2] Source: Baldauf, Plugge, Rquibate, Köhl, 2009: FAO, Forest Resources Assessment Working Paper 162

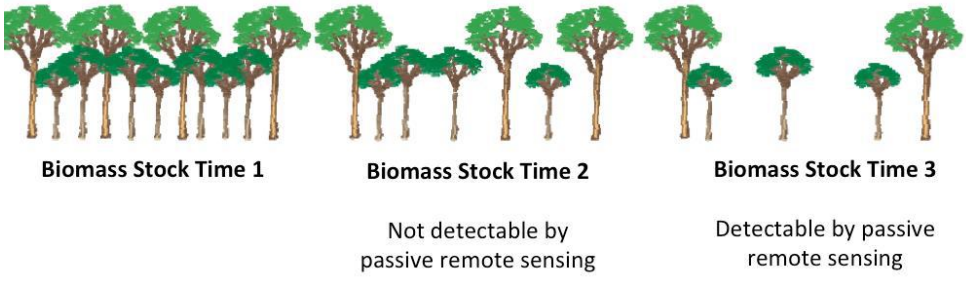
Stratification rules define the strata utilized and depend on the attributes of interest. Those may differ between the NFMS and the MRV-System. In the MRV –system the major attributes of interest are current state and changes of biomass, carbon stock and CO_2e. As the latter are derived from biomass the variance structure of the attributes is comparable, i.e., any stratification that is optimal for one attribute is simultaneously optimal for the other two attributes. Thus, the optimal stratification rule has to subdivide the population in a way that variances between strata are maximized and variances within strata are minimized.

Due to applied management systems and growth rates in Fijian forests, desirable strata could be as given in **Table 6**.

Table 6. List of possible forest strata in Fijian forests

Stratum	Description
1	Unmanaged forests
2	Forests with low/ moderate harvesting rates (SFM)
3	Degraded forests
4	Pine plantations
5	Hardwood plantations
6	Mangroves
7	Afforestation
8	Other land-use (incl. deforestation)

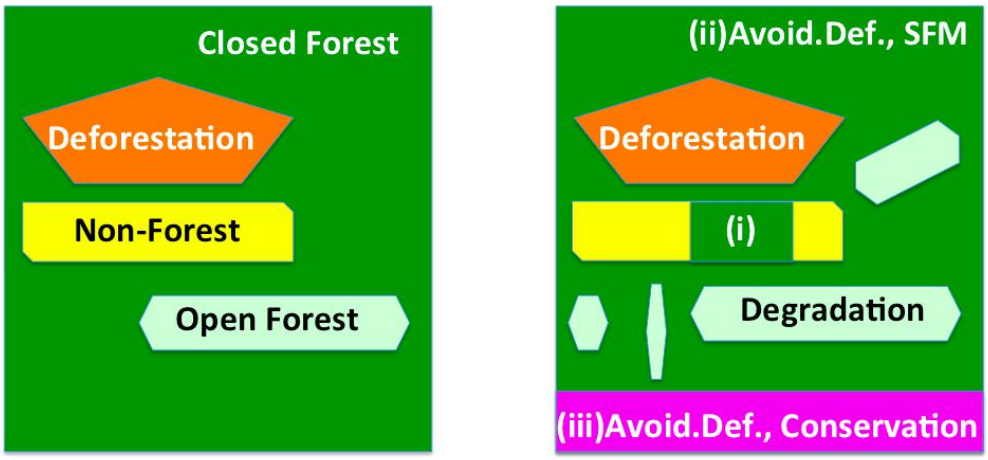
It is important to note that a distinction between the desired thematic strata can often not be made by remote sensing image analysis (RSIA). While degradation relates to a specific treatment of forests, RSIA detects differences between crown densities (i.e., open versus closed forests). Thus, crown



densities serve as a proxy for degradation. As degradation might occur even under closed forest canopies (e.g., removal of trees belonging to lower crown layers for fuel wood), not all forms and intensities of degradation can be captured by RSIA.

In practical applications strata can be a mixture of thematic and statistical considerations. Ideally the MRV system would apply a stratification rule reflecting the three key activities of the Fiji REDD+ program: (i) enhancement of carbon stocks, (ii) avoided deforestation through establishment of conservation areas and land use planning, and (iii) avoided forest degradation through sustainable management of forests. These activities are related to thematic differences (i.e., management strategies) and cannot be captured by RSIA, which provides a wall-to-wall stratification driven by crown coverage. **Figure 4** describes this situation. On the left-hand side, the RSIA is presented, on the right-hand side the three key activities as practised in-situ. The key activity "(i) enhancement of carbon stocks" by afforestation of former non-forest land might not be visible in RSIA due to carbon stocks that are still too low for detection by satellite imagery. Key activities "(ii) avoided deforestation through establishment of conservation areas and land use planning" and "(iii) avoided forest degradation through sustainable management of forests" cannot be separated by RSIA. In addition, in forests identified as closed forests by RSIA degradation activities might take place, which are not detectable by RSIA.

Figure 4. Complexities associated with detecting C-stock change due to management activities



A possible solution could be a sub-stratification of RSIA derived crown density based strata by, e.g., post-stratified sampling of field plots.

Note: in this situation strata are based on wall-to-wall RSIA, sub-strata sizes are estimated based on (post-stratified) field-plots. This option has to be further studied in the development of the MRV system. **For the construction of the FRL the three key activities cannot be included, as no activity data for the key activities is available.**

5.4 Assessment of NFMS

The consultant team analysed the existing NFMS of Fiji considering the UNFCCC criteria. The following paragraphs explain the existing NFMS and its gaps and the improvement needed to comply with IPCC good practice guidance and guidelines.

The UNFCCC decisions demand a NFMS should be a robust system which uses both remote sensing and ground-based carbon inventory approach. So far, Fiji has accomplished three National Forest Inventories (NFIs). First NFI was carried out in 1969 but the inventory report is not available. Second NFI took place in 1991-1994. In the second NFI, country forest area is classified into dense, medium dense and scattered forest. In addition, a forest function map was prepared and 529 field sample plots (clusters of 5 squares) were measured in all Islands and forest types. Third NFI was conducted in 2006 and comprised of more than 1000 sample plots. The geographical position of those sample plots were recorded with GPS. The plots are not visible now and those are never revisited. Hence, monitoring of changes in biomass and carbon stocks could not be happen. Distribution of sample plots is given in **Annex E**.

According to the IPCC GPG2003, the land use map of the country would need to have at least the following six categories: Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land. There may be needed to stratify forest areas according to ecosystem types or other nationally relevant categories for several reasons, for example, broader NFMS reporting requirements or to minimize the variability in carbon content. In the NFI 2006, the entire forest area was broadly classified into forest and non-forest areas. Forest area is further classified into open forest, closed forest, Pine plantation, Mahogany plantation, and Mangrove forest.

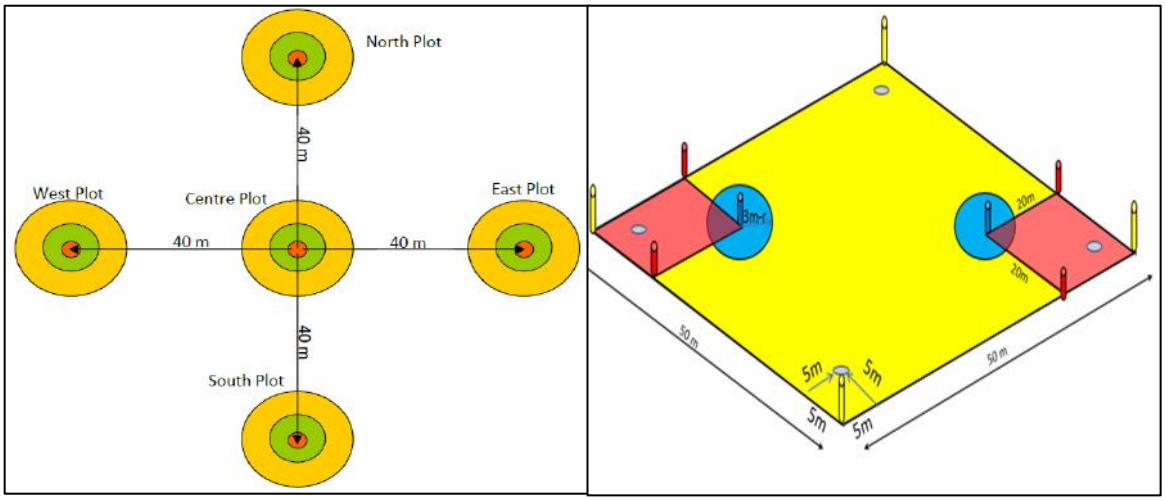
The second NFI (1991 -1994) and the third NFI (2006) were carried out to assess the amount of merchantable timber. Thus, attributes associated with carbon biomass such as quantity of deadwood and total height of the tree were not measured. A description of the NFIs is as given in **Table 7**. Details of the NFI 1969 are not available, but the NFI 1991 -1994 and NFI 2006 have used remote sensing and ground-based forest inventory.

Table 7. Description of the National Forest Inventories

NFI	Years	Characteristics of the NFI
1st	1969	Detail description is not available
2nd	1991 - 1994	• 529 field sample plots (clusters of 5 squares) • Functional forest: protection forest, preserved forest and multiple use • Three forest types: Closed, medium and scattered • Parameters include: Tree information (species, dbh, merchantable height, log grades), stand information (open/closed canopy, signs of logging), occurrence of NTFP and medicinal plants and site parameters, plot information (elevation, slope) • Not much field verification was conducted, so map is not so reliable and has limited use

3rd	2005 - 2007	• 1023 clusters were assessed. • Sample plots were randomly allocated. • Forest cover: closed forest, open forest, plantation, mangrove and non-forest

Figure 5. Sample plot design: National Forest Inventory (left), Permanent Sample Plot (right)



For the purposes of monitoring and reporting of REDD+ activities and estimating carbon emission by sources and removals by sinks and forest area change, the NFI should be consistent as far as possible with the permanent sample plot monitoring and measurement. However, the current PSP measurement is not fully consistent with the NFI system. The PSPs are mainly established for the monitoring carbon biomass, whereas the NFI targeting primarily on timber assessment. For example, although soil sample is not collected, sample plot for soil carbon is designed in PSP whereas NFI plot does not have such design. **Table 5** illustrates the plot layout used in NFI and PSP and tree attributes measured corresponding to each plot layout.

Table 8. Difference between NFI and PSP sample plot layout and forest attributes collected

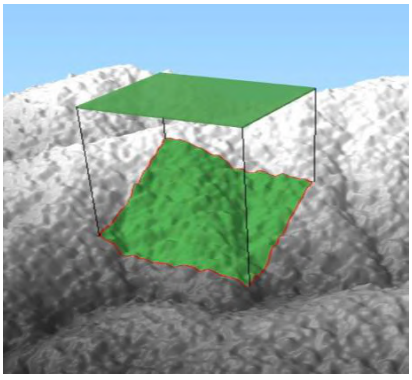
NFI 2006 Sample Plot		**Permanent Sample Plot 2010 - 2016**	
Plot layout	**Attributes measured**	**Plot layout**	**Attributes measured**
400 m^2 (r = 11.28 m)	All trees: dbh ≥ 20 cm, height of all trees ≥ 40 cm dbh	2500 m^2 (50 m x 50 m square plot)	All trees: dbh ≥ 30 cm dbh and tree height recorded
100 m^2 (r = 5.64 m)	Trees: dbh ≥ 5 cm and < 20 cm. Bamboo and Indicator Plants Species and Number	400 m^2 (20 m x 20 m square plot)	Trees: dbh ≥ 10 cm and < 29.9 cm, tree height recorded
10 m^2 (r = 1.78 m)	Tree regeneration: dbh < 5 cm and ≥ 1.3 m in height	28.26 circular plot (r = 3 m)	Tree regeneration: dbh > 3 cm and height < 1 m height

5.5 Permanent Sample Plot (PSP) design

For the current assessment, the cluster design of the NFI 2006 was abandoned in favour of a single permanent sample plot design (PSP). For both of the plot designs, statistical justifications taking into account population variances and cost considerations were not made available. No Standard Operation Procedure (SOP) or field manual has been developed for the PSP assessments.

The PSP design is subject to some sensitive issues:

- The large size of 2,500 m^2 plot used in PSP is more suitable for ecological assessments than for forest inventory, where – as a rule of thumb – plot areas larger than 1,000 m^2 are uncommon. The reason lies in the local variance structure of forest populations, which can be captured by smaller plot sizes.
- A perimeter of 200 m increases the probability for borderline trees, which basal area is cut by the plot boundary. It is good practice to include those trees in the sample, which centre is inside the plot area. The larger the diameter of a tree, the larger is its probability to become a borderline tree. The erroneous inclusion of those trees inflates the estimates such as biomass or C-stock and is especially unfortunate for larger trees.
- As all plot measurements are related to a horizontal plane, fixed area plot areas need to be adjusted for slope. In an area of 2,500 m^2, slope correction cannot be done properly. It is hard to keep measurement tapes horizontal for 50 m distance in the plots. It is unclear, how slope corrections are realized in PSP measurements. Where no slope correction is applied, the results will be subject to negative bias.



- The plot size of 2,500 m^2 increases the probability that the plot is located on boundaries of strata or extending beyond the forest area into non-forest land. In these situations, the areas of the plot located in different strata need to be measured and taken into concern in the statistical estimation process. Smaller plots reduce the probability of strata overlaps. Rules for measuring sub-plot areas need to be developed.
- Cost-efficiency is a driving factor for the development and implementation of plot designs. Comprehensive studies on small area population variance and time requirements for measurements as well as for reaching the plots (by walking or other means of transportation) are of uttermost importance for developing optimal plot designs. Especially in remote areas, it can be more advisable to use clusters of small plots rather than a single

large plot. The consultant team recommends that the next PSP assessments associated by a time study and that – if necessary – a cluster design is developed for remote islands.

- As the plots are visibly marked, their location and the extent are known. It is good practice to monument PSPs invisible, e.g., by recording the trees coordinates. Otherwise the plots are subject to treatment bias and become non-representative in the course of time, as management activities differ from the rest of the forest population. Therefore, the visibly marked plots have to be replaced over time by new, invisibly marked plots.

Hundred (100) PSPs have been established without any statistical analysis of variation in 2010 across Fiji. The plots were established using grid method. **Figure 5** (right) shows the design of a PSP. The distribution of the PSPs is as shown in **Annex E.** Out of the 100 plots, 84 plots have been measured periodically and regularly. Seven (7) plots on mangroves are yet to be measured, seven (7) of them fall on Grassland and two (2) plots lie in farmland. The PSPs which were designed for the Mangrove Forest could not be measured because of complexity of measuring mangrove trees in sample plot designed for other forest types. Different spacing was applied in different Island to accommodate the 100 PSPs and no stratification is employed except natural forest and plantation. Hence, based on the variability analysis, an increase in the number of permanent sample plot for robust estimate of carbon stock change is likely. Since the sample size used in PSP does not fit for the mangrove forest, a separate study is essential to design sample plot. Current frequency of measurement is 2 years, which is relatively short for forest crop, therefore an increase in time frame is essential to accommodate more measurement and plots without losing significance of results.

The consultant team also reviewed the document on assessment of carbon stock carried out by Ian Payton (2011). Ian Payton's assessment shows the underestimation of the C-stock in the natural forest and overestimation in plantation forest. He has assessed only 33 PSPs and suggested some improvement in existing PSP measurement system. The recommendation is valid. The following paragraph suggests improvement needed in PSP measurement.

Wood density is one important predictor of carbon stock. Wood density data is available only for limited number of commercial species in the country. However, natural forest contains many non-commercial species which make significant contribution to the national forest carbon stock. Hence wood density of the species which are making significant contribution to carbon stock in Fiji needs to

be derive (Payton, 2014). In addition, a protocol for collecting wood sample and determining their density is essential. A database of wood density is equally essential (Payton, 2014). Ian Payton (2014) used tree height-diameter from PSP data set to derive generalised height diameter equation. The height diameter equation which includes trees of different forms accounts only for 35% of variability in the dataset. Hence, species-specific height-diameter relationship is essential.

Dead wood is an important contributor to carbon stocks of the country especially in the logging area and recently in the cyclone damaged area. Deadwood is routinely measured on the permanent sample plots that are used for carbon stock inventory but deadwood is not included in carbon stock assessment. This requires a protocol for measurement of deadwood both for natural and plantation forests and analysis of measurement (Payton, 2014). Also, a study of the rate at which deadwood decays under different climatic condition both for natural and plantation forests is desirable (Payton, 2014).

5.6 Biomass assessment

Currently no country-specific biomass equations have been developed for Fiji. The Forestry Department conducted a study in which the biomass of 30 trees was assessed by destructive sampling. Based on these 30 trees a biomass function as shown in Equation 1 was developed that utilizes dbh as independent variable.

$$ABG_{est} = 0.063 * DBH^{2,6203} \quad \ldots\ldots(1)$$

Widely utilized biomass functions have been developed by Chave et al. (2005 and 2014). He presented an allometric equation that relates diameter (D), wood density (ρ) and an environmental stress factor (E) to the weight of aboveground biomass (AGB). An equation proposed for the situation in which height measurements are not available is.

$$AGB_{est} = \exp\{-1.803 - 0.976E + 0.976\ln(\rho) + 2.673\ln(D) - 0.0339(\ln(D)^2\} \quad \ldots\ldots(2)$$

The environmental stress factor E increases with the seasonality of temperature and the time when a plant is exposed to water stress. The factor E can be calculated by the R-routines made available by Chave et al. 2014. Wood densities (ρ) are available for 43 tree species of Fiji. Moreover, there are several wood density databases available in web (i.e., Dryad Digital Repository, World Agroforestry Centre- ICRAF's Tree Functional Attributes and Ecological Database)[3]. **Figure 6** shows the performance of the two biomass equations (equations 1 and 2 above). It can be seen that both equations provide similar results for individual tree biomass.

[3] http://datadryad.org/handle/10255/dryad.235, http://db.worldagroforestry.org/wd

Figure 6. Performance of two biomass equations

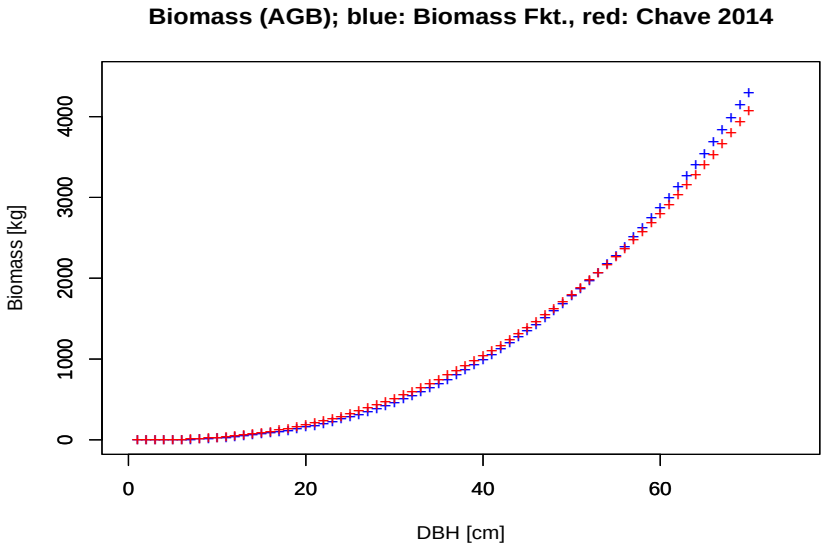
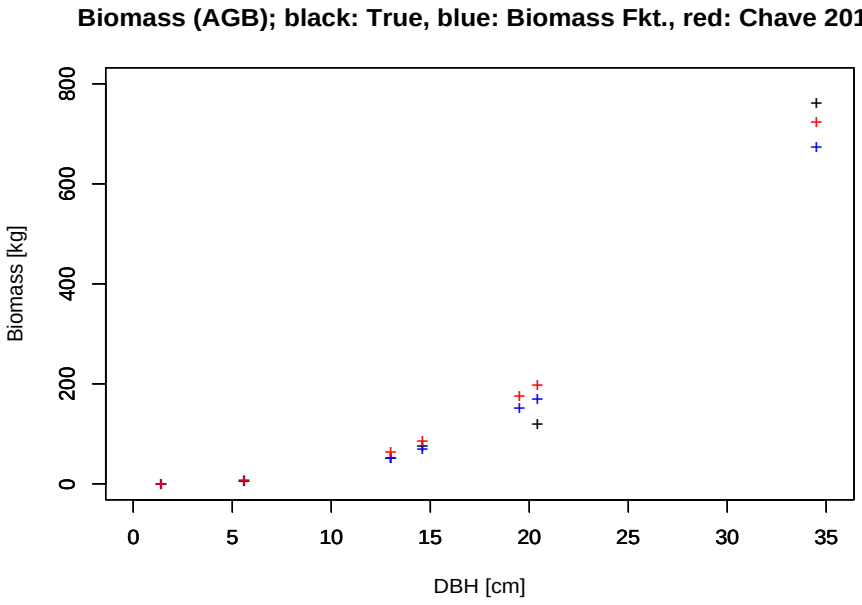


Figure 7 shows the estimates produced by the two equations with respect to true values of tree biomass as assessed in the destructive sample conducted by the Forest Department. The analysis gives no reason to assume a systematic bias. However, as the number of trees is low, the result cannot be transferred to the entire forests of Fiji.

Figure 7. Difference between true carbon biomass and biomass estimated using the Chave et al., (2014) allometric equation

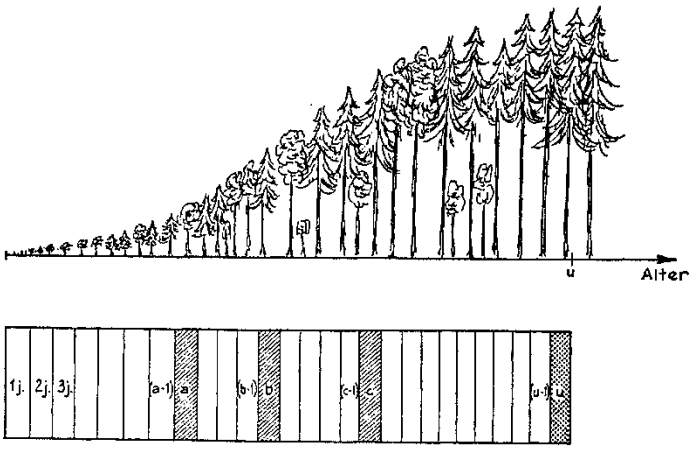


5.7 Plantations

Afforestation and reforestation can significantly contribute to the enhancement of carbon stocks. Information on mean annual increment, rotation periods and planted areas allows for a prediction of the future carbon effects of plantation forestry. However, when plantations are utilized the accumulated carbon is removed from the AGB pool. Introducing Harvested Wood Products (HWP) as an additional pool is an alternative to mitigate the C-loss in AGB.

An alternative solution incorporates good practice of sustainable forest management. In a defined time period only the amount of biomass is harvested that is accumulated by tree growth in the same period. This leads to the concept of normal forests (see **Figure 8**), where age classes are equally balanced. It is a task of forest management planning to modify the entity of plantations in a way that age classes are "normalized". Then the C-stock of plantation is maintained over time and C-losses by timber utilization are compensated by C-gains through biomass growth.

Figure 8. Diagram of a normal forest



5.8 Mangroves

For Mangroves the PSP-design is not suitable, as it would involve unjustifiable measurement efforts. The small-scale variability of mangrove forests can be captured by plots with considerably smaller areas – say 100-200 m^2. The consultant team therefore recommends the development of a plot design for mangroves.

Biomass estimation for mangroves is not straightforward. Root structures and tree stem taper preclude the application of biomass functions developed for other forest types.

Estimating current state and changes of carbon stock can be realized by (i) destructive samples of trees are taken on a not-yet-determined number of sample plots, and (ii) an estimation/analysis of biomass drain by wood fuel collection and timber harvest by local population surrounding the Mangrove Forests. The data on fuelwood collection and timber harvest can be obtained by Participatory Rapid Rural Appraisals (PRRA).

5.9 Estimation procedures

Estimation procedures for both the NFI 2006 and the PSP assessments are missing. It is on the fringe of acceptable practice to implement inventory designs without providing the respective estimation procedures. Statistical estimators for current values and changes need of area related (e.g. t/ha) as well as total values are to be developed. It goes without saying that estimators for sampling errors and the construction of confidence intervals need to be provided likewise.

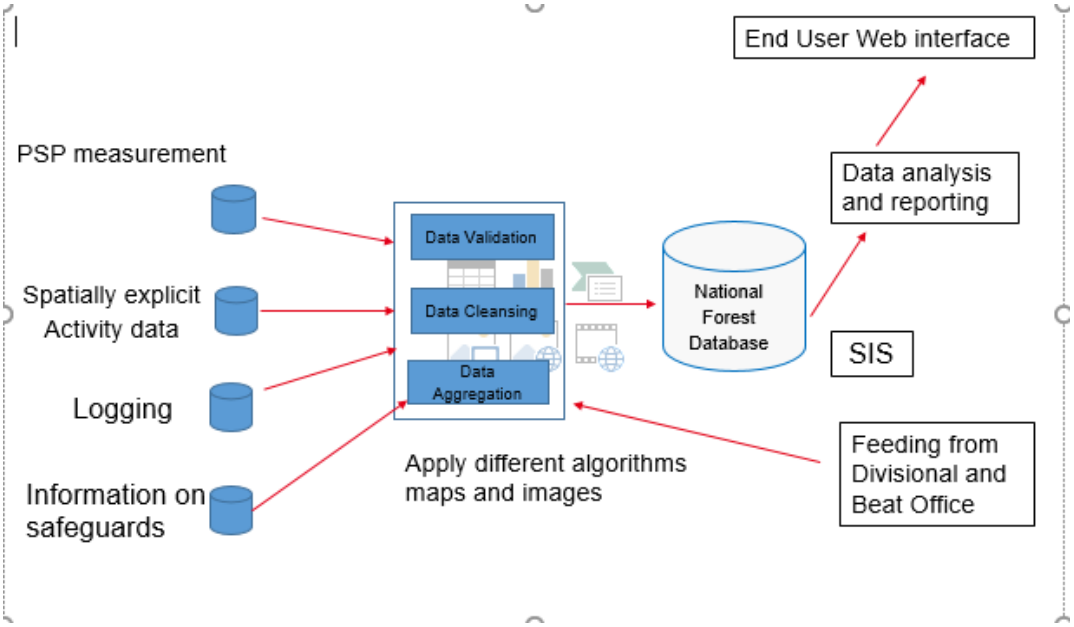
5.10 Field test

The TOR focuses the field test on measurement activities on sample plots. After getting familiar with the capacities and the experience available at the Management Service Division (MSD) of Forestry Department, the consultant team recommends to shift the focus of the field test. For an operational implementation of the MRV, the training of the entire chain from field measurements to final reporting tables should be the objective of the capacity building activities. This does not exclude the training of new measurement equipment of electronic data collection in the field. However, dealing with the different aspects of data handling, statistical analyses, uncertainty assessments, or preparation of final tables should be emphasized in order to foster the safe handling of all processes of the MRV by the MSD and Forestry Department staff.

6 Database

For National Forest Inventory, thereby MRV system of REDD+ to be successful in the long-term, issues of quality control and management of data are important. A systematic system to address the issue of data management and quality control is essential. Hence, a database system that incorporates all elements; data collection and analysis protocols, datasets etc. is required for national carbon stock estimation in Fiji forests. **Figure 9** shows a schematic diagram of database system for REDD+.

Figure 9. A schematic diagram of Database

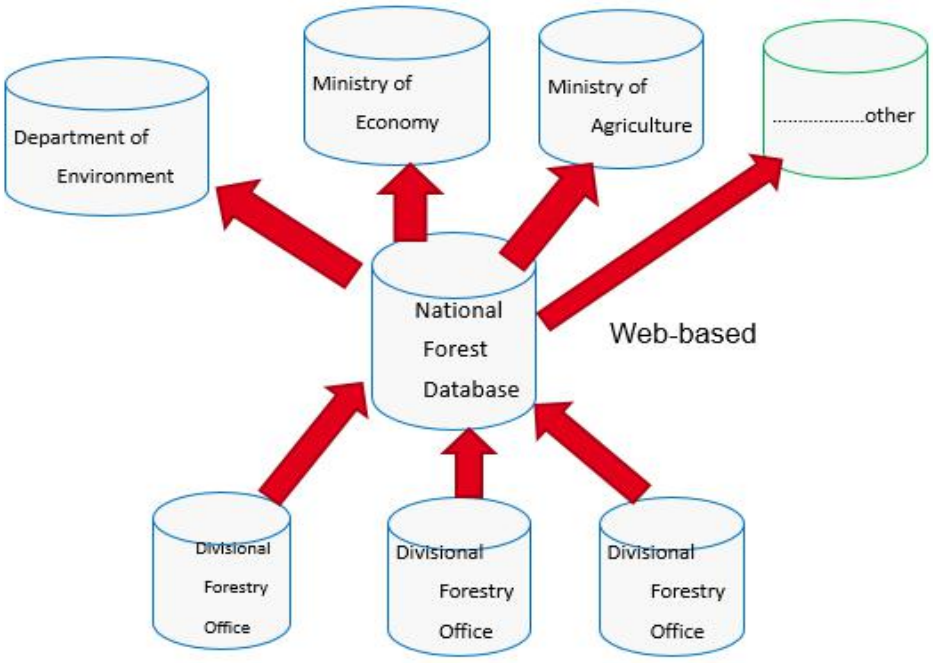


IPCC guidance recommends that a NFMS development is transparent and the results of the NFIs are publicly available for review. To address the recommendation to some extent, the MSD has established a database of the measurement of NFI 2006 and the periodic measurements of the PSPs (2010, 2012, and 2014). However, analysis of the measurement, report preparation and dissemination of the results are still yet to be done. The consultant team observed the existing database and found some gaps which are explained in a later section.

The database only contains NFI 2006 and the PSP measurements in Microsoft Access format. The information in the database is well maintained. As mentioned earlier, no further analysis such as volume and biomass calculation has been done. The database needs inclusion of algorithms to estimate biomass and carbon stock of forests based on the attributes recorded in the NFI and PSPs. As far as possible, free available software will be used for the storing and analysis of information (viz. R software). Automatic electronic data transfer system developed for; data quality assurance routine check is also essential. In addition, integration of the database with other REDD+ relevant organisations such as Environment Department and Ministry of Economy which are National

Designated Authority for Convention on Biodiversity and UNFCCC respectively is necessary. **Figure 10** presents a model for integration of database system.

Figure 10. A database integration model



7 Stakeholder analysis

For a project, stakeholder analysis is a vital component of a situational analysis which ensures that the project is implemented with the right stakeholders. Stakeholders' participation is becoming crucial in policy development and program implementation. Like many other programs the stakeholders' role is paramount in REDD+ implementation. Stakeholder analysis has become increasingly popular with a wide range of organisations in many different fields. Fiji REDD+ program has identified stakeholders for many other REDD+ readiness activities. However, stakeholders relevant for FRL, NFMS and database could be different from what the REDD+ program has identified before. Different stakeholders at levels might have different interests (expectations) from REDD+ program. They might contribute and influence REDD+ in different magnitudes. Such analysis has not been done yet.

Considering this fact, a stakeholder analysis was performed to identify the stakeholders relevant to this assignment. For the analysis, the consultant team, MSD and REDD+ Unit discussed a preliminary list, reviewed REDD+ relevant documents, conducted field visits and discussed with the stakeholders which were already identified by REDD+ Unit. A popular method of stakeholder analysis named "interest and influence" was used to classify the stakeholders into four distinct categories: i) high interest, high influence; ii) high-interest, low influence; iii) low-interest, high influence; and iv) low interest, low influence. The magnitude of stakeholders' influence, impact and interest leads to the development of different strategies, as followings, to engage the stakeholder in REDD+ program.

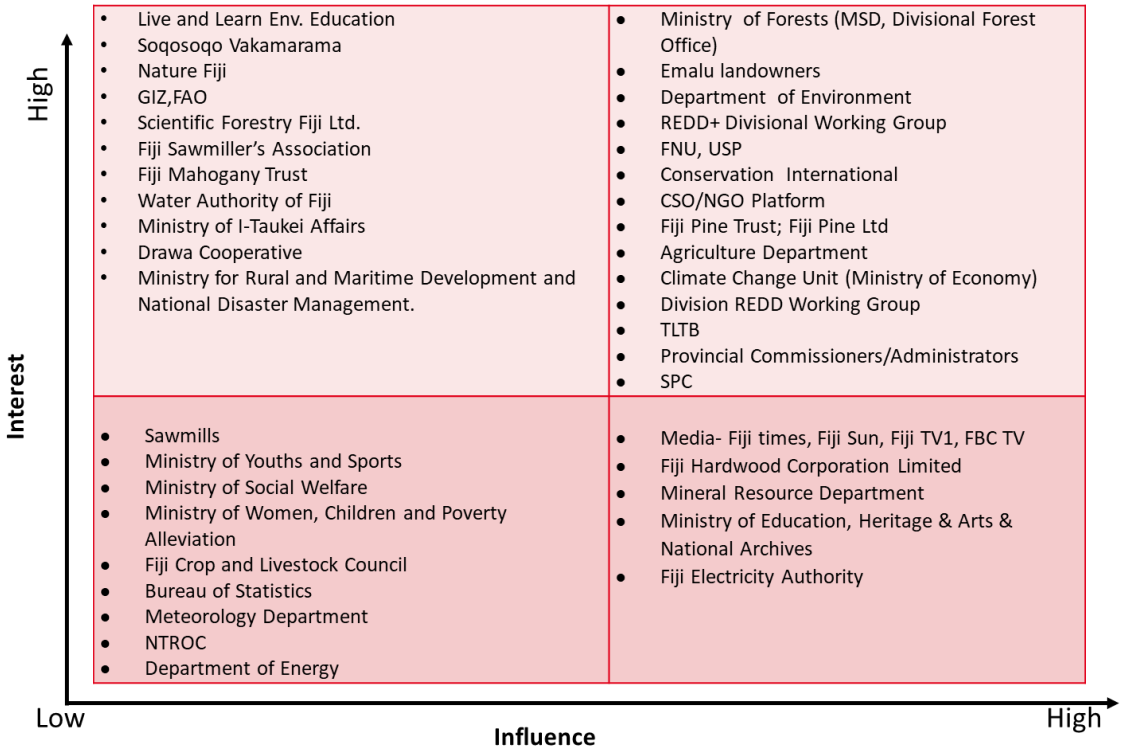
High influence / High impact/interest – need to keep satisfied; engage and consult regularly
High influence / Low impact/interest – engage and consult on topics of interest; try to increase interest (move to high interest)
Low influence / High impact/interest – Meet their needs – make use of interest. Keep informed.
Low influence / Low impact/interest – Keep informed via low effort means

The consultant team assessed the stakeholder interest- 'How much interest do they have in REDD+?' – at three levels: Low, Medium and High. Similarly, stakeholder's influence was assessed considering - 'How much influence do they have over the REDD+ processes?' – at the same levels: Low, Medium and High. At a later stage, the consultant team explored the expectations of the stakeholders towards REDD+ and articulated their potential roles (contributions) to the REDD+ program. Finally, based on the assessments (interest, influence, expectations and contributions), the consultant team proposed strategies for engaging the stakeholders in the REDD+ processes including design and implementation. **Figure 11** presents the schematic overview of the stakeholder mapping according to their influence and interest. The stakeholder matrix analysis is presented in **Annex G**. The annex also presents the category of stakeholders, stakeholder name and contact person details.

Note: The stakeholder mapping and the analysis should be taken as a preliminary analysis. Rigorous stakeholder consultations are to be carried out while performing the different tasks under the

assignment. Accordingly, the team improves the understanding of the interest, influence, expectations and contributions during the consultations and updates the analysis.

Figure 11. Schematic overview of REDD+ stakeholder mapping



8 Capacity building

REDD+ mechanisms require the systematic measuring and monitoring of national forests and their challenges. According to Romijn et al. (2012), Fiji is as one of the tropical non-Annex I countries with low existing capabilities to continuously measure forest area changes, conduct forest inventory, and report forest carbon stock changes on the IPCC Tier 2 level. The country faces high remote sensing technical challenges to adopt IPCC Approach 3. The country has been actively engaged in the UNFCCC REDD+ process in later years (Romijn et al., 2012) compared to its' low engagement in the process before 2010 (Herold, 2009). However, a large capacity gap exists to measure and verify the success of REDD+ implementation actions using the IPCC GPG and FCPF Carbon Fund Methodological Framework (FCPF-CF MF). Like most of the other developing countries, Fiji needs to improve capacity at technical, political and institutional levels to provide a complete, consistent, comprehensive and accurate estimation of forest area change and to attribute emissions and removals to these changes. For *forest area change monitoring* and for *carbon stock and carbon stock change estimation for different carbon pools* corresponding to Tier 2 and Approach 3 of IPCC guidelines for LULUCF and AFOLU and as required by the FCPF-CF MF for the ERPA, requires a huge investment in the form of human, technical, institutional and infrastructure resources.

One of the tasks of this consultancy is to assess capacity for relevant stakeholders involved in each task, and to prepare a capacity development strategy for MRV, including immediate trainings done in the consultancy implementation, as well as a future development plan.

For the purpose of this task, the capacity gap is defined as the difference between what is required for REDD+ monitoring under national circumstances and the current monitoring capacity of a country. Consultant team assessed capacity gaps of the stakeholders associated with FRL, NFMS, and database in Fiji. **Table 9** illustrates capacity gaps and the proposed capacities planned to build within the consultancy period.

Table 9. Capacity gap analysis matrix presenting proposed capacity development activities within consultancy period (2017/2018)

Assignment/ category	Capacity Required	Existing Capacity	Proposed capacity development activities	Sources	When/ where
Introduction of REDD+ in the context of UNFCCC and FCPF Processes	Knowledge on international UNFCCC-REDD+ negotiations and guidance for monitoring and implementation	• Fair understanding of UNFCCC processes and REDD+ • Inadequate information on FCPF Carbon Fund Methodological Framework (FCPF CF MF)	Day-long workshop which includes: 1. UNFCCC processes including Paris Agreement 2. REDD+ on Paris Agreement 3. Cancun Elements of REDD+ and status of the elements in Fiji REDD+ readiness processes 4. FCPF CF MF	Discussion with staff at the MSD	M4
Introduction of IPCC GPG 2003 (Monitoring /Reporting Requirement)	Understanding of 'good practice' and GHG monitoring and reporting process as specified in IPCC GPG 2003 (Key categories, sub-categories, reporting formats etc.)	• Inadequate understanding of the IPCC GPG and process of GHG monitoring and reporting format	Day-long workshop which includes: 1. What is 'Good Practice' 2. Key Categories, Approaches and Tiers 3. Reporting tables and data sources		Ongoing
Forest Reference Level **Forest area change assessment**	A country should be able to estimate AD and EF for each land use land cover exist in the country. In addition, a country has to able to estimate for all five activities of REDD+ in such a way, that the estimates comply with the land use categories as determines by the IPCC. 1. Review, consolidate and integrate the existing data and	• Inadequate capacity (technical and human resource) exists for estimating, analysing and interpreting activity data • Despite the limited human resources, the sample plot assessment (data collection) and data handling is very good. • However, lack of capacity to estimate C stock, and C stock changes is visible. • Furthermore, data analysis and interpretation of the results in line to the IPCC GPG and FCPF MF reporting requirement are the major shortcomings to come over.	Staff from the MSD and other relevant Departments will be involved right from the beginning with the consultant team. This involvement will enable the staff to develop skills and knowledge in estimating activity data and emission factors 1. Accessing, processing, and interpretation of forest area	Meetings with MSD and other stakeholders	Ongoing

Assignment/ category	Capacity Required	Existing Capacity	Proposed capacity development activities	Sources	When/ where
(Activity data)	information 2. Understanding of deforestation drivers and factors 3. Expertise and human resources in accessing, processing, and interpretation of multi-date remote sensing imagery for forest changes		change from satellite data 2. Approaches for dealing with technical challenges (i.e. cloud cover, missing data)		
Change in carbon stocks (Emission factors)	1. Consolidation and integration of existing information, i.e, NFIs or PSPs 2. Expertise and resources to monitor C stock changes: ○ Data collection and processing ○ Human resources and equipment for field work ○ Sample design, plot configuration 3. Estimation at sufficient IPCC Tier level for: ○ Estimation of C stock changes due to LUC ○ Estimation of changes in forest areas remaining forests		1. Data collection using electronic data capture, and data transfer to the national database 2. Estimation of C stock, and C stock changes 3. Interpretation of the estimates in line to the IPCC GPG and FCPF MF reporting requirements 4. Preparing the reporting Tables as specified in IPCC GPG 2003		

Assignment/ category	Capacity Required	Existing Capacity	Proposed capacity development activities	Sources	When/ where
Measurement and Monitoring of forest change	A country needs a robust and transparent NFMS, should have capacity to measure and monitor through a combination of RS and ground-based forest carbon inventory approaches for measuring forest area changes and forest carbon stocks and changes, needs human resources in accessing, processing and interpretation of multi-date remote sensing imagery for forest change.	Inadequate capacity in measurement and monitoring within the MSD, limited human resources in accessing, processing and interpretation of multi-temporal remote sensing imagery	See **Forest area change assessment (Activity data)** Linking Safeguard Information System (SIS) and information on other pragmatic elements of REDD+ to the national REDD+ database **(For detail- please Database – below)**		Ongoing

Assignment/ category	Capacity Required	Existing Capacity	Proposed capacity development activities	Sources	When/ where
Accuracy assessment and verification (***QA / QC procedures***)	Uncertainties arise in FRL setting and MM & R. Uncertainty assessment is one of the major requirements for the ERPD to received FCPF Carbon Fund. Uncertainties due to random and systematic errors for both AD and EFs used in the FRL and MM & R, should be addressed using standard procedures/approaches. 1. Understanding of error sources and uncertainties in the assessment process. 2. Capacity to identify the uncertainty in a consistent way and assess sources of uncertainty 3. Knowledge to minimize uncertainty where feasible and cost effective 4. Ability to quantify uncertainty	One of the biggest existing challenges in the emissions factor (data) is the lack of uncertainty assessment. The SoPs for the NFI (2006) and PSPs (2010) do not contain the procedures dealing with uncertainty assessments. Due to the lack of the knowledge and limited capacity of the relevant authorities responsible for AD and EF, uncertainty assessments have not performed yet.	1. Overview on the error sources and uncertainties 2. FCPF CF MF requirements for the uncertainty assessments 3. Uncertainty assessment and error analysis 4. Approaches to handle and minimize uncertainty		Ongoing
Database development and regular updating	Harmonized, comprehensive and fully operating web-based database established and is accessible to designated persons in different agencies. Robust yet transparent information system that can link to relevant databases on carbon and other social and environmental aspects	A database which focuses only on NFI 2006 and PSPs exist. The database system only established at the MSD and there is no linkage with other relevant divisions and departments. Similar database system exists in Division Forestry Offices, but not linked to the Central debase system at the MSD.	1. Harmonized, comprehensive and fully operating web-based database established 2. Training on database administration including transfer of raw data, access permission, statistical algorithms		Ongoing

Assignment/ category	Capacity Required	Existing Capacity	Proposed capacity development activities	Sources	When/ where
	The database should incorporate data required for various forestry thematic applications related to forest resources, forest carbon accounting, forest management, forest users and beneficiaries, LULUCF/Activities, REDD+ Safeguards The database structure should be sufficiently flexible to incorporate additional thematic data in future, able to provide summary of information on Safeguard and provide detail information for communication report specifically on GHG emission from forestry.				

9 REDD+ Steering Committee meeting (Inception Workshop)

In order to discuss the preliminary findings of the situational analysis and to sort out the issues related to this assignment, a REDD+ Steering Committee meeting (Inception Workshop) was held on 2-3 May 2017 at Hotel Holiday Inn, Suva, Fiji. Representatives from various organizations participated in the meeting. A list of participants is given in **Annex H**. The consultant team presented the preliminary findings of the analysis. The presentation was mainly focused on the availability of data, information and their quality. In addition, the meeting also discussed workable solutions to the issues related to data availability and analysis. **Table 10** presents the key issues raised during the RRSC meeting and their respective resolution.

Table 10. Issues raised in the RSC meeting and their resolution

Topic	Issue	Resolution
Forest Reference Level	Baseline adjustment, investigating significant change in future emission trends, is possible. But it is a big effort with little potential gain, FCPF limits adjustment to 0.1 % of overall baseline	No adjustment of historic baseline
Uncertainty analysis	None of the products used for the FRL has undergone uncertainty analysis (both AD and EFs). This has to be provided by Forestry Department. Ground verification of maps is needed, which affords resources.	Detailed work plan to be provided by MRV team and MSD. Budget to be sourced from Forestry Department, FCPF funds, potentially other sources, as needed.
Land-use classification 2012 and 2017	Maps not provided yet, though promised in ToR	SPC and MSD to finalise both products by August 2017. To deliver timely, work focusses on Viti Levu, Vanua Levu and Taveuni. Other islands to be finalised after delivering the data.
Stratification	Currently, forest strata include mangroves, hardwood, softwood, native forest. Additional strata can significantly increase overall accuracy.	Cloud forest to be stratified via GIS, open and closed forest to be stratified.
Measurement of mangroves	Currently no biomass data available for mangroves, and therefore, the overall uncertainty suffers. Solutions can be: exclude mangroves; include and accept uncertainty; conduct mangrove biomass measurements.	Consultants to further investigate potential data sources, give recommendations to the next RSC meeting. Exclusion of mangroves would be the last option, as the strata are important for the REDD+ concept in Fiji.
Database	Database development methodology and preliminary model presented. Main work will be done in July/August.	RSC acknowledges presentation and looks forward to further work steps. Stakeholders are encouraged to

Topic	Issue	Resolution
		engage in database development process, as database should cater to several reporting needs.
Capacity building	Consultants will mostly do on-the-job training. Seminars and workshops will be announced in due time.	No issue
Stakeholder identification	Stakeholder identification and analysis presented to RSC.	Further changes need to be deliberated. Revised version will be included in inception report for review.
Work plan	Work plan presented to RSC. No changes to ToR suggested	RSC accepted work plan.

10 Conclusion and recommendations

- The analysis shows that the envisaged methodology for the assessment of activity data allows for the implementation of Approach 3 in Fiji. However, a major obstacle is the currently absent land-use assessment for 2017.

- On the basis of the current data and information, as provided for this report, Forest Reference Level for the said period (2007-2017) cannot be constructed. The activity data for year 2017 and forest cover change assessment of 2007-2012 are not available.

- The method of data collection is not clearly and transparently reported and appears from the various data sources to be inconsistent over time. Inconsistency is observed in between National Forest Inventory 2006 and Permanent Sample Plots. To maintain consistency one method must be chosen and be applied consistently over time and reported transparently.

- The area of the permanent sample plot (PSP), i.e., 2,500 m^2 is more suitable for ecological assessments than for national forest inventory. As a rule of thumb, sample plot areas larger than 1,000 m^2 are uncommon. The reason lies in the local variance structure of forest populations, which can be captured by smaller plot sizes.

- PSPs are planned for mangrove forest, but the plots have not been established because of the complexity of measuring mangrove trees in such a big plot. Hence, new plot design for mangrove is desirable.

- The Database of the National Forest Inventory 2006 and measurement of Permanent Sample Plots is well recorded and maintained. However, substantial improvement such as use of algorithms, spatial data, maps and integration of this database with other relevant organisations is desirable.

- Capacity gaps exist to attain high accuracy in data collection, analysis and reporting. Hence trainings on remote sensing, forest inventory and statistical analysis are suggested.

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Annex A: List of participants in MRV consultants meeting with REDD+ Unit and MSD

Date: 18 April, 2017

Venue: MSD Conference room, Colo-I-Suva Forestry Station

Name	Organization	Designation	Email
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Joseva Duikoro	MSD, Ministry of Forests	Project Officer	josevaduikoro28@gmail.com
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Michael Köhl	University of Hamburg (UHH), Germany	Consultant	michael.koehl@uni-hamburg.de
Narendra Chand	UHH, Germany	Consultant	narendrachand@gmail.com
Prem Raj Neupane	UHH, Germany	Consultant	Prem.raj.neupane@uni-hamburg.de
Rama Chandra Reddy	Climate Change Policy and Finance Department World Bank Group	Senior Carbon Finance Specialist	rreddy1@worldbank.org
Salanieta Matai	FNU	Lecturer II	salanieta.matai@fnu.ac.fj
Timoci Sukulu	IT Division, Ministry of Forests	Programmer	tlagataki@govnet.gov.fj
Viliame Tupua	REDD+ Unit, Ministry of Forests	MRV Officer	vtupua@gmail.com
Wolf Forstreuter	South Pacific Community	Consultant	wolf.forstreuter@gmail.com

Annex B: List of participants in MRV consultants meeting with RSC WG MRV

Date: 18 April, 2017

Venue: SPC GeoScience Division (former SOPAC), Mead Road

Name	Organization	Designation	Email
Akosita Lewai	Management Service Division (MSD)	Principal Forest Officer	akosita_lewai@yahoo.com
Aminiasi Qareqare	Department of Environment	Principal Environment Officer	aminiasi.qareqare@environment.gov.fj
Björn Hecht	MFF	REDD+ Advisor	bjoern.hecht@posteo.de
Christian Fedlmeier	GIZ	Project Director	Christian.Redlmeier@giz.de
Daniel Plugge	SPC/GIZ	Technical Advisor	daniel.plugge@giz.de
Isaac Rounds	Conservation International	Forest Ecologist	irounds@conservation.org
Kataebati Batnun	SPC/GIZ	GIS/RS expert	kataibatib@spc.int
Maika Tabukovu	Fiji National University (FNU)	Lecturer	maika.tabukovu@fnu.ac.fj
Marika Tuiwawa	USP	Curator- SPRH	marika.tuiwawa@usp.ac.fj
Michael Köhl	University of Hamburg, Germany (UHH)	Consultant	michael.koehl@uni-hamburg.de
Narendra Chand	UHH	Consultant	narendrachand@gmail.com
Prem Raj Neupane	UHH	Consultant	prem.raj.neupane@uni-hamburg.de
Rama Chandra Reddy	Climate Change Policy and Finance Department World Bank Group	Senior Carbon Finance Specialist	rreddy1@worldbank.org
Salanieta Matai	FNU	Lecturer II	salanieta.matai@fnu.ac.fj
Semi V Dranibaka	Ministry of Forests and Fisheries	REDD+ Focal Point Acting Chief Forest Development Officer	semidranibaka@gmail.com
Timoci Nakalevu	GIZ	Program Assistant	timocinakalevu@giz.de
Timoci	IT Division, Ministry of	Programmer	tlagataki@govnet.gov.fj

Sukulu	Forests		
Viliame Tupua	REDD+ Unit, Ministry of Forests	MRV Officer	vtupua@gmail.com
Wolf Forstreuter	South Pacific Community	Consultant	wolf.forstreuter@gmail.com

Annex C: List of stakeholders consulted

Date	Method of consultation, and Venue	Person, designation and contact details	Stakeholder's name	Major topic discussed
18.04.2017	Meeting in-person (MSD Meeting hall)	Dr Rama Chandra Reddy Senior Carbon Finance Specialist, rreddy1@worldbank.org	Climate Change Policy and Finance Department World Bank Group	• Forest Carbon Partnership Facility, Carbon Fund, Methodological Framework (FCPF CF MF)
18.04.2017	Half-a-day-Workshop (14 participants) (MSD meeting hall)	Mrs. Akosita Lewai Principal Forest Officer Akosita_lewai@yahoo.com Mr. Björn Hecht Technical Specialist bjoern.hecht@posteo.de Dr Rama Chandra Reddy	Department of Forests, MSD REDD+ Unit The World Bank Group Consultant team	• Technical proposal of the Consultancy • Contact persons from Ministry of Fisheries and Forests (MFF) for different Tasks specified in the ToR of the Consultancy
18.04.2017	Meeting (16 participants) (SPS- GSD)	Mr Semi Dranibaka REDD+ Focal Point semi.dranibaka@gmail.com REDD+ MRV WG + MFF representative + Representative of Climate Change Policy and Finance Department World Bank Group	MFF REDD+ MRV WG	• Introduction of consultancy team and the MRV group • FCPF CF MF • Availability of activity data • Information on sources of available data required for FRL and MRV system development
19.04.2017	Meeting (Hotel Grand Pacific, Suva)	Dr Rama Chandra Reddy Senior Carbon Finance Specialist, rreddy1@worldbank.org Mr Vili Tupua MRV Officer vtupua@gmail.com	The World Bank Group REDD+ Unit	• Reference period for the FRL • Available activity data for the period of 2007 – 2017 • Accuracy assessment of the activity data • Uncertainty assessment • Forest stratification
20.04.2017	Meeting (REDD+ Unit)	Mr. Björn Hecht REDD+ Advisor bjoern.hecht@posteo.de	REDD+ Unit	• Content of Inception Workshop
23.04.2017	Field Visit (Mangrove Forests)	Mr. Vili Tupua MRV Officer vtupua@gmail.com Timoci Sukulu Programmer tlagataki@govnet.gov.fj	REDD+ Unit MFF	• Status of Mangrove forests in Fiji • Biomass assessment of Mangrove forest
25.04.2017	Visit (Divisional Forestry Office - DFO, Western	Mrs. Amelia Waqanibeqa Divisional Forestry Officer awaqanibeqa@gmail.com	Divisional Forestry Office, Western Division Lautoka	• Function, responsibility and organizational structure of the DFO • Forest area and forest cover

Date	Method of consultation, and Venue	Person, designation and contact details	Stakeholder's name	Major topic discussed
	Division, Lautoka)			• Log production and trends • A/R, Forest ownership
25.04.2017	Visit (Lautoka)	Mr. Stephen Walker stephenw@spc.int	Reforest Fiji	• A/R activities in sugar belt by cane growers • Forestry plantations and woodlots for improved livelihoods • Performance based payment for plantation
25.04.2017	Visit	Mr Asesela Wata Cokanacagi General Manager Operation Vakabuli Village Road, Drasa, Lautoka Acokanacagi@tropik.com.fj	Fiji Pine Limited	• Management of Pine plantations • REDD+ and Pine plantations • Participation of private sector in REDD+ readiness activities in Fiji • Pine plantations and local forest owners • Availability of data and biomass equations
26.04.2017	Visit (Nadarivatu Beat Office)	Mr. Setareki Namuloilagi Assistant DFO Divisional Forestry Office, Western Division Lautoka	Nadarivatu Beat Office	• Forest harvesting in a village woodlot • Forest damaged by Winston (Cyclone) • Grassland fire • Carbon stock in Lowland rainforest, and cloud forests • Visiting Eucalyptus plantation
26.04.2017	Visit (African Tulip tree invasive area)	Mrs. Akosita Lewai Principal Forest Officer Akosita_lewai@yahoo.com Mr Vili Tupua MRV Officer vtupua@gmail.com	MSD	• African Tulip tree as an indicator of forest degradation • An invasive tree species
26.04.2017	Visit (Rakiraki)	Mr. Nemani Vuniwaqa	Conservation International (CI) Field Office, Rakiraki	• Climate-focussed afforestation project in Rakiraki • Protection plantation • Enrichment plantation – commercial tree plantation (e.g., Teak – *Tectona grandis*, assisted by natural regeneration of native tree species • Alternative livelihood activities by the CI

Date	Method of consultation, and Venue	Person, designation and contact details	Stakeholder's name	Major topic discussed
27.04.2017	Visit	Mr. Samuela Lagataki Permanent Secretary slslagataki@gmail.com Mr. Eliki Senivasa Conservator of Forests Eliki.senivasa@gmail.com Mr Semi Dranibaka REDD+ Focal Point semi.dranibaka@gmail.com	Ministry of Fisheries and Forests Department of Forests	• Results of preliminary analysis of carbon stocks and carbon stock change (2001 – 2012) • Reflection of the consultant about the existing forest measurement and reporting system • Non-availability of activity data to prepare the FRL as mentioned in the ToR • Problems sharing (e.g., no activity data, no uncertainty assessment of EF data, problematic situation for forest stratification)
03.05.2017	Visit /Meeting (Suva)	Mr. Christian Feldmeier Project Director christian.feldmeirt@giz.de Dr. Daniel Plugge Technical Advisor daniel.plugge@giz.de	SPC-GIZ Regional REDD+ Programme II	• Possibilities of collaboration between GIZ and the consultant team on capacity develop activities
04.05.2017	Visit/ Meeting (Suva)	Sarah Pene sarah.pene@gmail.com	SESA team	• Drivers of deforestation, Land use change mapping
06.05.2017	Visit (Emalu)	Emalu Village People	Emalu REDD pilot site	• Modality of REDD+ • Expectations from the pilot area

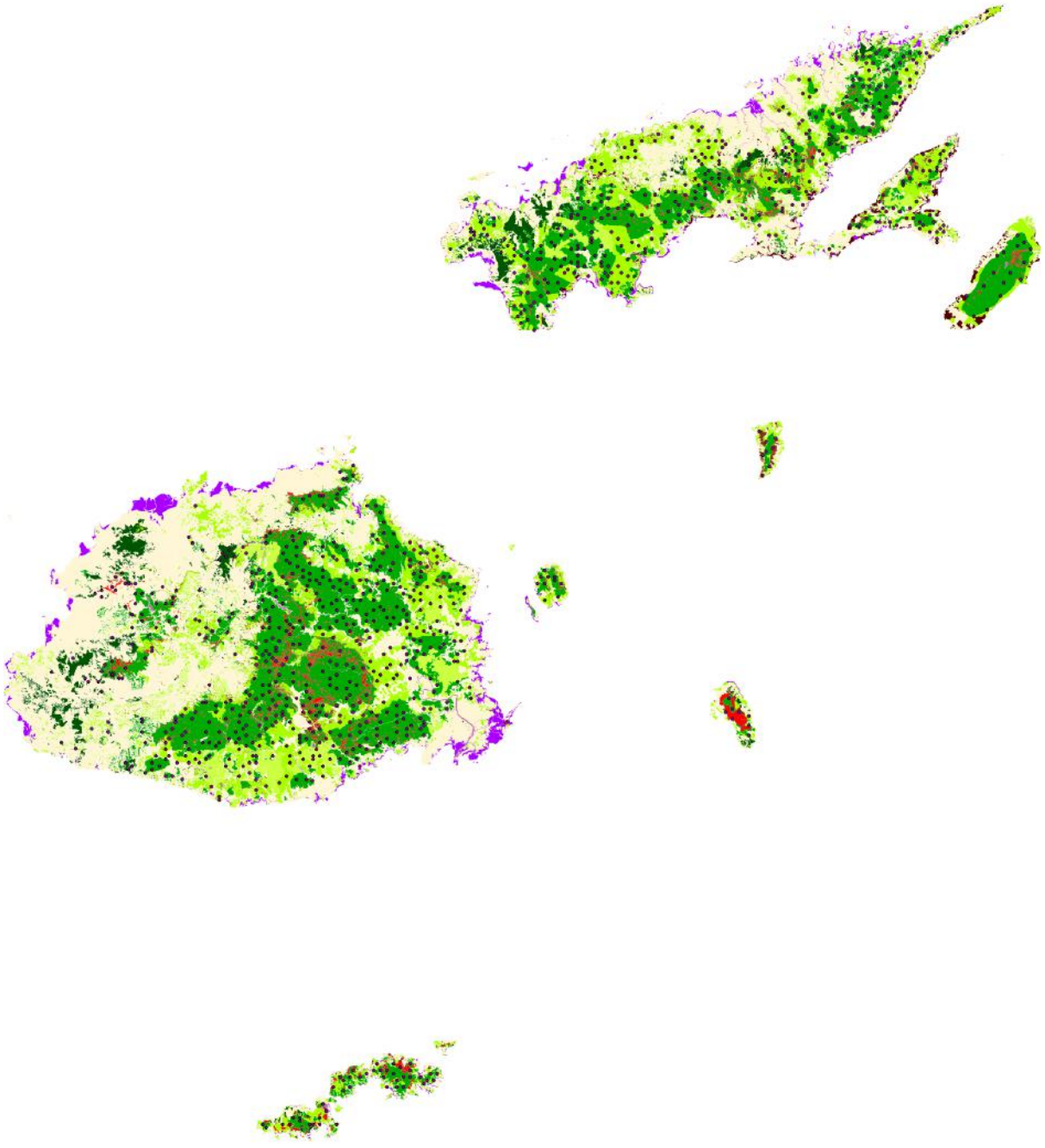
Annex D: List of participants in Inception Workshop

Date: 02-03, May 2017
Venue: Holiday Inn, Suva

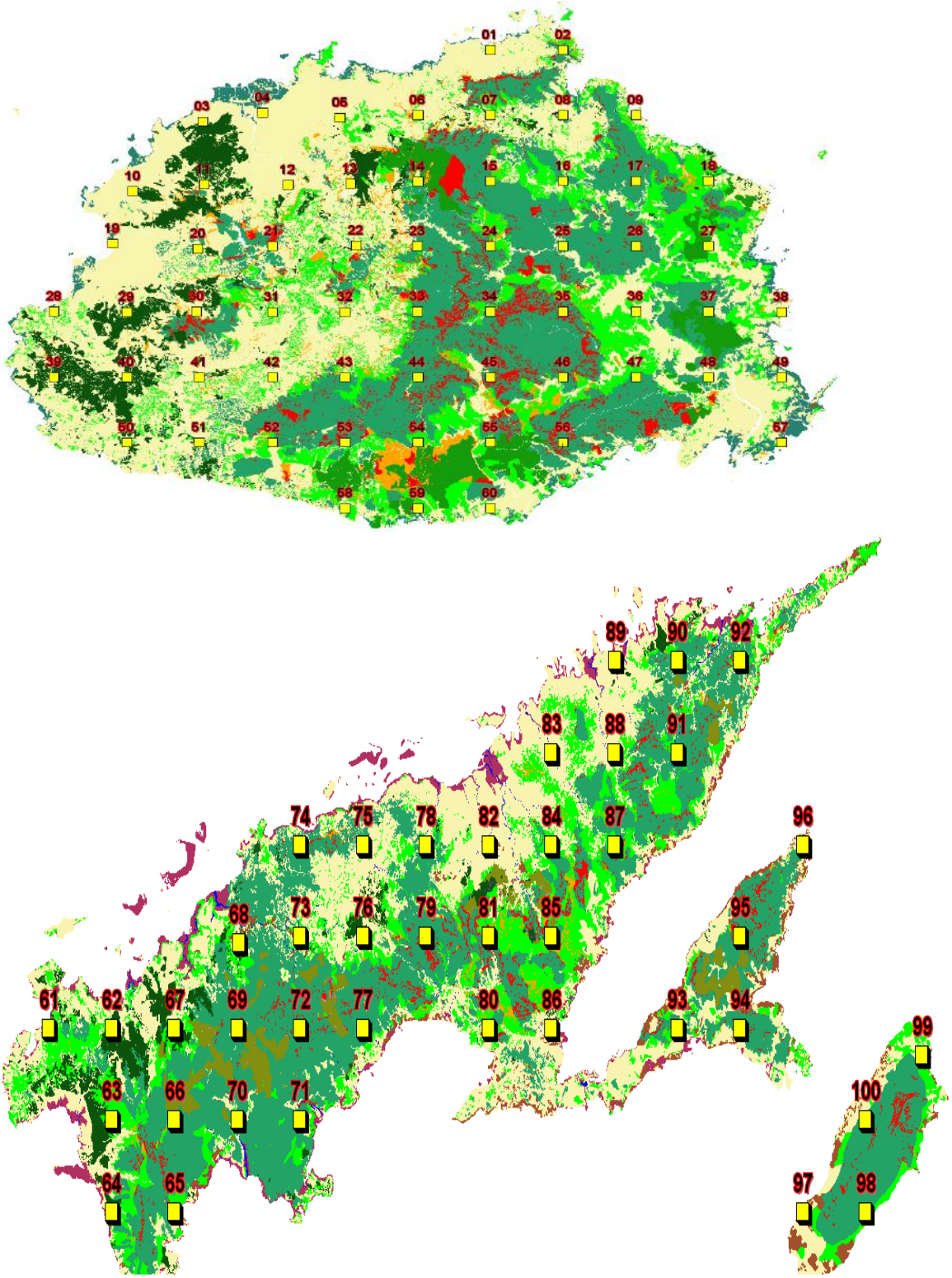
Name	Organisation	Designation	Email
Adi Nanise Nagusuca	SSMV, Ra	President Nakorowa	nanisekasami@yahoo.com
Akosita Lewai	Management Service Division (MSD)	Principal Forest Officer	akosita_lewai@yahoo.com
Alisi Vucago	Fiji Time		avucago@fijitimes.com.fj
Amena Tuisawau	FSA		amena_tui@yahoo.com
Anare Nayacakalou	MSD, Ministry of Forests (MFF)	Forest Guard	anayacakalou@ymail.com
Björn Hecht	Ministry of Forests	REDD+ Advisor	bjoern.hecht@posteo.de
Christian Fedlmeier	GIZ	Project Director	christian.Redlmeier@giz.de
Daniel Plugge	SPC/GIZ	Technical advisor	daniel.plugge@giz.de
Eroni Valili	Department of information	Assist. Information Officer	Newgovnet.gov.fj
Ilaitia		Reporter	irauiwai@gmail.com
Ilaitia Leitabu	EMALU Forest	LO REP	ilaitial@connect.com
Ilimo Tulevu	MSD, Ministry of Forests	Project officer	itulevu@yahoo.com
Joseva Duikoro	MSD, Ministry of Forests	MSD	Josevaduikoro28@gmail.com
Jossefa Naiqe	Department of Information	Assist. Information Officer	Newgovnet.gov.fj
Kathrin Krishna	Fiji Sun		kathrin.krishna@fijisun.com.fj
Kilisaniasi Koroigasagasa	MSD, Ministry of Forests	FG	kiliniasi@yahoo.com
Loraini B. Kasainaseva	SPC	REDD+ Adviser	lorainib@spc.int
Maika Daveta	FAO	NPC	maika.daveta@fao.org
Maika Tabukovu	FNU	Consultant	maika.tabukovu@fnu.ac.fj
Marama Tuivana	MSD, Ministry of Forests	Project Officer	marama.tuivana@gmail.com
Marika Tuiwawa	USP	Curator- SPRH	marika.tuiwawa@usp.ac.fj
Martin Naboua	MOE (SPC)	Senior Economist	Martin.nabola@economy.gov.fj
Michael Köhl	University of Hamburg	Consultant	michael.koehl@uni-hamburg.de
Nacani Ratabacaca	Department of	Assist. Information	Newgovnet.gov.fj

Name	Organisation	Designation	Email
	information	Officer	
Narendra Chand	University of Hamburg	Consultant	narendrachand@gmail.com
Noa Bale	MTA	A/SAO	noa.bale@govnet.gov.fj
P. Rokobiau	Pine Trust	Forest manager	prokobiau@gmail.com
Prem Raj Neupane	University of Hamburg	Consultant	neuprem@gmail.com
Priyanka Lal	Department of Information	Assist. Information Officer	newsgovnet.gov.fj
Rafaele Raboaliku	Forestry Department	Principal Utilisation Officer	rafaele_raboiliku@yahoo.com
Romuluse Rajale	MSD, Ministry of Forests	Forester	Romu.rajale@yahoo.com
Sairusi Kunadei	FMT		skunadei@gmail.com
Salanieta Matai	FNU	Lecturer II	salanieta.matai@fnu.ac.fj
Sarah Pene	USP	SESA Coordinator	sarah.pene@gmail.com
Semi V Dranibaka	Ministry of Forests and Fisheries	REDD+ Focal Point Acting Chief Forest Development Officer	semidranibaka@gmail.com
Sevanaia Tawake	Smooth Water		tawakesevanaia@gmail.com
Sukunu Cavu	MSD, Ministry of Forests		Scavu70@yahoo.com
Timoci Nakalevu	GIZ	Program Assistant	timocinakalevu@giz.de
Timoci Sukulu	IT Division, Ministry of Forests	Programmer	tlagataki@govnet.gov.fj
Viliame Tupua	REDD+ Unit, Ministry of Forests	MRV Officer	vtupua@gmail.com
Waisea Bolatolu	Ministry of Forests	MRV Officer	wisebolatolu@gmail.com
Waisea Rabuka	Ministry of Forests	TRFG	wysevabuka@gmail.com
Wolf Forstreuter	South Pacific Community	Consultant	wolf.forstreuter@gmail.com

Annex E: National Forest Inventory 2006 plot distribution



Annex F: Distribution of Permanent Sample Plots



Annex G: REDD+ stakeholder analysis matrix

REDD+ Stakeholder Analysis

High influence / High impact/interest – need to keep satisfied; engage and consult regularly

High influence / Low impact/interest – engage and consult on topics of interest; try to increase interest (move to high interest)

Low influence / High impact/interest – Meet their needs – make use of interest. Keep informed.

Low influence / Low impact/interest – Keep informed via low effort means

(**Stakeholder type**: Donor, Government, Private sector, INGO, NGO, CSO, Media, Research, other; **Level**: International, Regional, National, Local; **Interest**: How much interest do they have in REDD+? (Low – L, Medium- M, High- H); **Influence**: How much influence do they have over the REDD+ processes? (Low – L, Medium- M, High- H))

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
Academia	Fiji National University (FNU)	Maika Tabukovu maika.tabukovu@fnu.ac.fj Salanieta Matai Salanieta.matai@fnu.ac.fj	National	H	H	REDD+ readiness and REDD+ implementation supported by background studies and experimental/action research for 'adaptive' REDD+ Financial support for research and development Employment opportunities	Research and development Raising awareness Inclusion of Climate change and REDD+ in University curricula	Involvement in REDD+ institutional set up at levels Research and development (R&D) consultancies Research internship for MSc/PhD students/fresh graduates Capacity building (co-organizing) Providing guest lectures on climate change and REDD+
Academia	University of the South	Mr Marika Tuiwawa	National	H	H	REDD+ readiness and REDD+ implementation	Research and development	Involvement in REDD+ institutional set up at

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	Pacific (USP) – Institute of Applied Sciences	marika.tuiwawa@usp.ac.fj Dr Isoa Korovulavula isoa.korovulavula@usp.ac.fj Dr Sarah Eftonga Pene sarah.pene@gmail.com				supported by background studies and experimental/action research for 'adaptive' REDD+ Support for research and development Employment opportunities	(Biodiversity sector in particular) Raising awareness Inclusion of Climate change and REDD+ in University curricula	levels) R&D consultancies Research intern Capacity building (co-organizing) Providing guest lectures on climate change and REDD+
CSO & NGO	Conservation International	Ms Susana Tuisese Director swaqainabete-tuisese@conservation.org	International	H	H	Alternative livelihood activities Functioning safeguard system	Contributing to REDD+ readiness Carbon enhancement Non-carbon benefits Financial support to implement REDD+ strategies, policy and measures (PAM) Experiences in reforestation project for reduction of Carbon Footprint (Fiji Water) Conservation project (Sovi Basin) served as blueprint for Emalu lease Data on A/R areas (ha) and locations, species	Collaboration in policy design Involvement in REDD+ institutional set up at levels Conduct sector-focused / Thematic meetings and workshops

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
CSO & NGO	CSO/NGO Platform	Ms Finau Tabakaucoro ftabakaucoro@gmail.com Ms Nunia Thomas nuniat@naturefiji.org	National	H	H	Recognition by the Government of Fiji Involvement in REDD+ readiness processes	Consultation and participation Capacity building Dissemination of REDD+ approach to the grass root level	Recognize CSO Platform Conduct sector-focused / Thematic meetings and workshops Capacity building
CSO & NGO	Fiji Crop and Livestock Council (FCLC)	Simon Cole (9921757)	National	L	M	Alternative livelihood activities	REDD+ awareness Part of Grievances Redress Mechanism (GRM)	Engagement in REDD+ strategic options design process Capacity building Involving them in GRM Data and experience sharing
CSO & NGO	Fiji Mahogany Trust	Ratu Tomasi Kubuabola tomasikay@gmail.com Sairusi Kunadei	National	H	L	Capacity Development of landowners Extension services Institutional structures	Part of policy making processes Facilitation and participation of landowners Facilitating lease renewal	Involvement in REDD+ institutional set up at levels (also in REDD+ Divisional WG) Capacity building Part of Grievances Redress Mechanism (GRM)
CSO & NGO	Fiji Pine Trust	Pita Rokobiau prokobiau@gmail.com	National	H	M	Capacity Development of landowners Extension services Institutional structures Facilitation on land leasing/ Renewal of leasing	Part of policy making processes Facilitation and participation of landowners Facilitating lease	Involvement in REDD+ institutional set up at levels (also in REDD+ Divisional WG) Capacity building Part of Grievances

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
							renewal	Redress Mechanism (GRM)
CSO & NGO	Fiji Sawmiller's Association	Amena Tuisawau amena_tui@yahoo.com	National	H	M	REDD+ should not be detrimental to timber harvesting and trade in legal timber. In this regard, more information and a high assurance are needed.	Policy making Data and information sharing	Involvement in REDD+ institutional set up at levels Capacity building
CSO & NGO	Live and Learn Environmental Education	Mr Josefa Lalabalavu josefa.lalabalavu@livelearn.org	National	H	M	REDD+ National Governance Standards are formulated and effective Capacity building	REDD+ awareness Capacity building of landowners Institutional strengthening (Formation of cooperatives) Alternative livelihood activities	Monetary and non-monetary support for REDD+ interventions (e.g., for livelihood enhancements, capacity building)
CSO & NGO	Nature Fiji-Mareqeti Viti	Nunia Moko (Steering committee member)	National	H	M	REDD+ National Governance Standards are formulated and effective Capacity building	REDD+ awareness Capacity building of landowners Institutional strengthening (Formation of cooperatives) Alternative livelihood activities	Monetary and non-monetary support for REDD+ interventions (e.g., for livelihood enhancements, capacity building)
CSOs & NGOs	Soqosoqo Vakamarama	Ms Finau Tabakaucoro ftabakaucoro	National	H	M	FPIC Gender inclusive REDD+ activities	Empowerment of women Facilitating lease process	Involvement in REDD+ institutional set up at levels

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
		@gmail.com				Cancun and World bank safeguards are addressed and respected Mainstreaming women in REDD+ activities	(Women headed Mataqali)	Capacity development
CSOs & NGOs	NTROC	Provincial Administration	National	M	L	FPIC	Facilitating lease process on native land	Involvement in REDD+ institutional set up at levels Capacity development
CSOs	Drawa Cooperative REDD+ project	Peni Maisiri Cahirman	National	H	L	FPIC Rights over the carbon Capacity building Monitory and non-monetary incentives	Land leasing for REDD+ activities Support to implement REDD+ activities Monitoring	Capacity building Monitory and non-monetary incentives
Commissioners Office	Commissioners Province: Administrators, Roko Tuis	Roko Tui's	National	H	H	FPIC Cancun/World Bank Safeguards are addressed and respected Functioning Grievances Redress Mechanism (GRM) Capacity building and awareness about pros and cons about REDD+ Functioning and legally supported Benefit Sharing Mechanism	Land leasing to REDD+ activities REDD+ activities implementation (Real-time) Monitoring	Involvement in REDD+ institutional set up at levels Capacity building Monetary and non-monetary incentives
Government	Agriculture Department (Ministry of	Mr Nacanieli Waka, Director,	National	M	H	Agroforestry and village wood lot promotion REDD+ addresses the slash-	Collaboration in designing and implementing REDD+	Collaboration in policy design and enforcement Involvement in relevant

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	Agriculture), Extension offices & Land Use Division	Land Resources Planning Department nwaka@agriculture.gov.fj Mr Gilbert Lewanavanua Team Leader, Land Use glewanavanua@govnet.gov.fj Solomoni Nagaunavou, Assistant Team Leader				and-burn activities Afforestation Crop diversification	strategic options Promoting intensive agriculture Agroforestry Village woodlot promotion Information on crop, livestock and farmers	decision making and implementing REDD+ institutional set up at levels Conduct sector-focused / thematic REDD+ meetings and workshops
Government	Bureau of Statistics	Director	National	L	L	Database (relevant) data sharing and exchange	Providing information on Social (demographic), Economic, Bio-physical situation and trends	Conduct sector-focused / thematic REDD+ meetings and workshops Involvement in capacity building, trainings, and NFMS database management
Government	Climate Change Unit - Ministry of Economy	Mr Nilesh Prasad, Director Climate	National	H	H	Effective implementation and reporting of REDD+ activities Disbursement of	National focal point for change in Fiji and UNFCCC International policy	Monitoring of financial transactions Collaboration in the design of policy and

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	(NDA for UNFCCC) Strategic Planning Unit	Change Division Manasa Katonivualiku Aradhana Singh Mr Ovini Ralulu, OIC Management Services / Planning oralulu@economy.gov.fj				international financial support	support, climate negotiation, international relations (Global, and South-south cooperation) Engaged with multilateral and bilateral partners for REDD+ financial and technical support	measures- Benefit Sharing Mechanism, in particular Involvement in REDD+ institutional set up at levels
Government	Department of Energy	Inia Saula inia.saula@moit.gov.fj	National	L	L	Capacity building Technological transfer in low-carbon emission energy sector through REDD+	Providing information on hydropower, alternative energy, bio-energy etc. Preparation of international communications	Involvement in REDD+ institutional set up at levels Capacity building
Government	Department of Environment (National focal point to the Convention on Biological	Mr Aminiasi Qareqare, Principle Environment officer, Department of Environment	National	M	M	Biodiversity safeguards are addressed and respected Restoration of degraded forest land Interventions for the conservation of Mangroves and coastal ecosystem	Technical support for measurement and monitoring of forest biodiversity and forest ecosystem services Supporting REDD+ implementation	Involvement in design, implementation and monitoring of non-carbon benefits (e.g., Biodiversity monitoring, SIS) Involvement in REDD+ institutional set up at levels

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	Biodiversity (CBD) secretariat))	aminiasi.qareqare@environment.gov.fj Ms Sandeep Singh, Director Environment singhsk@govnet.gov.fj						
Government	Ministry of Forests	Mr Semi Dranibaka, Acting Chief Forest Development Officer REDD+ Focal Point semidranibaka@gmail.com Mr Waisea Bulatolo Project Manager, RDF Mr Maika Daveta Combating Desertificatio	National	H	H	Functioning REDD+ Programme	REDD+ Focal Point Implementation of REDD+	REDD+ National Program design and implementation

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
		n						
Government	Meteorology Department	Mr Sepesa Gauna (8429265)	National	L	L	REDD+ implementation use the data and information services (early warning system) while designing activities related to afforestation and forest fire management	Climate and hydrological data and projections (relevant for afforestation, forest fire)	Involvement in REDD+ institutional set up at levels (e.g., REDD+ MRV WG)
Government	Ministry of Forests-Management Service Division & Division of Forestry office	Mrs Akosita Lewai, PMO Akosita_lewai@yahoo.com	National	H	H	Capacity building Functioning NFMS	NFI, LU and LUC Assessment, Research, MM & R Host REDD+ Unit Research and Development	Major component of MMR Involvement in REDD+ institutional set up at levels
Government	Mineral Resource Department (Ministry of Lands and Mineral Resources)	Ms Akata Takala, Director Cartography	National	L	H	REDD+ should not undermine the licensing for minerals	Data sharing for REL and MRV Land Use Planning	Involvement in REDD+ institutional set up at levels Capacity building
Government	Ministry for Rural and Maritime Development and National Disaster	Ms Loata Vakacegu Deputy Secretary loata.vakacegu@govnet.go	National	H	M	Facilitate to and initiatives for formalizing the land tenure FPIC Cancun/World Bank Safeguards are addressed	Land leasing to REDD+ activities REDD+ activities implementation (Real-time) Monitoring	Initiative to formalize the land tenure Involvement in REDD+ institutional set up at levels Capacity building

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	Management	v.fj				and respected Functioning GRM Capacity building and awareness about pros and cons about REDD+ Functioning and legally supported Benefit Sharing Mechanism		Monetary and non-monetary incentives
Government	Ministry of Education, Heritage & Arts & National Archives of Fiji	Mr Saimoni Waibuta, Deputy Secretary saimoni.waibuta@govnet.gov.fj Ms Releshni Karan, Director Corporate Services	National	M	H	Climate change and REDD+ awareness at all level of education Green (or eco-school) school program	Research and development Awareness raising Resource person for REDD+ Capacity building	Research and development Providing research and training materials Funding awareness campaigns
Government	Ministry of I-Taukei Affairs	Marilyn Korovusere Marilyn.korovusere@govnet.gov.fj	National	H	M	Climate change and REDD+ awareness at all level of education Green (or eco-school) school program	Research and development Awareness raising Resource person for REDD+ Capacity building	Research and development Providing research and training materials Funding awareness campaigns
Government	Ministry of Social Welfare	Ms Sala Gulivakadua	National	L	L	FPIC Gender inclusive REDD+ activities	Participating in SESA	Involvement in REDD+ institutional set up at levels)

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
						Cancun and World bank safeguards are addressed and respected		Participation in SESA Capacity building
Government	Ministry of Women, Children and Poverty Alleviation	Ms Asenaca Qiolevu	National	M	M	Gender and inter-generational inclusive REDD+ activities Pro-poor REDD+ activities Capacity building Enhancement of livelihoods of forest dependent people including women	Part of decision making process REDD+ awareness Participating in implementation of REDD+ activities	Involvement in REDD+ institutional set up at levels Capacity building Financing livelihood enhancement activities
Government	Ministry of Youths and Sports	Timoci Bakanivesi	National	M	L	Support (training, funding) for general awareness on climate change, forest management and sustainability	Awareness through stakeholder networks, e.g. schools and youth groups	Involvement in REDD+ institutional set up at levels Capacity building
Intergovernmental Organization	Pacific Community	Mr Sairusi Bulai Sairusib@spc.int Mr Jalesi Mateboto jalesim@spc.int	Regional	H	H	Research findings and lessons learned be included in national REDD+ Policies Capacity building of national and sub-national level	Research and Development Finance and in-kind support Information sharing and dissemination Highlighting REDD+ agenda in international forums	Involvement in REDD+ institutional set up at levels Request for their convening power for coordination, cooperation, and technical and technological support
International Agencies	Deutsche Gesellschaft für	Mr Christian Fedlmeier Christian.fedl	Internati onal	H	M	REDD+ implementation meeting UNFCCC requirements	Financial and technical (MMR) support to REDD+ readiness	Involvement in REDD+ institutional set up at levels

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
	International e Zusammenarbeit (GIZ)	meier@giz.de Mr Daniel Plugge Daniel.plugge@giz.de Vilisi Naivalulevu Timoci Nakalevu timocinakalevu@giz.de				Findings and lesson learned are included in Country REDD+ policies Effective enforcement of forest policies and guidelines	processes Research and development Dissemination of research results Information sharing Capacity building Coordination and cooperation among Pacific Countries in REDD+ activities International workshops and conferences	Capacity building activities
International cooperation	FAO (GEF 4)	Mr Rudolf Hahn Mr Ilai Tulele	International	M	L	Coordination between the regimes having similar policy goals (reducing deforestation, poverty alleviation, SFM)	Funding Guidance and Guidelines Capacity building	Involvement in REDD+ institutional set up at levels Using FAO convening power to facilitate policy development Linking REDD+ with other FAO led policy regimes (FLEG, SFM etc.) and Programs Participating in FAO workshop and conferences and bring the REDD+ country agendas
Internation	Pacific	Mr Wolf	Regional	H	H	Engagement in REDD+	Providing support for	Involvement in REDD+

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
al cooperation	Community – GeoScience Division	Forstreuter wolf.forstreuter@gmail.com				activities particularly for Activity data	activity data Capacity building Research and development	institutional set up at levels (e.g., REDD+ MRV WG) Involve GSD in activity data processing and analysis
Landowner Representative	REDD+ Pilot Site Mataqali Emalu	Mr Ilaitia Leitabu ilaitial@connect.com.fj	Local	H	H	FPIC Rights over the carbon Capacity building Monitory and non-monetary incentives	Land leasing for REDD+ activities Support to implement REDD+ activities Monitoring	Capacity building Monitory and non-monetary incentives
Media	Fiji Times Fiji Sun Fiji TV1 FBC TV	Reama Reama T. Naco reama.naco@gmail.com	National	L	M	Information sharing Financial support for information dissemination (news articles, documentary)	Dissemination of REDD+ activities Awareness raising	Sharing information Capacity building Financing (disseminating materials, audio-visual aids, participation in international workshop/conferences)
Multi-stakeholder working group	Divisional REDD+ Working Group (Northern and Western Division)	Northern DRWG Mr Tevita Bulai & Western DRWG Ms Amelia Waqanibeqa	National	H	H	Capacity building Engagement into policy making process	Designing and implementation of REDD+ policy measures at provincial level Part of the monitoring system and GRM Oversee REDD+ implementation program at divisional	Regularly conduct sector-focused REDD+ meetings and workshops Involvement in REDD+ institutional set up at levels Designing and implementation of REDD+ policy measures at

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
							level	provincial level Capacity development particularly on REDD+ related international negotiations, and country REDD+ readiness
Private	Scientific Forestry Fiji Ltd.	Mr Usa Tukana usa@sfsfiji.com	National	H	L	REDD+ implementation use their high quality products (seedlings), services and database (soil testing, plant grafting)	Providing high quality seedlings for forestation (A/R, enrichment plantation and degraded land restoration)	Involvement in REDD+ institutional set up at levels Obtain high quality seedlings of Mahogany, Teak, Pine and Sandalwood for forestation activities Facilitate landowners to get superior seedlings for agroforestry and village wood lots. Use their database on soil testing
Statutory Bodies	iTaukei Land Trust Board (TLTB) (Ministry of iTaukei Affairs)	Mr Solomoni Nata snata@tltb.gov.fj Raijeli Taylor, Director Research rtaylor@tltb.gov.fj	National	H	H	Community needs are addressed; community formal/informal tenure rights are respected including land rights of the registered land owning unit Legal provision on Benefit Sharing Mechanism (Payment of REDD+ and other PES specified by Act)	Faster lease issuance, Encourage landowners to take part in REDD+ activates	Involvement in REDD+ institutional set up at levels Capacity building of land owners Payment of lease money in time

Stakeholder Type	Stakeholder Name	Contact person	Level	Interest	Influence	Stakeholder expectations towards REDD+	How does/could the stakeholder contribute to REDD+?	Strategy for engaging the stakeholders in REDD+ processes
Statutory Body	Fiji Electricity Authority	CEO	National	L	H	Capacity building Technological transfer in low-carbon emission energy sector through REDD+	Providing information on hydropower, alternative energy, bio-energy etc. Preparation of international communications	Involvement in REDD+ institutional set up at levels Capacity building
Statutory body	Fiji Hardwood Corporation Limited (FHCL)	CF / PS to connect with CEO and invite them	National	L	M	Carbon assessment of Mahogany Plantation Capacity building to FHCL and land owners	Forestation (Afforestation and Reforestation - A/R) Data sharing Forest Inventory, Forest Mapping	Involvement in REDD+ institutional set up at levels Capacity building Conduct workshops and conferences to update the private sector
Statutory body	Fiji Pine Limited	Mr. Asesela Wata General Manager ACokanacagi@tropik.com.fj	National	H	M	Include more private plantations/private woodlots Forest management training to landowners Market exploration for private forest owners Capacity building to FHCL and land owners	Forestation (Afforestation and Reforestation - A/R) Data sharing Forest Inventory, Forest Mapping	Involvement in REDD+ institutional set up at levels Capacity building Conduct workshops and conferences to update the private sector
Statutory Bodies	Water Authority of Fiji (WAF)	CEO	National	H	M	Support (training, funding) for general awareness on climate change, forest management and sustainability	Awareness through stakeholder networks, e.g. schools and youth groups	Involvement in REDD+ institutional set up at levels Capacity building

Annex H: Work Plan

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
1. Situational analysis and data revision, final work plan development	1. Data assessment: availability of forest data (Activity data – AD and Emission Factors - EF) and methods 2. Gaps are identified to meet the UNFCCC reporting requirements (IPCC Guidance and guidelines, Principles of *good practice*) 3. Stakeholder mapping, and 4. Consultancy work plan finalized, and agreed and validated by the RSC.	1. Review: policy and institutional set-up and decisions relevant to REDD+ process 2. Screening: assessment of existing relevant studies, assessments, reports and data sets on forest (management) 3. Gap assessment (target and actual comparison): availability of forest data and methods and UNFCCC/IPCC (reporting) requirements 4. Stakeholder consultation / mapping 5. Revise and finalize consultancy work plan 6. Validate work plan by RSC	M1	Report 1 – Situational analysis: - Stakeholder assessment - Gap analysis (IPCC GPG reporting/good practice requirements and existing activities and EF data availability /methods) Report 1 includes: - Consultancy work plan (revised) - Budget allocation - Coordination mechanism
2. Development of a national forest reference level (FRL)	A 'comprehensive' FRL for the period of 2007 - 2017 in accordance with the UNFCCC, IPCC GPG and FCPF Carbon Fund MF standards	1. Review- studies on drivers of deforestation and forest degradation 2. Develop different approaches for the FRLs 3. Uncertainty analysis for each of the approaches 4. Determining the approach that has the highest potential for generating climate benefits 5. Evaluation of alternatives/draft FRL 6. Construction of FRL	M1-M8	1. Report: “Methodology Development for FRL” (D-2) 2. Report: “FRL construction for the different REDD+ activities, with sub-national relevance” (D-3) 3. Module for SOP describing the applied methodology for developing a FRL, broken down for each activity and locality 4. Documentation of the consultation and decision-making process

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
3. Development of a NFMS, including monitoring, measuring, reporting and verifying (M & MRV) carbon emissions and removals (ERs)	A NFMS: - that provides methods and procedures for monitoring and reporting anthropogenic GHG ERs associated with avoided deforestation, avoided forest degradation through SFM, and enhancement of forest carbon stocks by A/R activities; and - which is guided by the IPCC guidance and guidelines, based on the principles of *good practice*, and suitable for MRV of REDD+ activities, as well as consistent with FCPF MF.	1. Methodology development for stakeholder consultation, 2. Methodology development for MRV and NFMS processes, 3. Establishment of NFMS and MRV 4. SOP for NFMS and MRV, and 5. Documentation.	M1-M9	1. Report: "Methodology development for NFMS and MRV" (D-4) 2. Report: "NFMS establishment" (D-6) 3. Module for SOP describing the applied methodology for NFMS and MRV, the integration of different elements, information provided, and compliance with international requirements – according to specifications made in the TOR 4. Documentation of the consultation and decision-making process

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
4. Forest carbon inventory test	1. As a component of NFMS development, a NFI test builds upon the NFI and PSP – conducted, 2. Forest carbon inventory database is functional, 3. Capacity building: forest inventory design, in-situ or remote carbon measurement, data management, accuracy assessment and error analysis, and 4. Recommendation and work plan and tentative cost for NFI.	1. Consolidation and integration of the existing data and information, 2. Preparation phase: -Preparation of NFI test -Selection of test sites, 3. Capacity building trainings: -Organizing logistics/equipment - Field assessment -Data submission 4. Implementation of NFI test: - In-situ/remote carbon measurement - Transferring data to database 5. Data analysis - Activity data and emission factors -Uncertainties 6. QA/QC, and 7. Preparation of draft inventory report.	M1-M8	1. Report on the preparation, implementation and analysis of the forest inventory (D-5), 2. Report: "Collection of emission factor / field data to test all practical elements of the system" (D-7), 3. Module for SOP describing all operational aspects of NFMS/ MRV (field work preparation, field assessments and measurements, community engagement, data handling, data analysis, verification, reporting, etc.) 4. Documentation of the consultation/ review process, and 5. Documentation of capacity building measures.

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
5. Database development	A functional database: - as a component of NFMS (NFIS), - supplemented by a specified protocol, and - fully run by trained staff.	1. Integration of data with diverse thematic areas and nomenclature, varying spatial and temporal resolutions, and prepared in different format, 2. Analysis of data sources and interfaces, 3. Design of the logical model, 4. Draft physical design, 5. Implementation of the data model, 6. Creating an application for entering field data and to transfer the data from electronic recording devices, and 7. Capacity building.	M6	1. Functional database according to the TOR (as part of D-9), 2. Report: "Identification of database specifications and locations" (D-8), 3. Report: "Database development and establishment" (D-9), 4. Module for SOP describing all operational aspects of the database management and application, 5. Documentation of the consultation and decision-making process, and 6. Documentation of capacity building measures.
6. Quality Assurance/Quality Control (QA/QC) procedures	A complete set of SOPs which covers all of the consultancy tasks; and expert peer reviewed QA/QC measures	1. SOPs for all of the tasks under consultancy, 2. Hot, exit and cold checks, and 3. Training on the different aspects of the QA/QC.	M1-M11	1. Report on QA/ QC procedures, followed by validation processes, 2. A set of SOPs, and 3. Documentation of the consultation and decision-making process, implementation, and analysis, documentation of capacity building measures (D10)

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
7.Guidance on the nesting of sub-national MRV and FRL within national MRV and FRL	A draft text on guidance on the nested approach of FRL and MRV to be included as a chapter of the ERPD	1. Review of jurisdictional / project level MRVs 2. Review of project documents (REDD+ initiatives and Pilot projects), and project site visit (e.g., Emalu and Drawa): - Stakeholder consultation: project developer, project implementer, local people - Benefit Distribution Mechanism and information on safeguards - Institutional and technical capacity of the forest / landowners in the program, and 3. Preparation of a guidance document for nested approaches to integrate jurisdictional / project level REDD+ activities into national REDD+ scheme.	M1-M6	1. Report on nesting of sub-national with national MRV and FRL, including draft text for chapters on carbon accounting and programme design/ implementation of the ERP Document (part of D-4)

Project tasks	Expected outcomes	Key activities	Schedule	Deliverables
8.Capacity development	1. Capacity gap assessed, 2. Appropriate capacity building to match between known REDD+ requirements and current country capacity accomplished, and 3. Plan for near-term (First commitment period) capacity building is presented.	1. Assess current measurement and reporting capacity, and identify capacity gaps, 2. Determine information to be analysed and identify information sources, 3. Determination of capacity building in terms of NFMS, and REDD+ policy development and REDD+ Phase, 4. Prioritization of capacity building activities / trainings, 5. Capacity development plan 2017 (consultancy period), 6. Capacity building (Trainings, consultations, workshop, seminar), and 7. Post consultancy capacity development plan (Implementation phase).	M1-M12	1. Report: - Capacity gap assessment - Capacity development plan (2017) 2. Training / Seminar proceedings, and 3. Near-term Capacity Development Plan (Implementation phase, First commitment period).

Annex I: Breakdown of contract price

Description	USD	FJD
A. Remuneration	356,809	197,740
B. Reimbursable including capacity building	154,150	364,772
Total	**510,959**	**562,512**

FIJI REDD+ STEERING COMMITTEE SPECIAL MEETING

INCEPTION WORKSHOP OF THE MRV CONSULTANCY

Presentations

Date: **Tuesday, 2 May, and Wednesday, 3 May 2017**

Venue: Holiday Inn, Suva

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Establishing Forest Reference Level

MRV/NFMS Development

Michael Köhl
Institute for World Forestry
University of Hamburg

Suva, 2-3 May 2017

Decision 4/CP. 15, Paragraph 1d

Use **a combination of remote sensing and ground-based forest carbon inventory approaches** for estimating ... anthropogenic forest forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes

Activity Data

Emission Factors

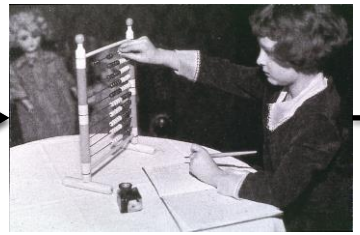


TABLE 2.3.4
ILLUSTRATIVE EXAMPLE OF APPROACH 2 DATA IN A LUC MATRIX WITH CATEGORY SUBDIVISIONS

Final \ Initial	Forest land (Unmanaged)	Forest land (Managed)	Grassland (Rough grazing)	Grassland (Improved)	Cropland	Wetlands	Settlements	Other land	Final area
Forest land (Unmanaged)	5								5
Forest land (Managed)		10	1	2	1				14
Grassland (Rough grazing)		2	56						58
Grassland (Improved)			2	22					24
Cropland					29				29
Wetlands						0			0
Settlements		1	1		1		5		8
Other land								2	2
Initial area	5	13	60	24	31	0	5	2	140
NET change	0	+1	-2	0	-2	0	+3	0	0

Note: Column and row totals show net changes in land use as presented in Table 2.3.2 but subdivided into national subcategories as in Table 2.3.3. "Initial" indicates the category at a time previous to the date for which the assessment is made and "Final" the category at the date of assessment. Net changes (bottom row) are the final area minus the initial area for each of the (sub) categories shown at the head of the corresponding column. Blank entry indicates no land-use change for this transition.

Available Data and Reports

Reference	Reports	Availability for consultants
1	Report on construction of an REL/RL in Fiji (Trines, 2012),	yes
2	Forest data accuracy assessment from 2014 (SPC / GIZ)	yes
3	Forest cover change analysis for 2001-2007	yes
4	Forest cover change analysis for 2007-2012	no
5	Fiji National Forest Carbon Stock Assessment (Payton & Weaver, 2011)	yes
6	Drivers of deforestation and forest degradation study	no
7	Current and planned policies that affect the land use in Fiji	no
	Data	
8	NFI 2006 data	yes
9	PSP 2010 and 2012 data	yes
10	Land use stratification	no
11	Forest cover change analysis currently being undertaken with Earth Collect/ FAO Open Foris	no

FCPF Forest Fund Methodological Framework

3.1 Scope and Methods

Indicator 3.1: The ER Program identifies which anthropogenic sources and sinks associated with any of the REDD+ Activities will be accounted for in the ER Program.

Key activities

(i) enhancement of carbon stocks

(ii) avoided deforestation through establishment of conservation areas and land use planning

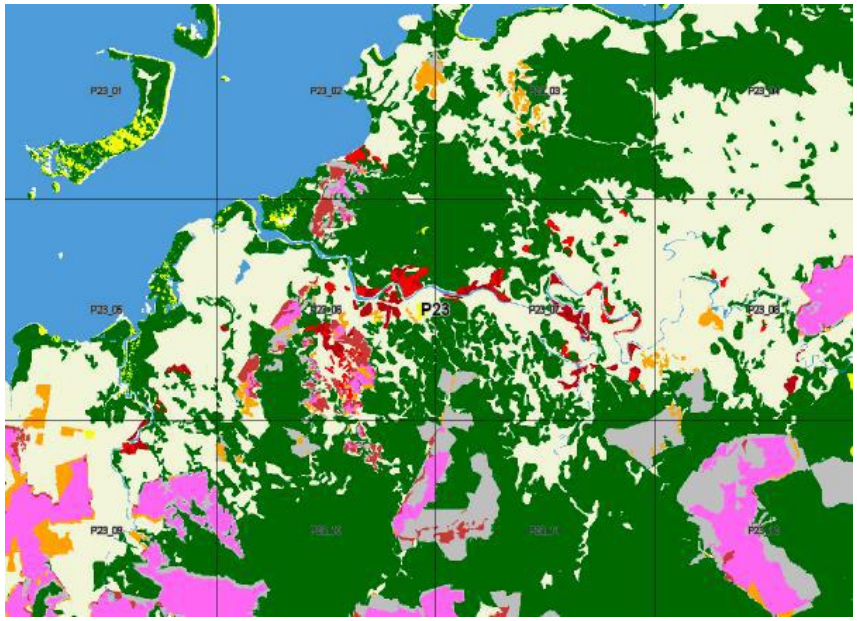
(iii) avoided forest degradation through sustainable management of forests

FCPF Forest Fund Methodological Framework

3.1 Scope and Methods

Indicator 3.1: The ER Program identifies which anthropogenic sources and sinks associated with any of the REDD+ Activities will be accounted for in the ER Program.

Indicator 3.2: The ER Program accounts for emissions from deforestation.



FCPF Forest Fund Methodological Framework

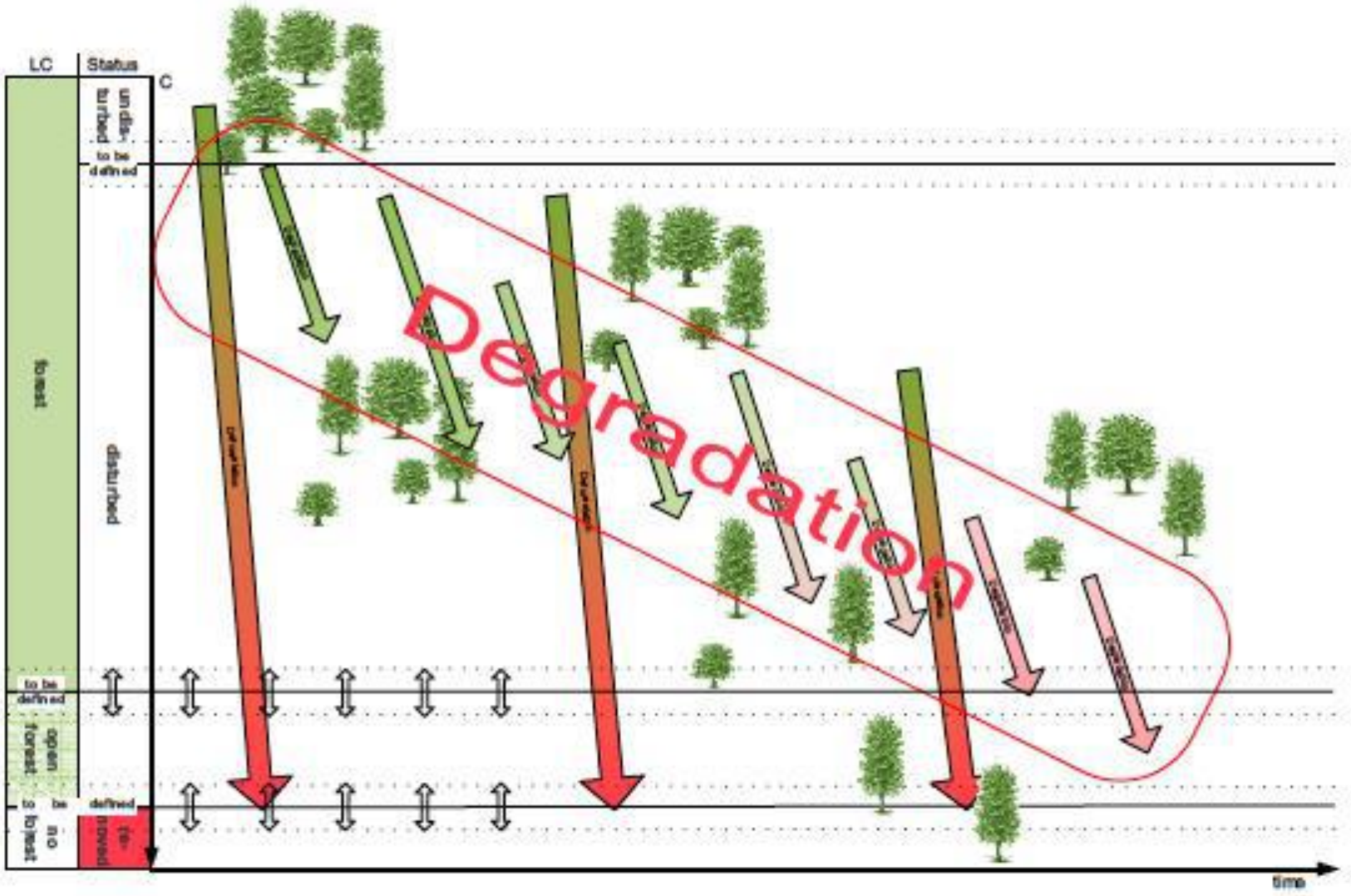
3.1 Scope and Methods

Indicator 3.1: The ER Program identifies which anthropogenic sources and sinks associated with any of the REDD+ Activities will be accounted for in the ER Program.

Indicator 3.2: The ER Program accounts for emissions from deforestation.

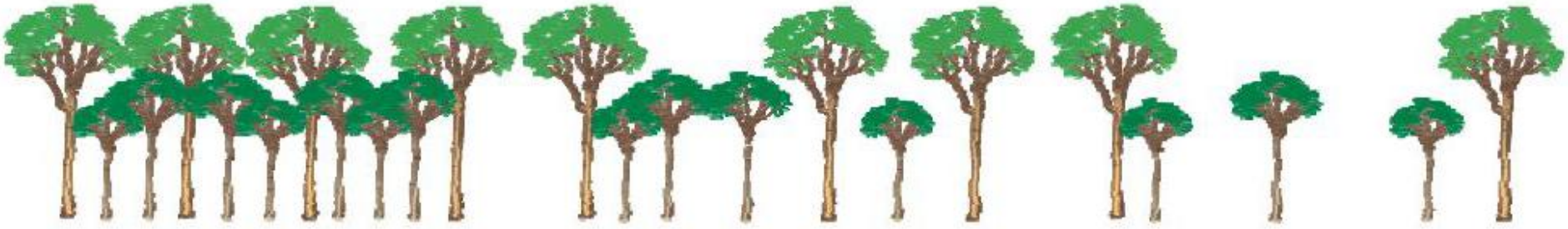
Indicator 3.3: Emissions from forest degradation are accounted for where such emissions are more than 10% of total forest-related emissions in the Accounting Area, during the Reference Period and during the Term of the ERPA. These emissions are estimated using the best available data (including proxy activities or data).

Degradation/ Deforestation



Source: Baldauf, Plugge, Rquibate, Köhl, 2009: FAO, Forest Resources Assessment Working Paper 162

Degradation/ Deforestation



Biomass Stock Time 1

Biomass Stock Time 2

Not detectable by passive remote sensing

Biomass Stock Time 3

Detectable by passive remote sensing

Proxy: GPS measurements from areas with harvesting licences

Source: Baldauf, Plugge, Rquibate, Köhl, 2009: FAO, Forest Resources Assessment Working Paper 162

3.1 Scope and Methods

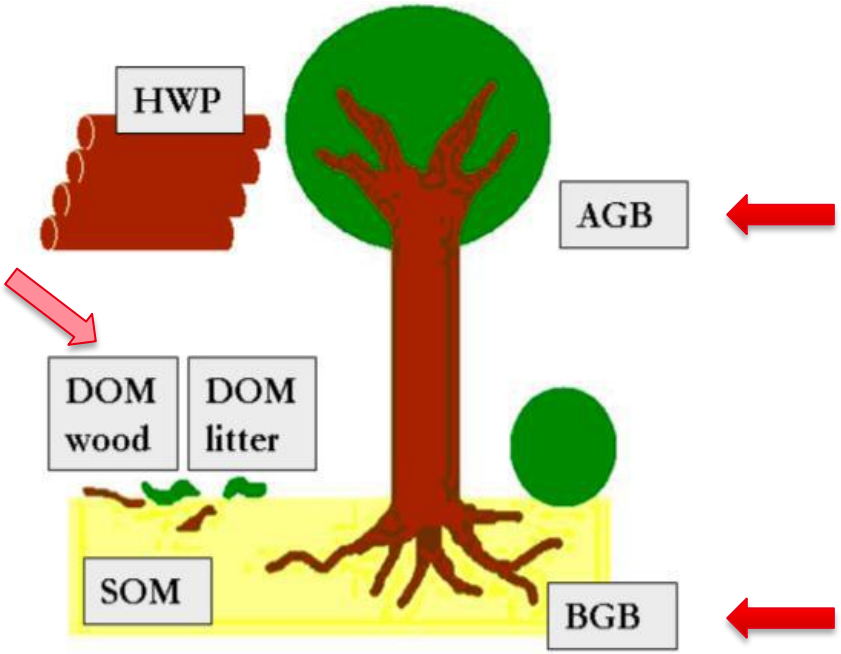
Indicator 3.1: The ER Program identifies which anthropogenic sources and sinks associated with any of the REDD+ Activities will be accounted for in the ER Program.

Indicator 3.2: The ER Program accounts for emissions from deforestation.

Indicator 3.3: Emissions from forest degradation are accounted for where such emissions are more than 10% of total forest-related emissions in the Accounting Area, during the Reference Period and during the Term of the ERPA. These emissions are estimated using the best available data (including proxy activities or data).

3.1 Scope and Methods

Indicator 4.1: The ER Program accounts for all Carbon Pools and greenhouse gases that are significant within the Accounting Area, both for Reference Level setting and Measurement, Monitoring and reporting (MMR).



(AGB above-ground biomass; BGB below-ground biomass; SOM soil organic matter; DOM dead organic matter; HWPs harvested wood products)

3.1 Scope and Methods

Indicator 4.2: Carbon Pools and greenhouse gases may be excluded if:

i. Emissions associated with excluded Carbon Pools and greenhouse gases are collectively estimated to amount to less than 10% of total forest-related emissions in the Accounting Area during the Reference Period; or

ii. The ER Program can demonstrate that excluding such Carbon Pools and greenhouse gases would underestimate total emission reductions.

Aboveground biomass	=> biomass equation: AGB=f(DBH)
Belowground biomass	=> root : shoot-ratio (1.2 to 1.3)
Harvested Wood Products	=> underestimation (4.2.ii)
Soil organic matter	=> literature
Dead wood	=> assessment in PSP
Litter	=> assessment in PSP

3.1 Scope and Methods

Indicator 5.1: The ER Program identifies the IPCC methods used to estimate emissions and removals for Reference Level setting and Measurement, Monitoring and reporting (MMR).

Approaches: Activity Data

Tiers: Emission Factors

Approach and Tier Level

Activity Data

Approach 1: Total land-use area, no data on conversions between land uses

Approach 2: Total land-use area, including changes between categories

Approach 3: Spatially-explicit land-use data, including changes between categories

TABLE 2.3.4
ILLUSTRATIVE EXAMPLE OF APPROACH 2 DATA IN A LUC MATRIX WITH CATEGORY SUBDIVISIONS

Final \ Initial	Forest land (Unmanaged)	Forest land (Managed)	Grassland (Rough grazing)	Grassland (Improved)	Cropland	Wetlands	Settlements	Other land	Final area
Forest land (Unmanaged)	5								**5**
Forest land (Managed)		10	1	2	1				**14**
Grassland (Rough grazing)		2	56						**58**
Grassland (Improved)			2	22					**24**
Cropland					29				**29**
Wetlands						0			**0**
Settlements		1	1		1		5		**8**
Other land								2	**2**
Initial area	**5**	**13**	**60**	**24**	**31**	**0**	**5**	**2**	**140**
NET change	0	+1	-2	0	-2	0	+3	0	**0**

Note: Column and row totals show net changes in land use as presented in Table 2.3.2 but subdivided into national subcategories as in Table 2.3.3. "Initial" indicates the category at a time previous to the date for which the assessment is made and "Final" the category at the date of assessment. Net changes (bottom row) are the final area minus the initial area for each of the (sub) categories shown at the head of the corresponding column. Blank entry indicates no land-use change for this transition.

Source: IPCC, 2003

Approach 2: Total land-use area, including changes between categories

TABLE 2.3.4
ILLUSTRATIVE EXAMPLE OF APPROACH 2 DATA IN A LUC MATRIX WITH CATEGORY SUBDIVISIONS

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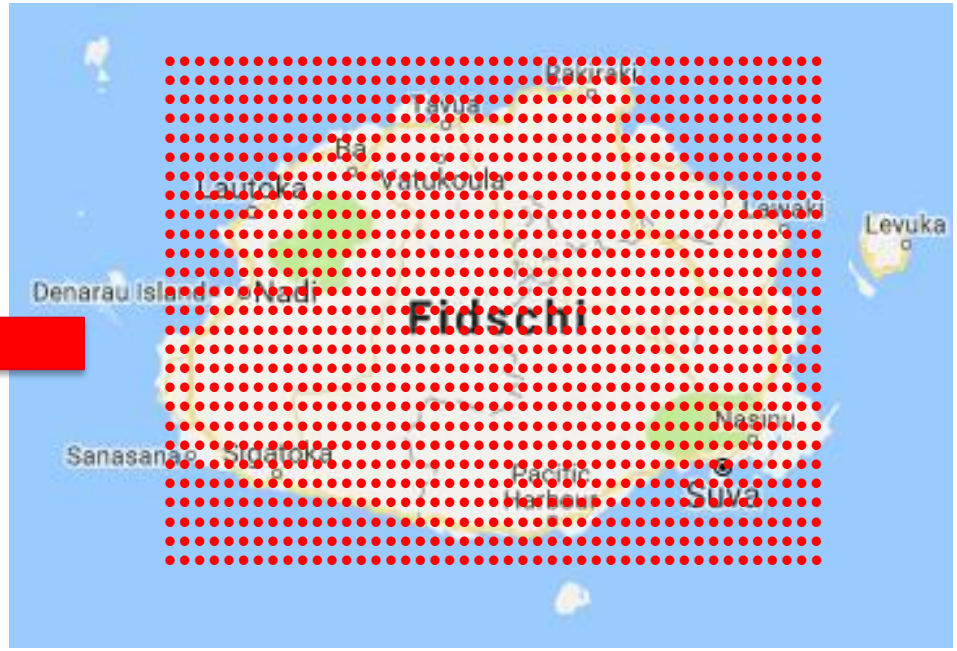

Approach 3: Spatially-explicit land-use conversion data

TABLE 2.3.4
ILLUSTRATIVE EXAMPLE OF APPROACH 2 DATA IN A LUC MATRIX WITH CATEGORY SUBDIVISIONS

Final \ Initial	Forest land (Unmanaged)	Forest land (Managed)	Grassland (Rough grazing)	Grassland (Improved)	Cropland	Wetlands	Settlements	Other land	Final area
Forest land (Unmanaged)	5								**5**
Forest land (Managed)		10	1	2	1				**14**
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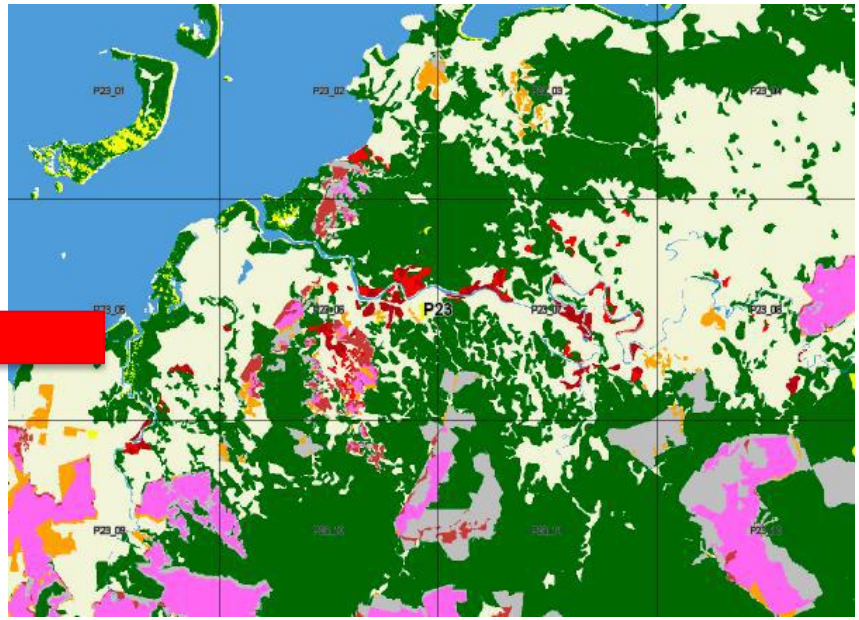
Grassland (Improved)			2	22					**24**
Cropland					29				**29**
Wetlands						0			**0**
Settlements		1	1		1		5		**8**
Other land								2	**2**
Initial area	**5**	**13**	**60**	**24**	**31**	**0**	**5**	**2**	**140**
NET change	0	+1	-2	0	-2	0	+3	0	**0**

Note: Column and row totals show net changes in land use as presented in Table 2.3.2 but subdivided into national subcategories as in Table 2.3.3. "Initial" indicates the category at a time previous to the date for which the assessment is made and "Final" the category at the date of assessment. Net changes (bottom row) are the final area minus the initial area for each of the (sub) categories shown at the head of the corresponding column. Blank entry indicates no land-use change for this transition.



Approach and Tier Level

Activity Data

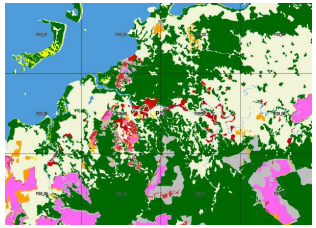
Approach 1: Total land-use area, no data on conversions between land uses

Approach 2: Total land-use area, including changes between categories

Approach 3: Spatially-explicit land-use data, including changes between categories

The envisaged methodology allows for the implementation of Approach 3.

A major obstacle is the currently absent land-use assessment for 2017.



2007

2017

Approach and Tier Level

Emission Factors

Tier 1 – default values

Tier 2 - country-specific emission factors

Tier 3 – higher order methods

higher-order methods are already available => Tier 2 possible

3.1 Scope and Methods

Indicator 5.1: The ER Program identifies the IPCC methods used to estimate emissions and removals for Reference Level setting and Measurement, Monitoring and reporting (MMR).

Approaches: Activity Data 

Tiers: Emission Factors 

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;

Land spanning more than **0.5 hectares** with **trees higher than 5 meters** and a **canopy cover of more than 10%**, or trees able to reach these thresholds in situ. It does not include land that is predominately under agricultural or urban land use.

Source: FAO

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;

2007 Land-Use Map

1. Natural forest
2. Mangrove
3. Hardwood plantation
4. Pine plantation
5. Coconut
6. Water bodies
7. Other non forest areas

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;

Desired further strata

Open forest

Crown cover by trees and / or ferns 10 - 40% and ground coverage by palm and bamboo by 50 – 80%

Closed forest

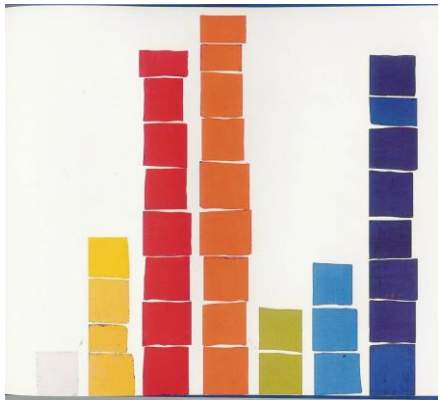
Crown cover by trees and / or ferns 40 - 100% and ground coverage by palm and bamboo over 20%.

Forests above 800 msl

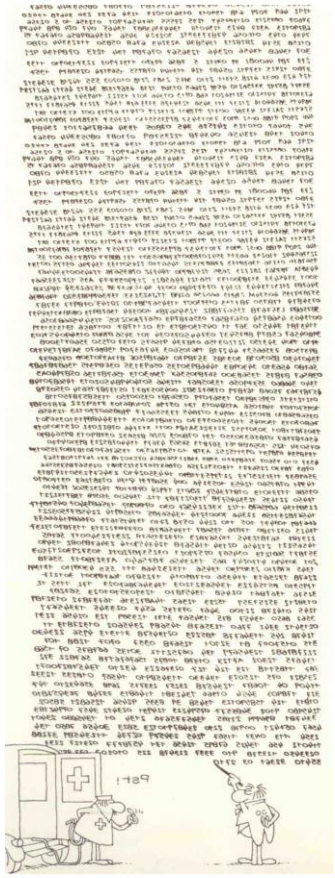
Forests below 800 msl

Two Approches to Look at Stratification

Consumer: Thematic strata



Producer: Statsitical estimation and reduction of sampling error



3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;

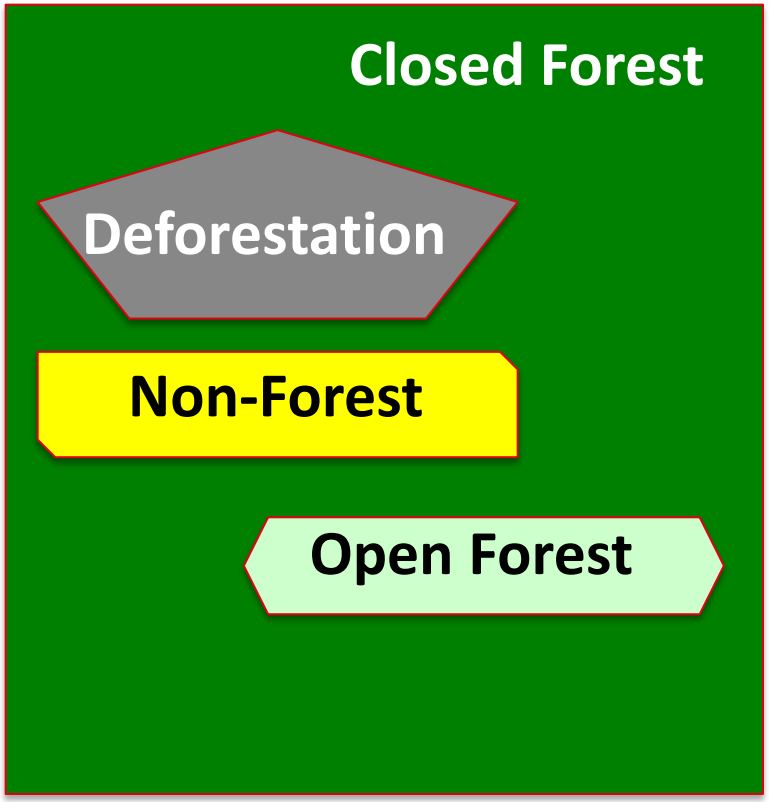
Stratification by key activities?

(i) enhancement of carbon stocks,

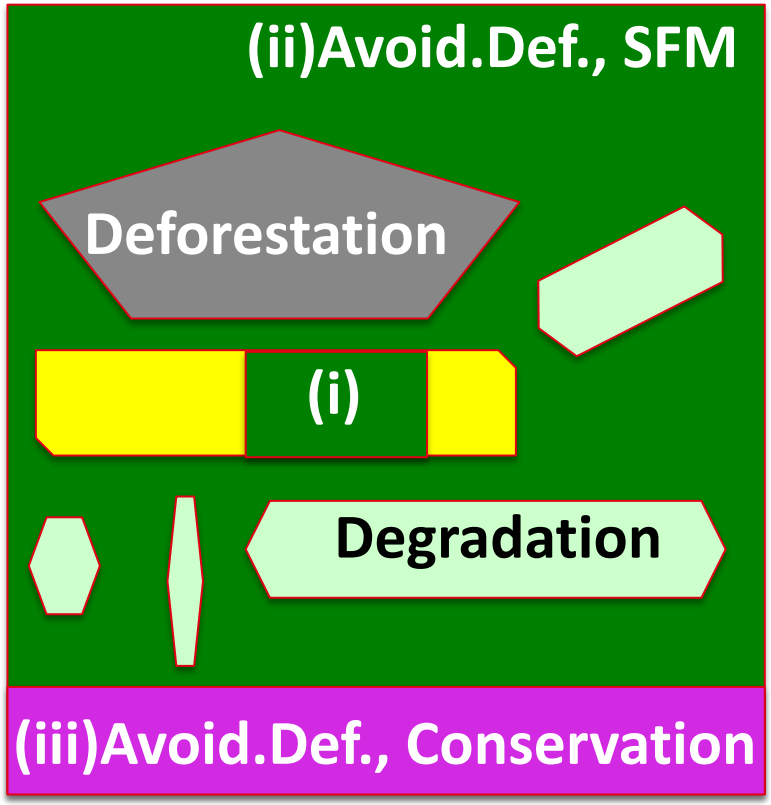
(ii) avoided deforestation through establishment of conservation areas and land use planning, and

(iii) avoided forest degradation through sustainable management of forests

Stratification and Key Activities



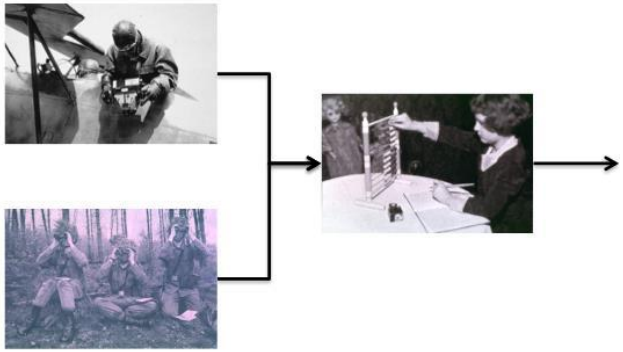
Remote Sensing Image Analysis



Key Activities of the Fiji REDD+ Program

Stratification and Key Activities

	Stratum (Remote Sensing 2017)			
		Closed Forest	Open Forest	Plantation
Sub-Stratum NSP 2017	(i) Enhancement			
	(ii) avoided Deforestation			-
	(iii) avoided degradation			-
	Degradation			
	.....			



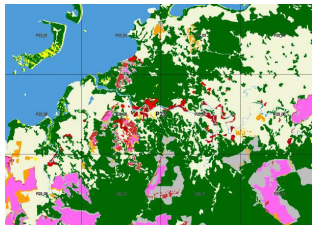
	Stratum (Remote Sensing 2017)			
		Closed Forest	Open Forest	Plantation
Sub-Stratum NSP 2017	(i) Enhancement			
	(ii) avoided Deforestation			-
	(iii) avoided degradation			-
	Degradation			
	.....			

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;
- Choice of activity data, and pre-processing and processing methods;

Land-Use Map 2017 and Land-Use Change Map 2007-2017 missing



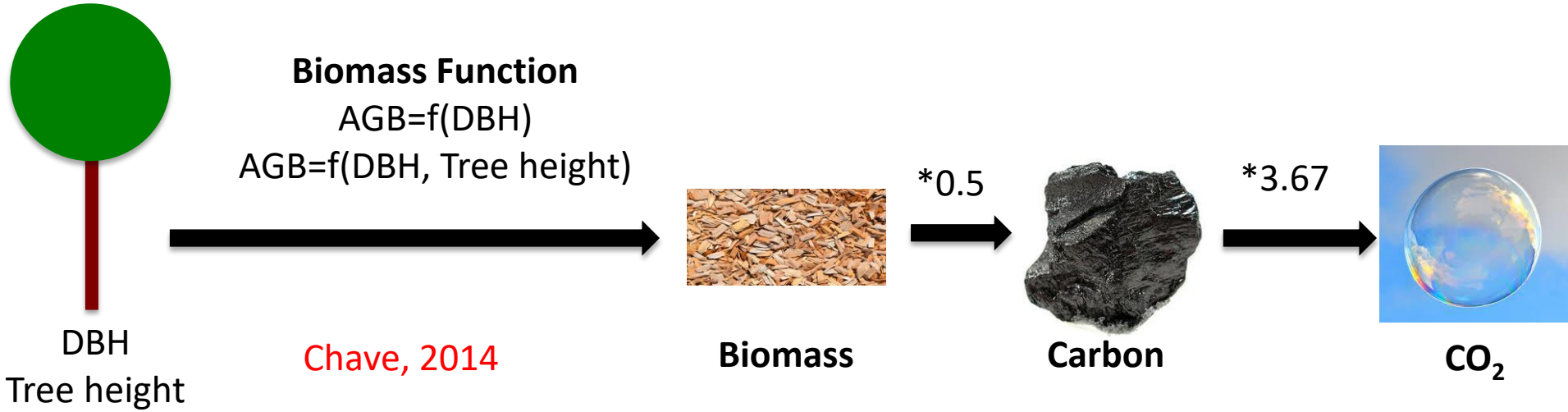
2007

2017

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

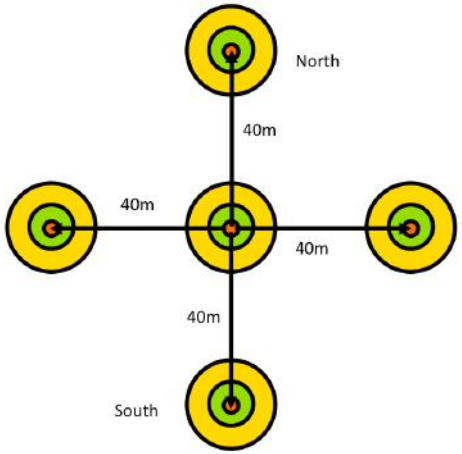
- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;
- Choice of activity data, and pre-processing and processing methods;
- Choice of emission factors and description of their development;



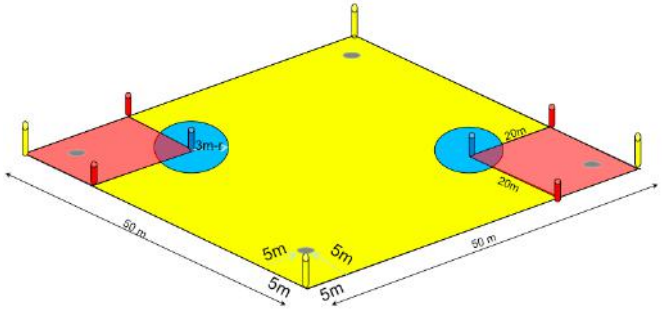
Development of Forest Carbon Stock in Fiji

Data Sources

NFI 2006

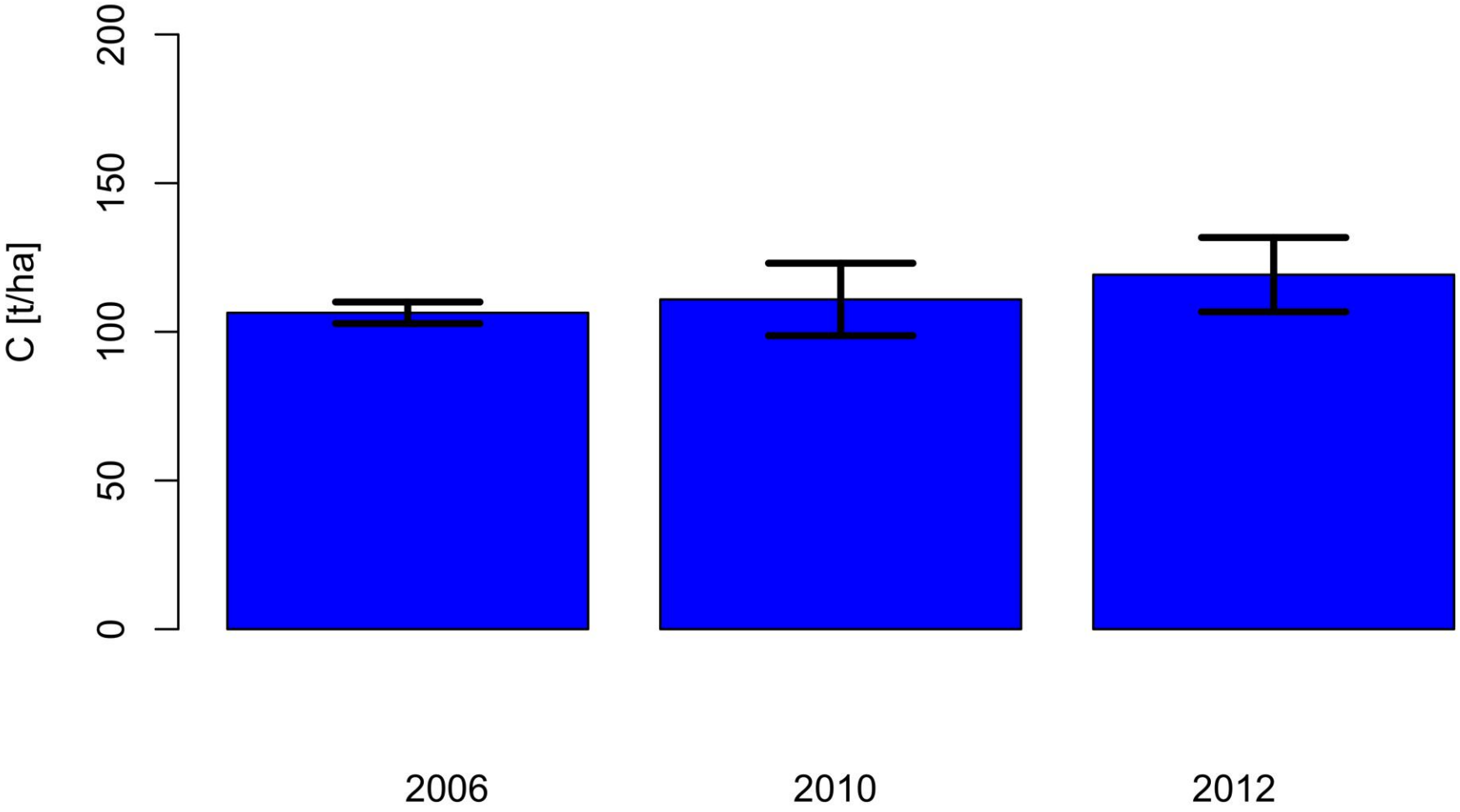


PSP 2010 and 2012



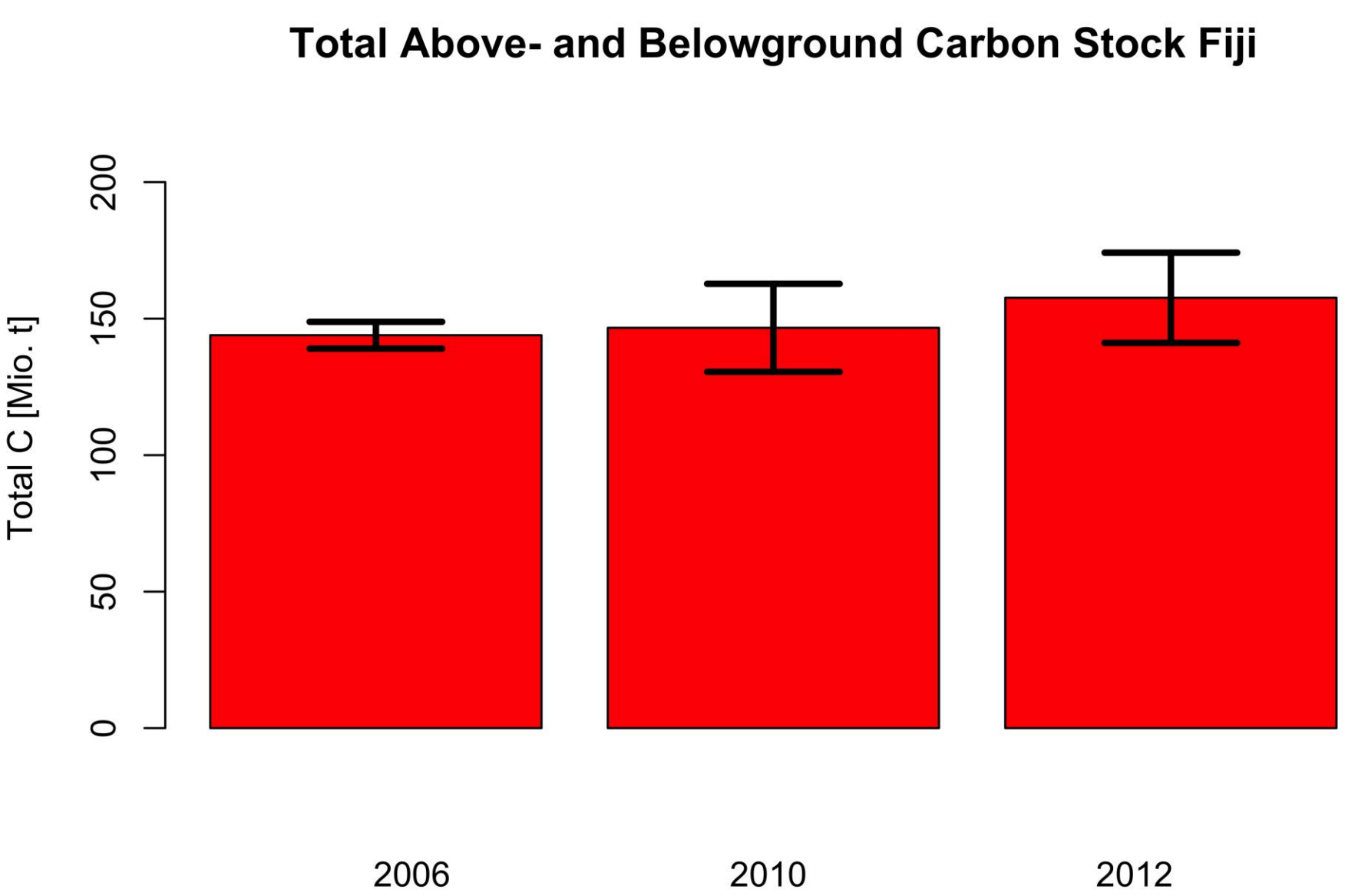
Preliminary results, which present only **order of magnitude**

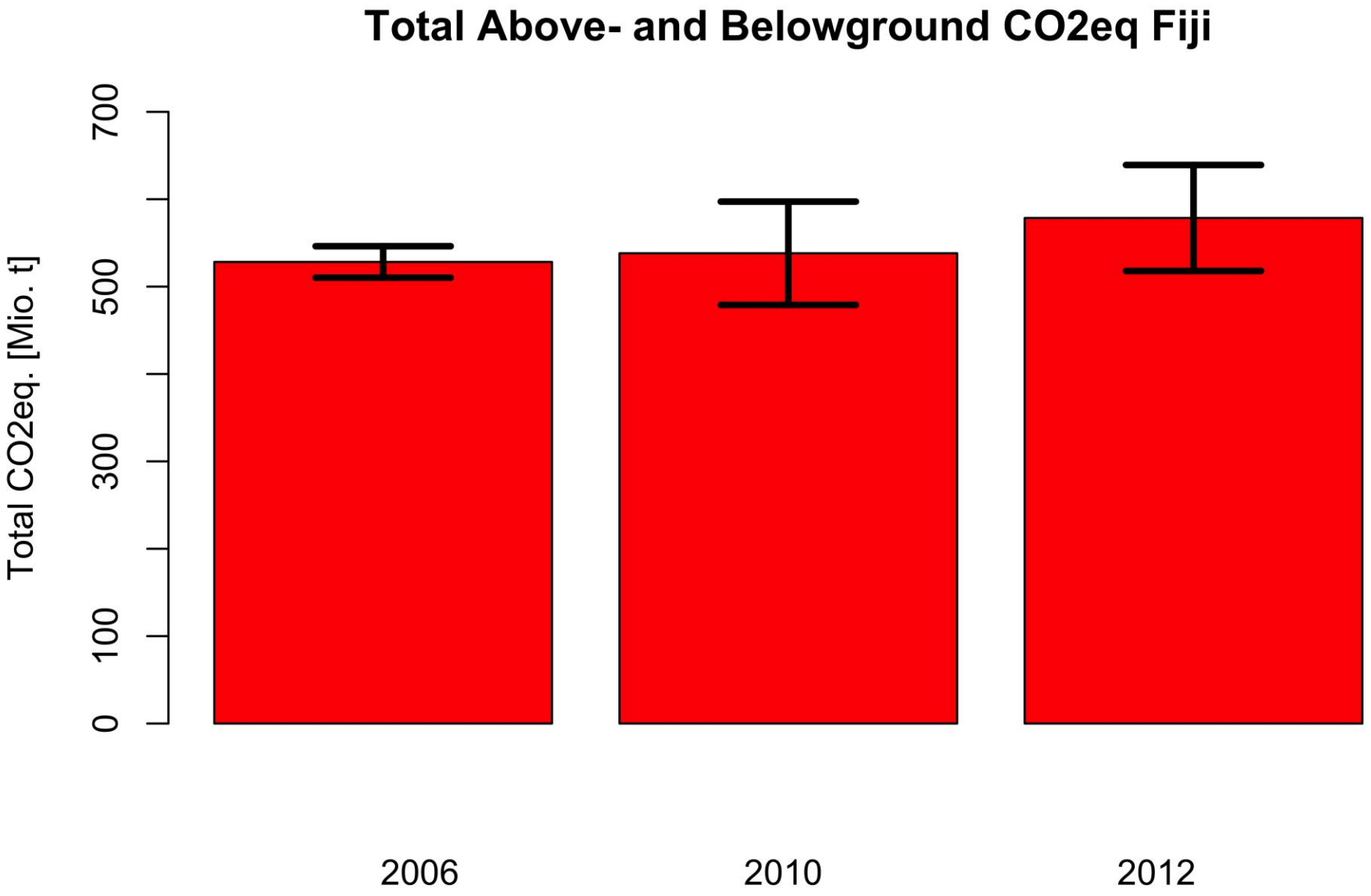
Per Hectare Aboveground Carbon Stock Fiji



Carbon Stock [t/ha]

	2006	2010	2012
Aboveground C [t/ha]	106,4	110,9	119,2
95%-C.I. lower	102,8	98,7	106,7
95%-C.I. upper	110,0	123,1	131,7
Above-and belowground C [t/ha]	141,5	144,2	155,0
95%-C.I. lower	136,7	128,3	138,7
95%-C.I. upper	146,3	160,0	171,2


Total Above- and Belowground Carbon Stock Fiji
Total C [Mio. t]
0
50
100
150
200
2006
2010
2012


Total Above- and Belowground CO2eq Fiji
Total CO2eq. [Mio. t]
0
100
300
500
700
2006
2010
2012

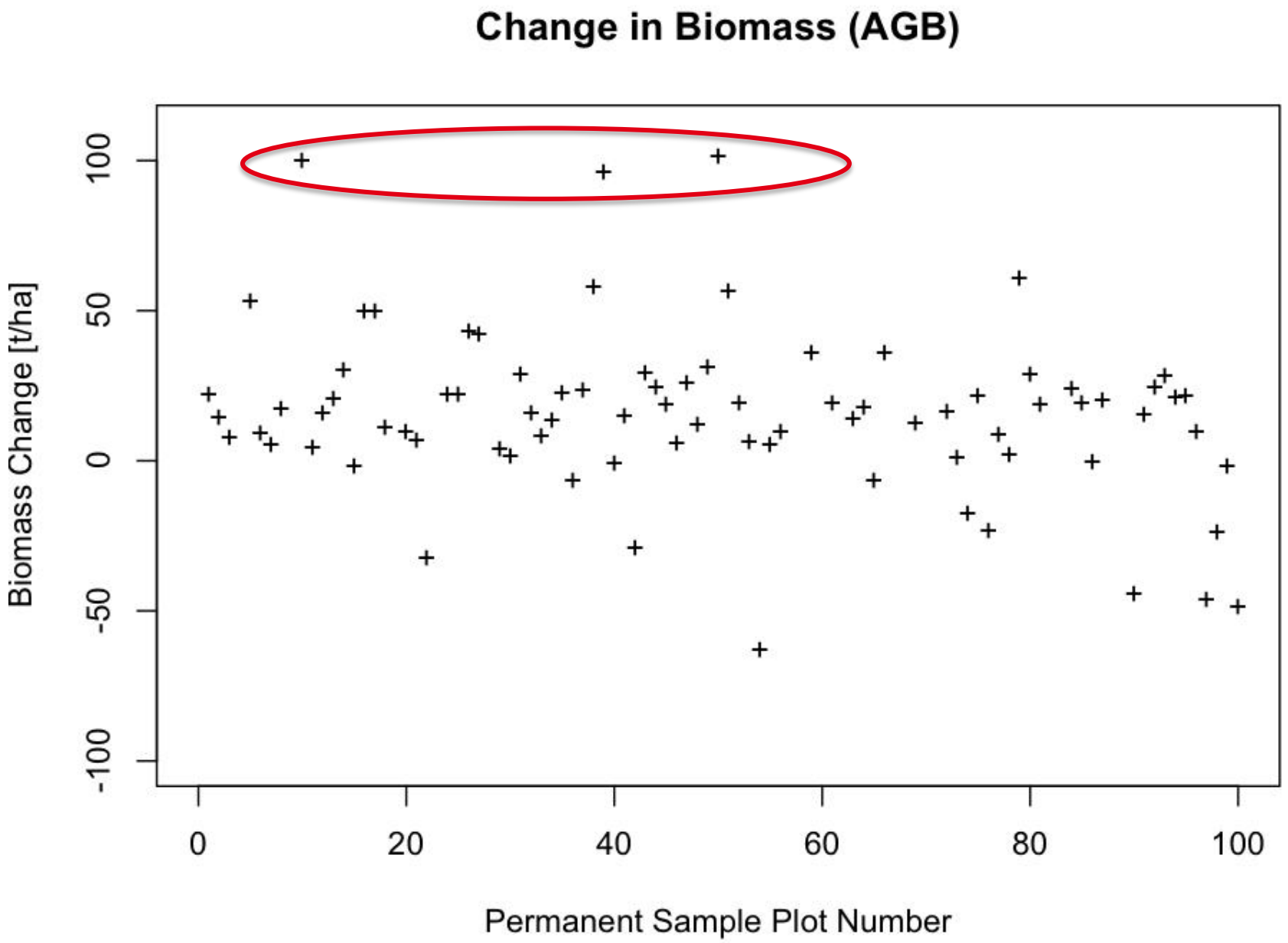
Total CO_{2eq}

Aboveground

	2006	2010	2012
Total CO_{2eq} [t]	397.167.062	413.953.054	445.007.046
95%-C.I. lower	383.606.116	368.467.768	398.339.233
95%-C.I. upper	410.728.009	459.438.341	491.674.859

Above- and belowground

	2006	2010	2012
Total CO_{2eq} [t]	528.199.715	538.139.157	578.509.160
95%-C.I. lower	510.164.246	479.008.288	517.841.005
95%-C.I. upper	546.235.183	597.270.027	639.177.316


Change in Biomass (AGB)
Biomass Change [t/ha]
100
50
0
-50
-100
0
20
40
60
80
100
Permanent Sample Plot Number

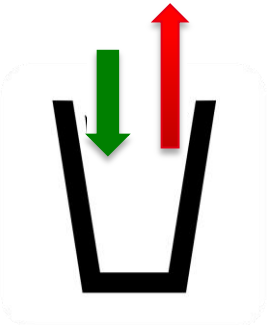
3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;
- Choice of activity data, and pre-processing and processing methods;
- Choice of emission factors and description of their development;
- Estimation of emissions and removals, including accounting approach;

Accounting approach:

Gain-Loss



Stock-Change

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:

- Forest definition;
- Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;
- Choice of activity data, and pre-processing and processing methods;
- Choice of emission factors and description of their development;
- Estimation of emissions and removals, including accounting approach;

No estimation procedures available for Fiji!

But doable!

3.1 Scope and Methods

Indicator 6.1: The following methodological steps are made publicly available:


– Forest definition;


– Definition of classes of forests, (e.g., degraded forest; natural forest; plantation), if applicable;


– Choice of activity data, and pre-processing and processing methods;


– Choice of emission factors and description of their development;


– Estimation of emissions and removals, including accounting approach;

3.1 Scope and Methods

Indicator 6.2: For the following spatial information, maps and/or synthesized data are displayed publicly, and reasonable efforts are made to explain how these were derived from the underlying spatial and other data, and to make key data sets or analyses publicly available:


- Accounting Area


- Activity data (e.g., forest-cover change or transitions between forest categories)


- Emission factors


- Average annual emissions over the Reference Period
- Adjusted emissions
- Any spatial data used to adjust emissions, if applicable.

3.2 Uncertainties

Indicator 7.1: All assumptions and sources of uncertainty associated with activity data, emission factors and calculation methods that contribute to the uncertainty of the estimates of emissions and removals are identified.

Indicator 7.2: The sources of uncertainty identified in Indicator 7.1 are assessed for their relative contribution to the overall uncertainty of the emissions and removals.

1. **No uncertainty assessment done for Activity Data**
2. **IPCC-methods for uncertainty assessment can be implemented***
3. **Relative contributions can be derived***

***given that AD-uncertainty assessment is available**

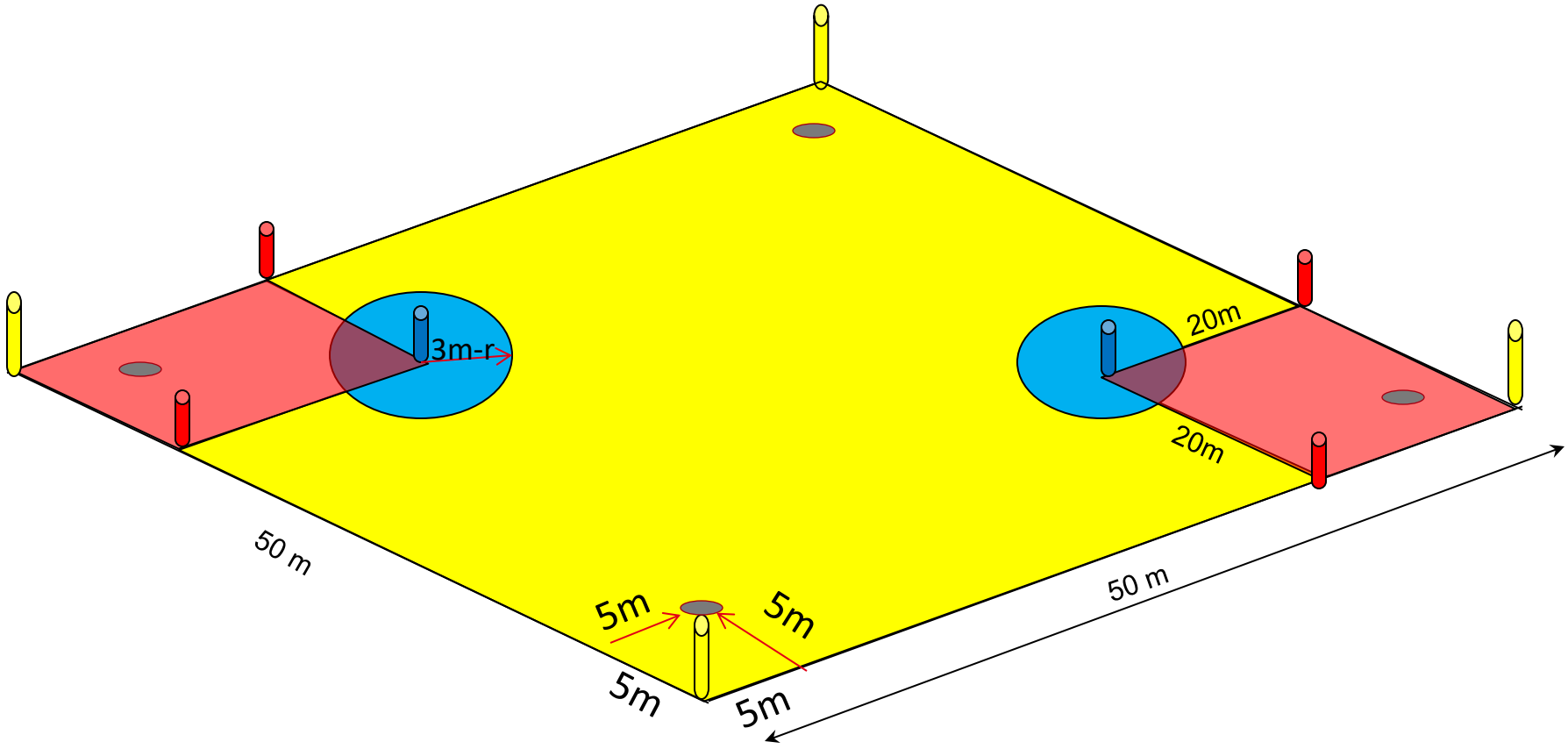
3.2 Uncertainties

Indicator 8.1: Systematic errors are minimized through the implementation of a consistent and comprehensive set of standard operating procedures, including a set of quality assessment and quality control processes that work within the local circumstances of the ER Program.

Indicator 8.2: Random errors and other uncertainties are minimized to the extent practical based on the assessment of their relative contribution to the overall uncertainty of the emissions and removals.

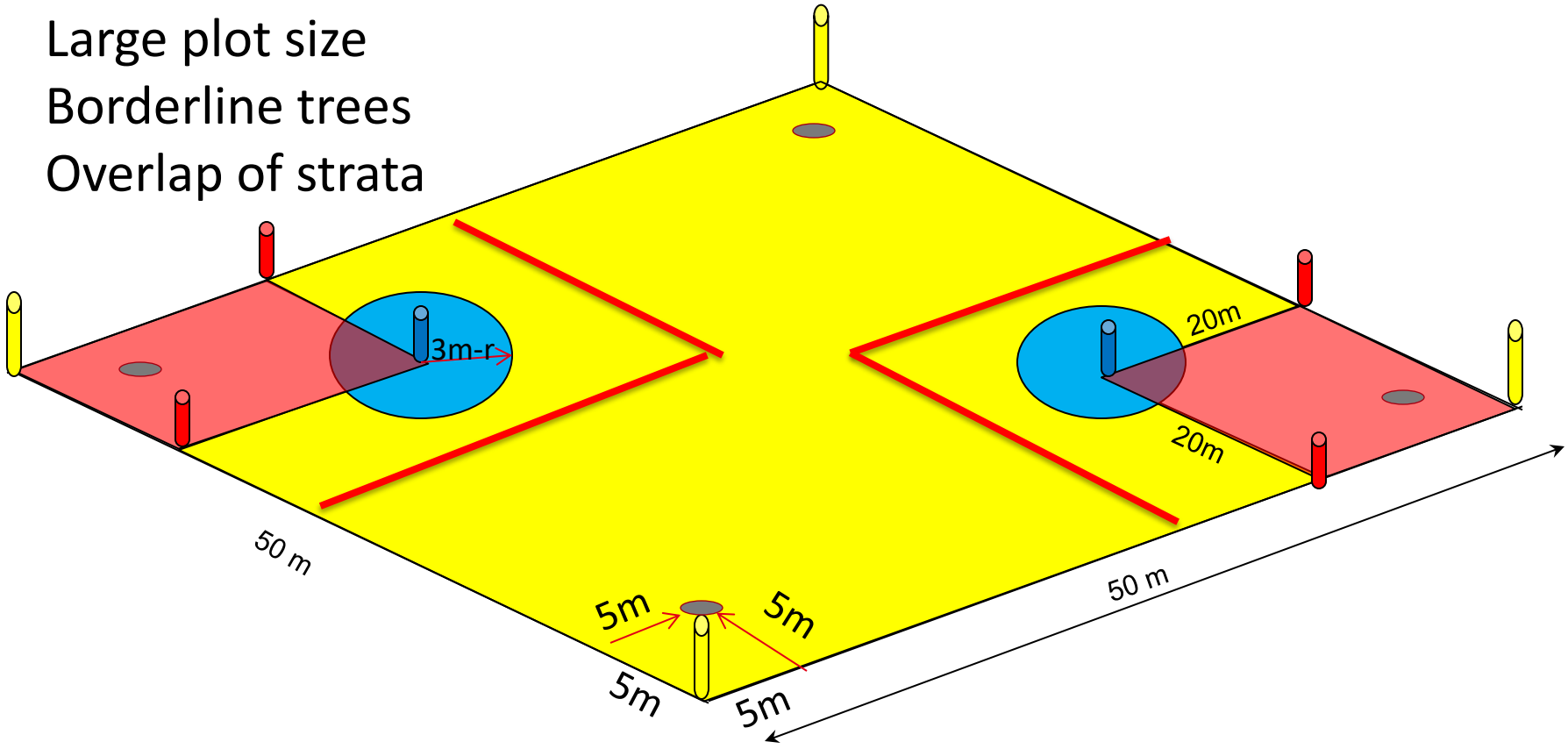
- Measurement error
- Classification error
- Frame error
- Model error
- Treatment bias

MRV/NFMS Plot Design



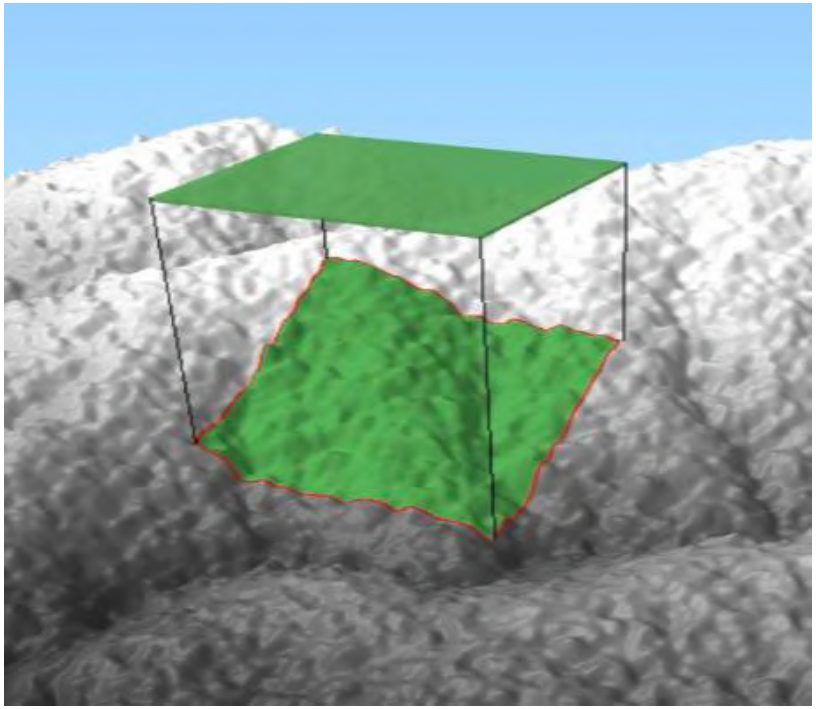
MRV/NFMS Plot Design

- No SOP/Field manual available
- No cluster – cost-efficiency?
- Large plot size
- Borderline trees
- Overlap of strata



MRV/NFMS Plot Design

Slope Correction

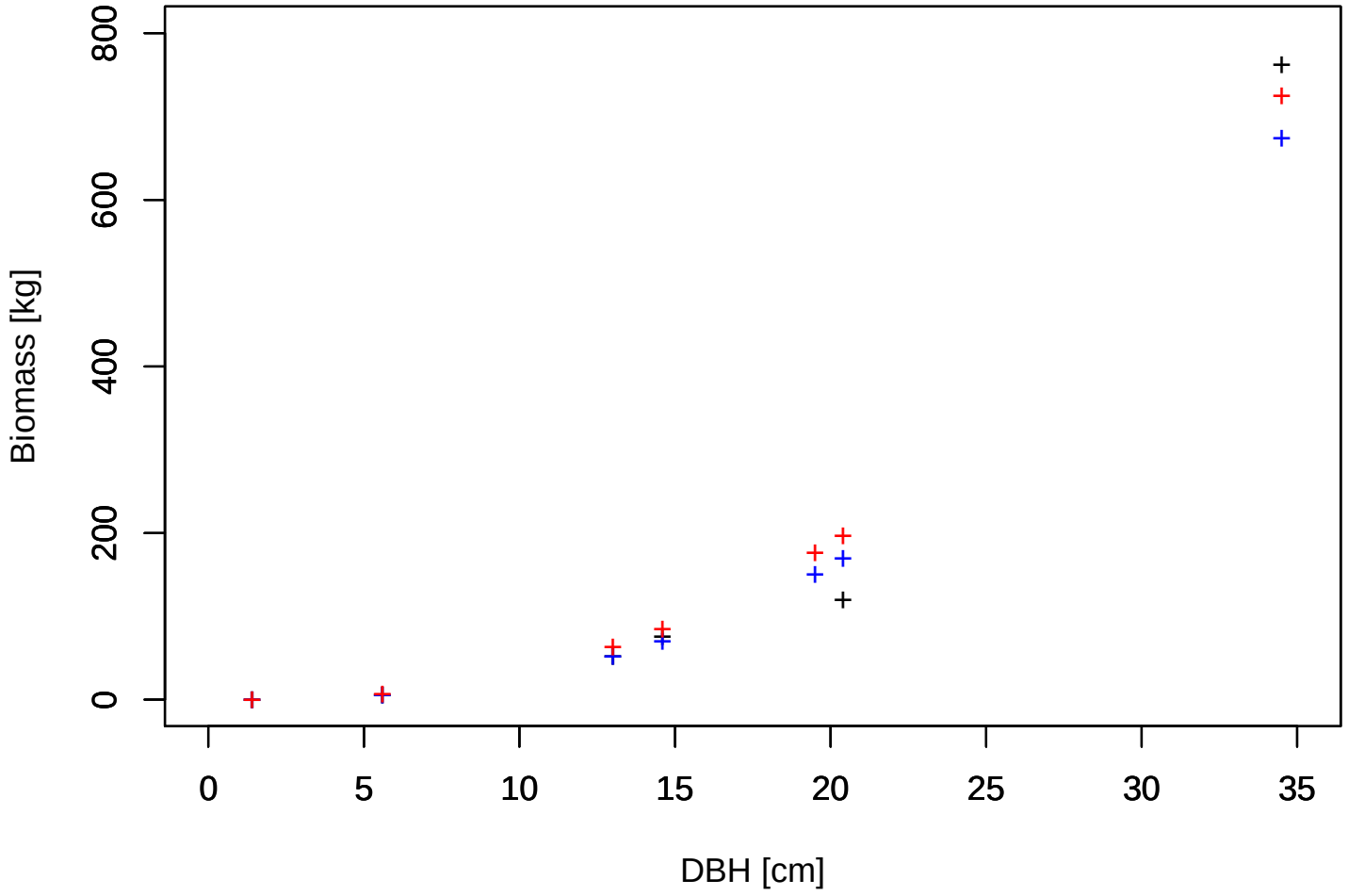


MRV/NFMS Plot Design

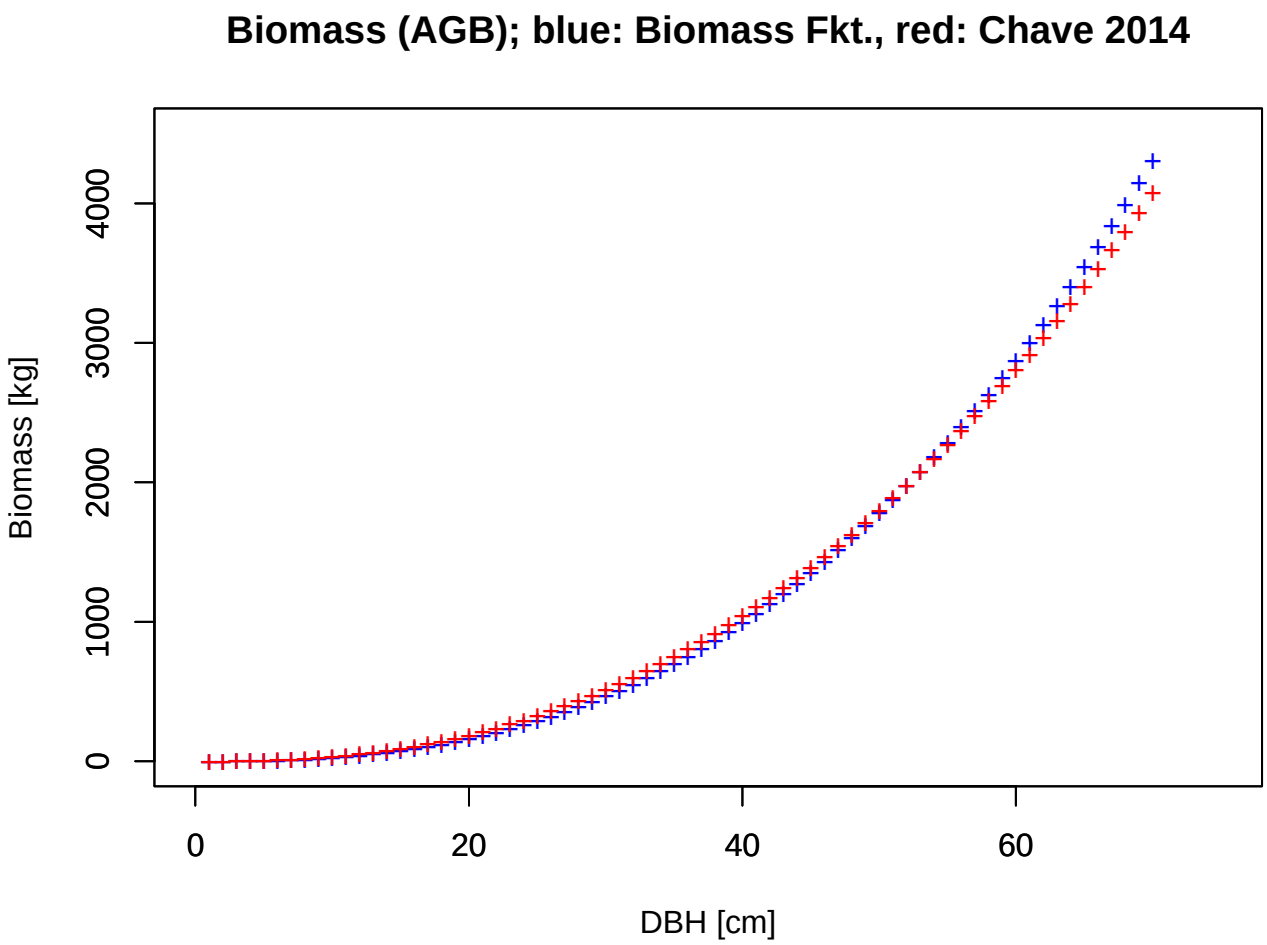
Treatment Bias

Fiji Biomass Study

Biomass (AGB); black: True, blue: Biomass Fkt., red: Chave 2014



Comparison Of Biomass Functions



Mangroves

- 2500 m^2 PSP wholly unsuitable
- Biomass assessment not straightforward

Alternatives

- New plot design (e.g. 100 m^2 circular plot)
- Destructive sample for biomass
- Exclude Mangroves in the first ERP

3.2 Uncertainties

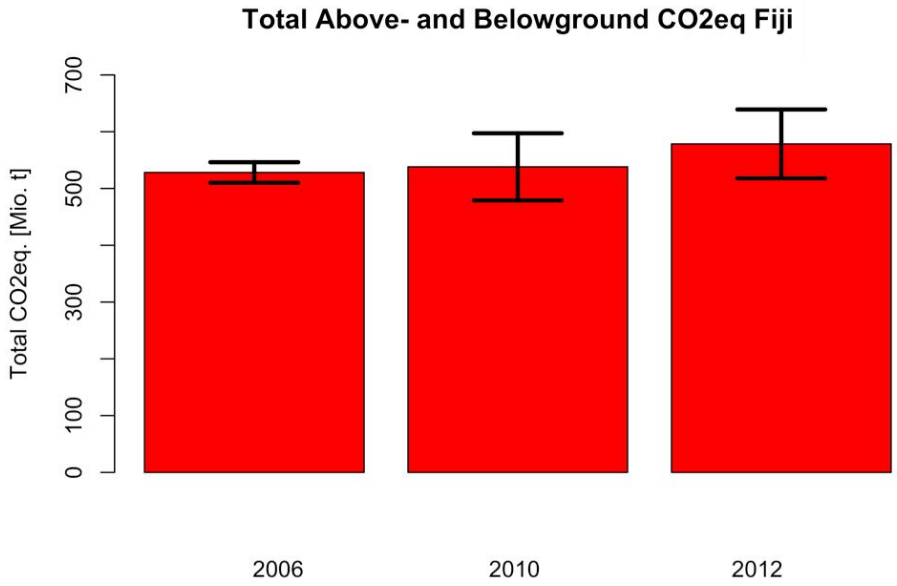
Indicator 8.1: Systematic errors are minimized through the implementation of a consistent and comprehensive set of standard operating procedures, including a set of quality assessment and quality control processes that work within the local circumstances of the ER Program.

Indicator 8.2: Random errors and other uncertainties are minimized to the extent practical based on the assessment of their relative contribution to the overall uncertainty of the emissions and removals.

- Revision of the SOPs for field assessments (slope correction, bordertree control, forest margin,...)
- Biomass study
- QA/ QC procedures to be developed (part of the ToR)

3.2 Uncertainties

Indicator 9.1: Uncertainty associated with activity data and emission factors is quantified using accepted international standards, for example by providing accuracy, confidence interval, distribution of error, and propagation of error. Where errors in data and methods are considered large as defined in IPCC Guidelines, Monte Carlo methods (numerical simulations) should be used to estimate uncertainty[4].



3.2 Uncertainties

Indicator 9.2: Uncertainty of the estimate of Emission Reductions is quantified using Monte Carlo methods. Underlying sources of error in data and methods for integrated measurements of deforestation, forest degradation and enhancements (e.g., as in a national forest inventory) are combined into a single combined uncertainty estimate and are reported at the two-tailed 90% confidence level.

Indicator 9.3: Uncertainty of Emissions Reductions associated with deforestation, forest degradation and enhancements are reported separately if measured through separate (i.e., non-integrated) approaches and when degradation is estimated using proxy data.

3.2 Uncertainties

Indicators 9.1 to 9.3

- Uncertainty assessment for Activity Data not done
- All other aspects are fulfiled

Activities

- SOPs for uncertainty analysis, including confidence intervals, error propagation, error budget
- Uncertainty Assessment for Land-use Map 2007 and 2017

3.2 Uncertainties

Indicator 10.1: The Reference Level is expressed in tonnes of carbon dioxide equivalent per year.

Indicator 10.2: The ER Program explains how the development of the Reference Level can inform or is informed by the development of a national Forest Reference Emission Level or Forest Reference Level, and explains the relationship between the Reference Level and any intended submission of a Forest Reference Emission Level or Forest Reference Level to the UNFCCC.

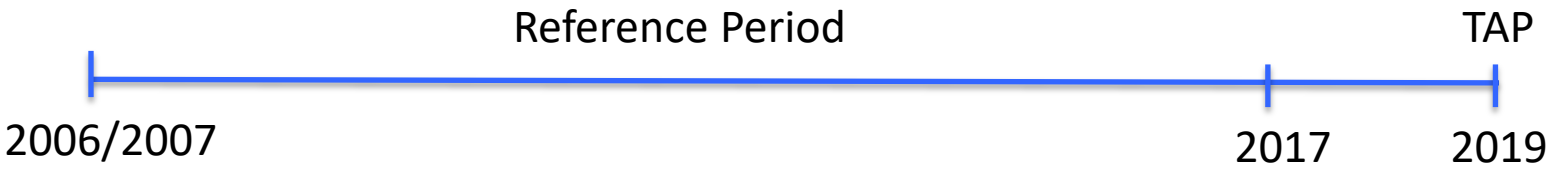
Indicator 10.3: The ER Program explains what steps are intended in order for the Reference Level to achieve consistency with the country's existing or emerging greenhouse gas inventory.

3.2 Uncertainties

Criterion 11: A Reference Period is defined.

Indicator 11.1: The end-date for the Reference Period is the most recent date prior to two years before the TAP starts the independent assessment of the draft ER Program Document and for which forest-cover data is available to enable IPCC Approach 3. An alternative end-date could be allowed only with convincing justification, e.g., to maintain consistency of dates with a Forest Reference Emission Level or Forest Reference Level, other relevant REDD+ programs, national communications, national ER program or climate change strategy.

Indicator 11.2: The start-date for the Reference Period is about 10 years before the end-date. An alternative start-date could be allowed only with convincing justification as in Indicator 11.1, and is not more than 15 years before the end-date.



3.2 Uncertainties

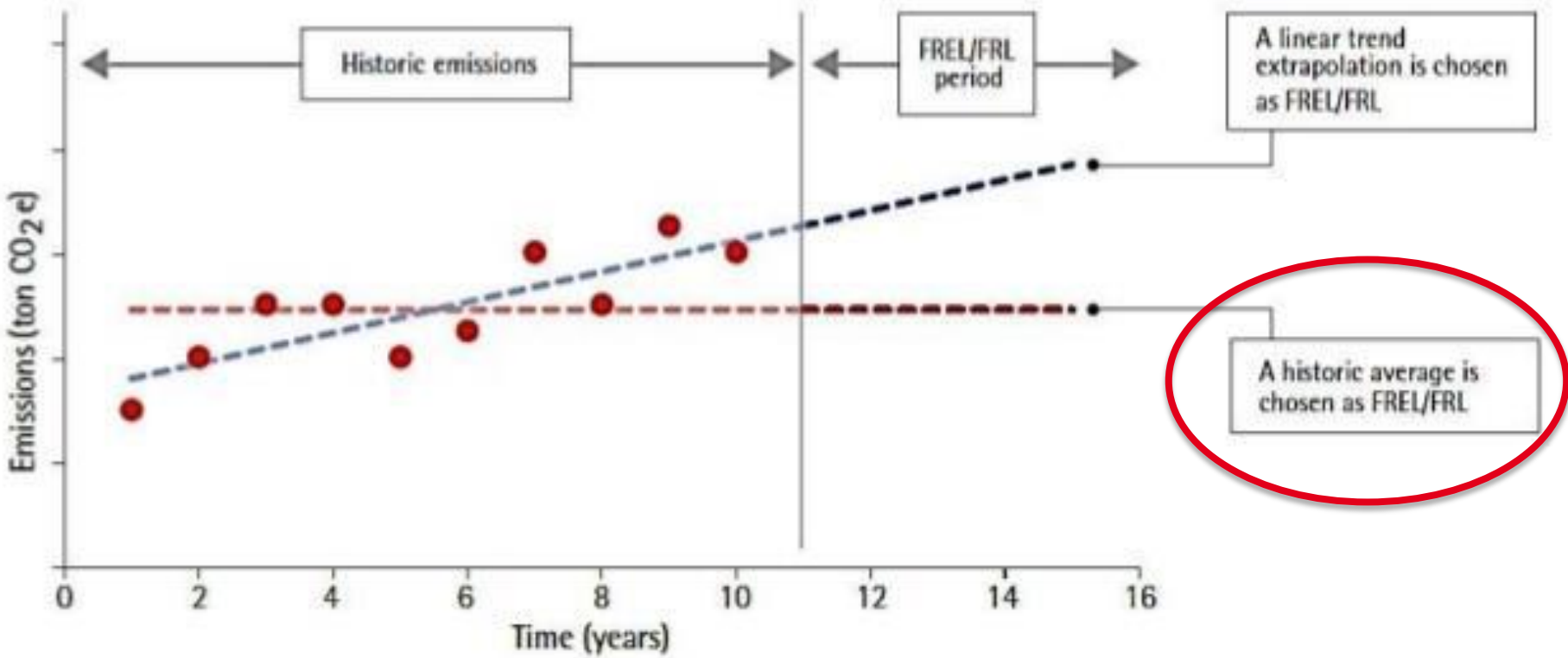
Indicator 12.1: The definition of forest used in the construction of the Reference Level is specified. If there is a difference between the definition of forest used in the national greenhouse gas inventory or in reporting to other international organizations (including an Forest Reference Emission Level or Forest Reference Level to the UNFCCC) and the definition used in the construction of the Reference Level, then the ER Program explains how and why the forest definition used in the Reference Level was chosen.[5]

Forest definition: see indicator 6.1 

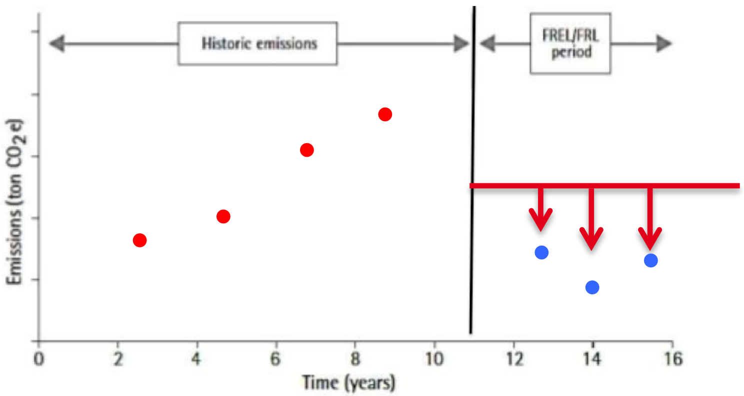
3.2 Uncertainties

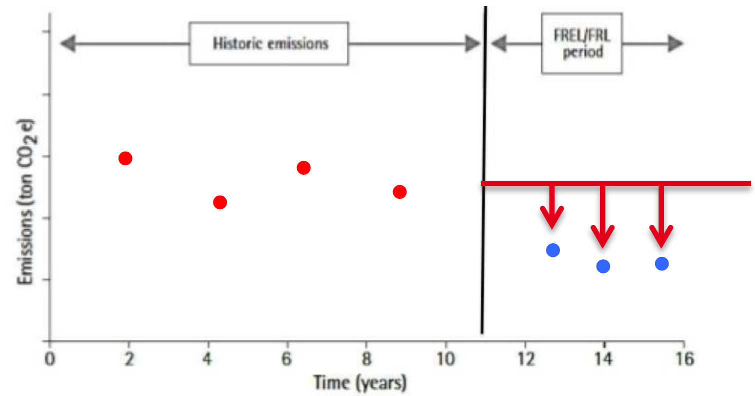
Indicator 13.1: The **Reference Level** does **not exceed** the average **annual historical emissions** over the Reference Period, unless the ER Program meets the eligibility requirements in Indicator 13.2. If the available data from the National Forest Monitoring System used in the construction of the Reference Level **shows a clear downward trend**, this should be taken into account in the construction of the Reference Level.

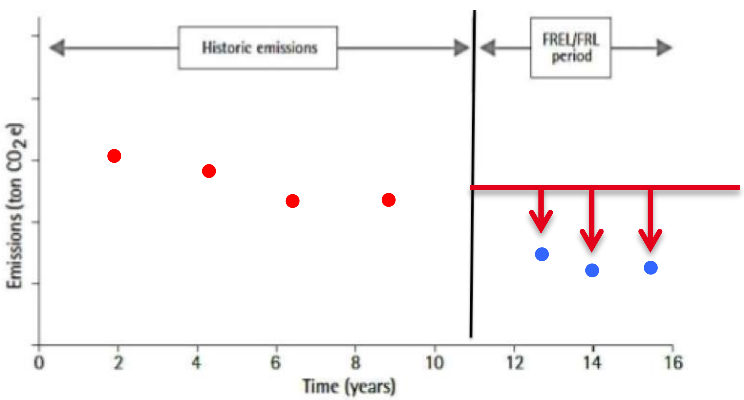
FREL/ FRL terminology

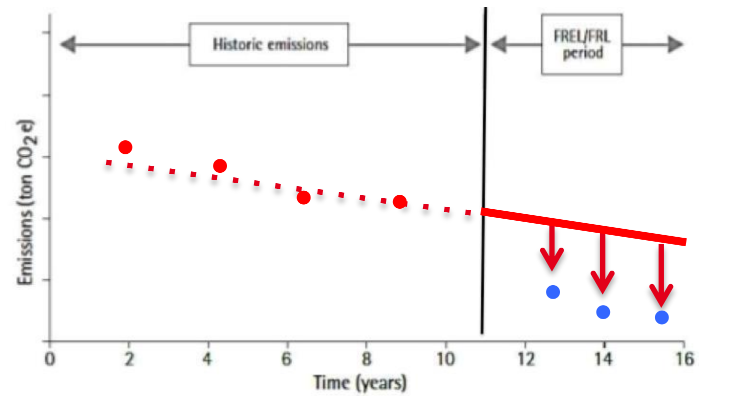


FREL/ FRL terminology









3.2 Uncertainties

Indicator 13.2 -13.4: Deal with adjustments

Indicator 13.4: An **adjustment** of the Reference Level above the average annual historical emissions during the Reference Period may **not exceed 0.1%/year of Carbon Stocks**.

0.1%/year ~ 500.000 tC ~ 375.000 US$

Adjustments attractive?

3.4 Measurement, Monitoring and Reporting on Emission Reductions

Indicator 14.1: The ER Program monitors emissions by sources and removals by sinks included in the ER Program's scope (Indicator 3.1) using the same methods or demonstrably equivalent methods to those used to set the Reference Level.

3.4 Measurement, Monitoring and Reporting on Emission Reductions

Indicator 14.2: **Activity data are determined periodically**, **at least twice** during the Term of the ERPA, and allow for ERs to be estimated from the beginning of the Term of the ERPA. **Deforestation** is determined using **IPCC Approach 3**. Other sinks and sources such as **degradation** may be determined **using indirect methods** such as survey data, proxies derived from landscape ecology, or **statistical data on timber harvesting** and regrowth if no direct methods are available.

3.4 Measurement, Monitoring and Reporting on Emission Reductions

Indicator 14.3: **Emission factors** or the methods to determine them are the **same for Reference Level** setting and for Monitoring, or are demonstrably equivalent. **IPCC Tier 2 or higher methods** are used to establish emission factors, and the uncertainty for each emission factor is documented. IPCC Tier 1 methods may be considered in exceptional cases.

3.4 Measurement, Monitoring and Reporting on Emission Reductions

Indicator 15.1: ER Programs articulate how the **Forest Monitoring System fits into** the existing or emerging **National Forest Monitoring System,** and provides a rationale for alternative technical design where applicable.

Identical

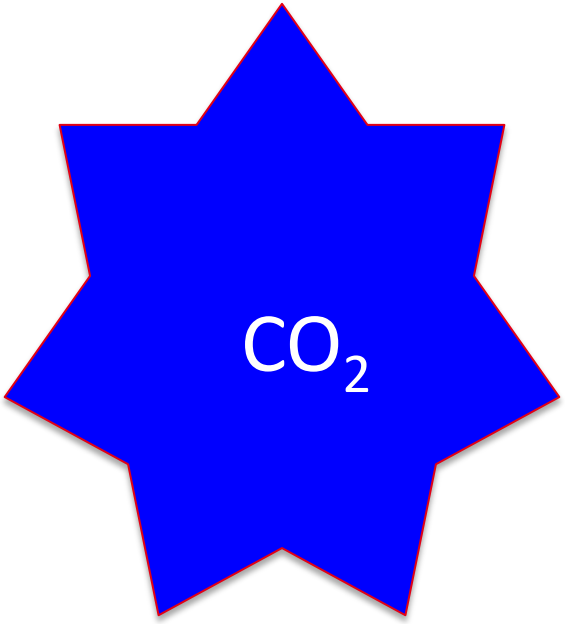
- PSP
- Forest definition
- Data base
- ....

3.5 Accounting for Displacement (Leakage)

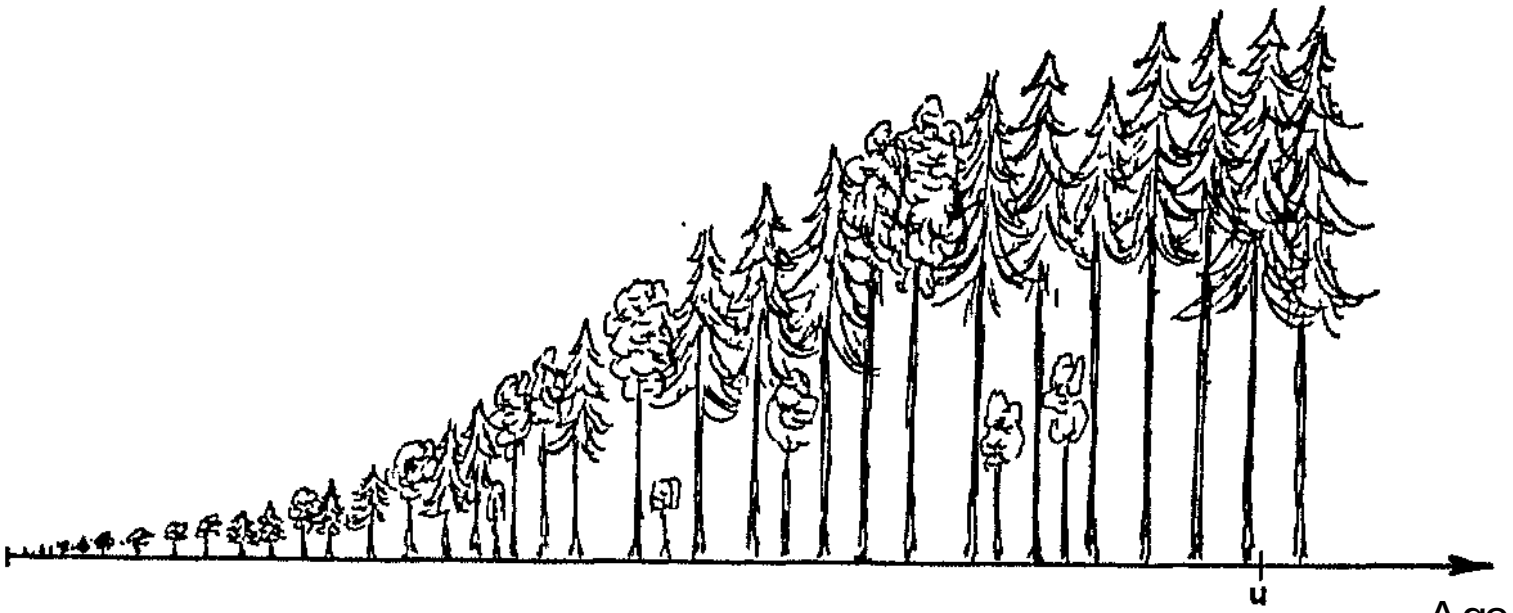
3.6 Accounting for Reversals (Non-permanence)

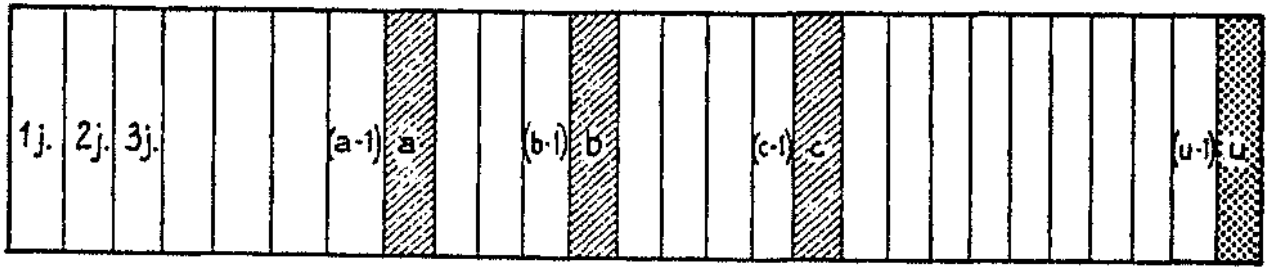
Not part of the consultancy

Non-Permanence



Plantations





3.7 Calculation of ERs

Criterion 22: Net ERs are calculated by the following steps:

1. **Subtract the reported and verified emissions and removals from the Reference Level**

$$\text{Net ERs} = RL - E_{deforestation} - E_{degradation} + R_{C\text{- enhancement}} + \ldots\ldots$$

3.7 Calculation of ERs

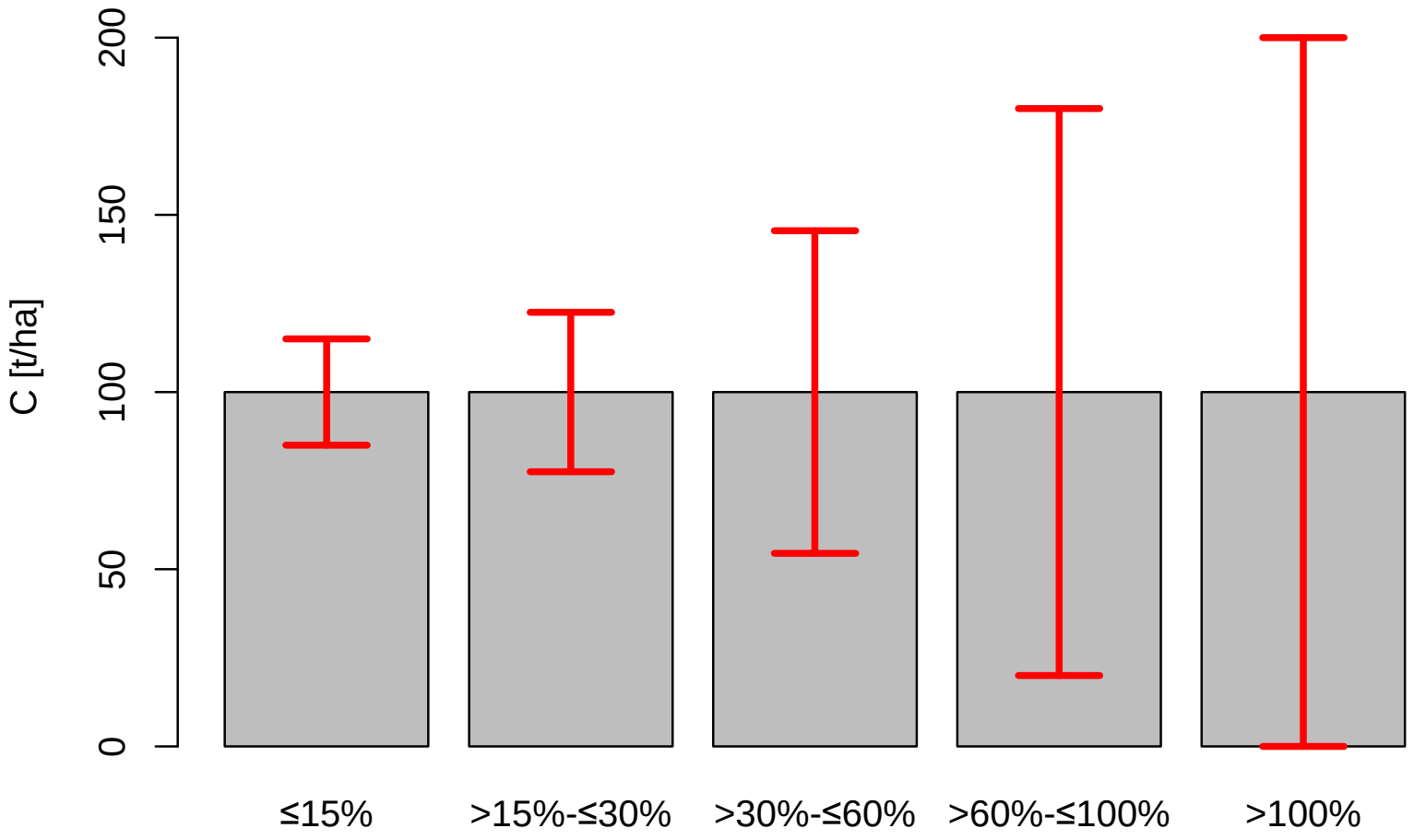
Criterion 22: Net ERs are calculated ***by the following steps:***

2. Set aside a number of ERs from the result of step 1, above, in a **buffer reserve.** This amount **reflects the level of uncertainty** associated with the estimation of ERs during the Term of the ERPA. The amount set aside in the buffer reserve is determined using the following conservativeness factors for deforestation:

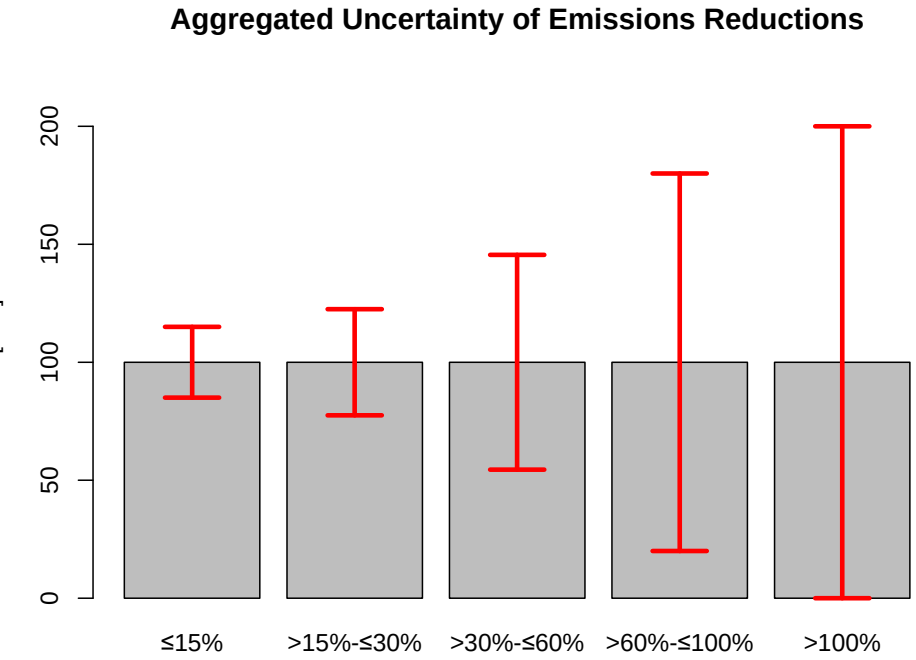
Aggregate Uncertainty of Emissions Reductions	Conservativeness Factor
≤ 15%	0%
> 15% and ≤ 30%	4%
> 30 and ≤ 60%	8%
> 60 and ≤100%	12%
> 100%	15%

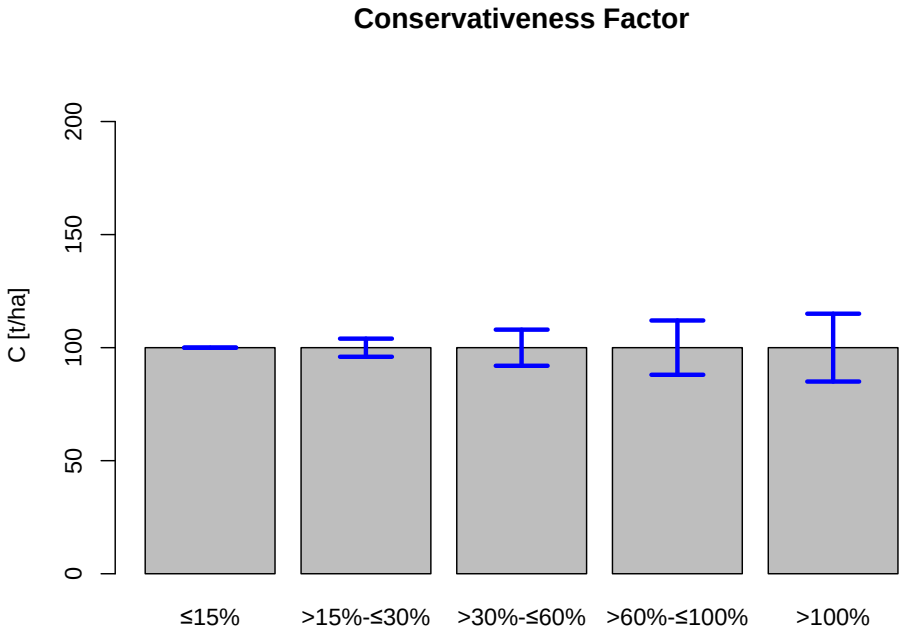
3.7 Calculation of ERs

Aggregated Uncertainty of Emissions Reductions



3.7 Calculation of ERs





3.7 Calculation of ERs

Criterion 23: Prevent double-counting

Decisions to be made

Decisions to be made

Adjustments of the Reference Level

Implications

- Development of the FRL complex
- Could be controversial when presented to FCPF
- Financial benefit < 400.000 US$

Decisions to be made

Conduct uncertainty analysis for the 2007 classification

Use field plots of the NFI 2006 as ground truth, if technically feasible

Implications

- Requirement for the construction of a FRL
- Additional funding needed
- Critical with respect to capacities of SPC

Decisions to be made

Missing 2017 land use assessment

1. Complete a land-use classification for 2016/2017 by August 2017

Implications

- FRL is in compliance with ER-PIN
- Funding has to be provided
- Critical with respect to capacities of SPC

Decisions to be made

Missing 2017 land use assessment

2. Complete a land-use classification for 2016/2017 for a reduced area by August 2017.

Implications

- Size of reduced area depends on available funds
- Reduced capacities for image analysis and uncertainty assessment.
- Stipulations of the ER-PIN not met => negotiations with FCPF

Decisions to be made

Missing 2017 land use assessment

3. Reanalyze the Collect Earth data, combine data with the wall-to-wall land-use classification 2006, and derive the land-use and land-use change data

Implications

- Reduced capacities needed
- Might not be accepted as Approach 3
- Stipulations of the ER-PIN not met => negotiations with FCPF

Decisions to be made

Missing 2017 land use assessment

4. Reanalyze the Collect Earth data, derive the land-use and land-use change data and move to Approach 2

Implications

- Reduced capacities needed
- Changes are not spatially explicit => Approach 2
- Stipulations of the ER-PIN not met => negotiations with FCPF

Decisions to be made

Missing 2017 land use assessment

1. Complete a land-use classification for 2016/2017 by August 2017
2. Complete a land-use classification for 2016/2017 for a reduced area by August 2017
3. Reanalyze the Collect Earth data, combine data with the wall-to-wall land-use classification 2006, and derive the land-use and land-use change data
4. Reanalyze the Collect Earth data, derive the land-use and land-use change data and move to Approach 2

Decisions to be made

Stratification of forest land

Further stratify forests into the following strata or a selection/ combination thereof:

(i) open forest / closed forest
(ii) forest above 800m altitude/ forest below 800m altitude
(iii) open forest forest above 800m altitude/ closed forest forest above 800m altitude / open forest forest below 800m altitude/ closed forest forest below 800m altitude

Implications

- Cannot be done for 2006 assessment
- Additional funds and capacities needed
- Might increase uncertainties.

Decisions to be made

Proxy for degradation areas

Include GPS-data for areas with harvesting licences in the forest class as a proxy for degradation

Implications

- Cost-effective approach to designate degradation areas
- Reduces uncertainties
- Allows to quantify emissions by logging

Decisions to be made

Biomass equations

- No biomass equations are available for Fiji
- Need to be developed
- Development of tree specific biomass functions involves a substantial amount of resources.

Decision

- Develop biomass functions before September 2017

or

- Use e.g. Chave's equations and postpone development to a later phase (stepwise approach)

Implications

Larger uncertainties

Decisions to be made

Mangroves

- No sound methodology for C-stock
- PSP cannot be applied in Mangrove forest

Decision

- Exclude Mangroves from first ERPA phase
- Develop methods at later phase

Implications

- Unreliable C-stock estimates for Mangroves are avoided
- Decision needs to be justify and discussed with FCPF

Decisions to be made

Mangroves

Decision

2. Assess C-stock of mangroves in a specific study that utilizes destructive sampling

Implications

- Resources required (30-50 plots)
- Uncertainty reduced

Decisions to be made

Mangroves

Decision

3. Assess biomass drain from mangroves by means of a specific study that addresses fuel wood and timber extractions

Implications

- Resources required
- Uncertainty reduced
- Decision needs to be justify and discussed with FCPF

Decisions to be made

Mangroves

Decision

1. Exclude Mangroves from first ERPA phase and develop methods at later phase
2. Assess biomass drain from mangroves by means of a specific study that addresses fuel wood and timber extractions
3. Assess biomass drain from mangroves by means of a specific study that addresses fuel wood and timber extractions

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Database System

University of Hamburg,
Consultancy team
Suva, Fiji
May 2 - 3, 2017

Outline

- Objective of the database
- How is the existing database?
- The essential improvements required
- An architexture of database
- Database integration

Objective of database development

The concept of Database emerged from the Copenhagen decision 4/CP.15 which specifies "*establish according to national capabilities, robust, and transparent national forest monitoring systems*…."

This database fulfils the requirements of the National Forest Monitoring System of Fiji

The existing database

- Database **exists** in Microsoft Access at MSD
- Good shape and well recorded
- No further analysis has been done: volume, biomass, **carbon** etc
- The database with other relevant stakeholders **not** linked: Department of Environment (CBD focal point), Ministry of Economy (DNA for UNFCCC), ….

The essential improvements

- New tables to be created for different purposes- for reporting

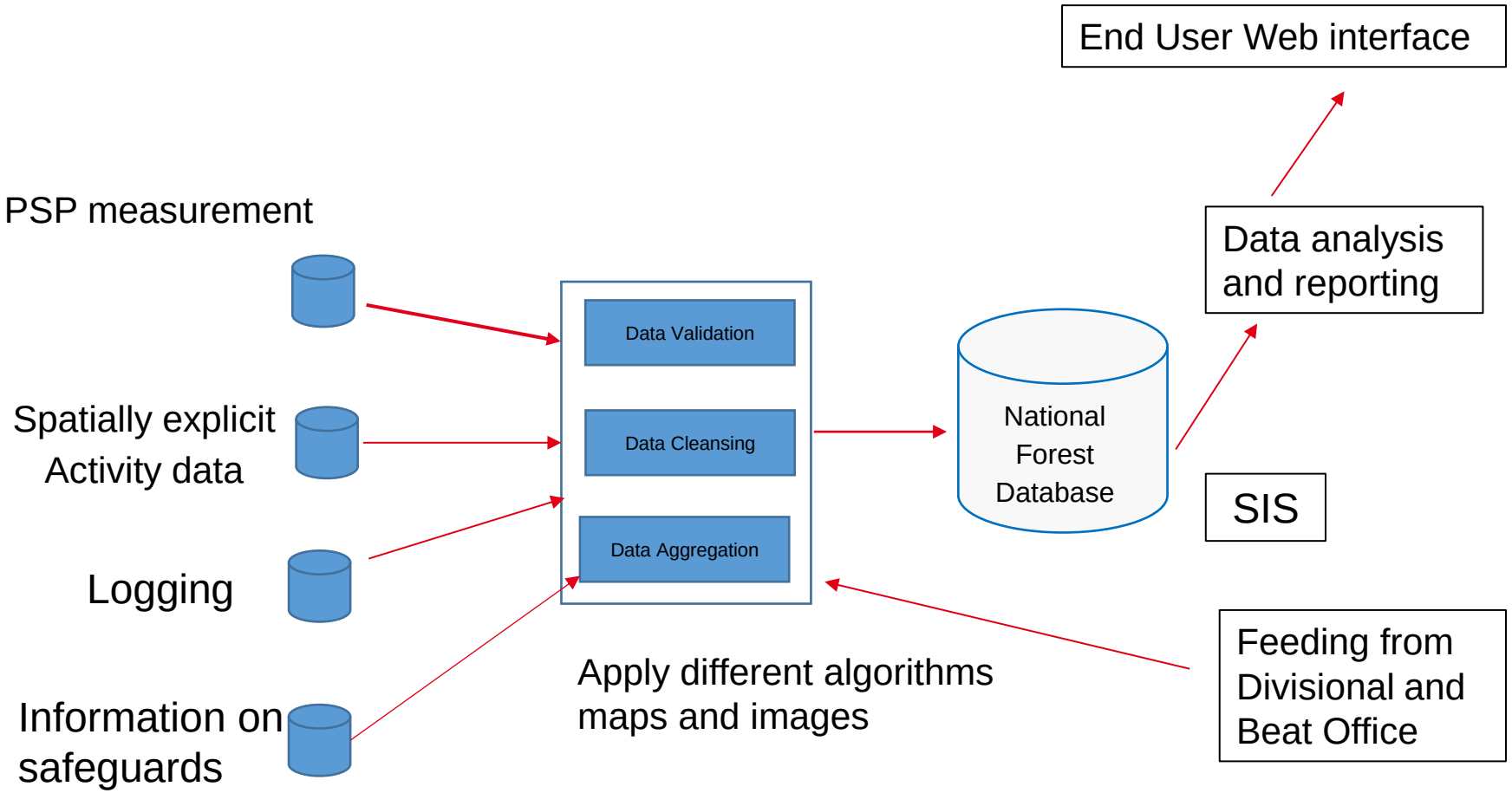
- Automatic electronic data transfer system developed for;
  - Data quality assurance
  - Routine check

- Two options for using algorithms for further analysis;
  - Use R software environment,
  - Develop algorithms in the Microsoft Access

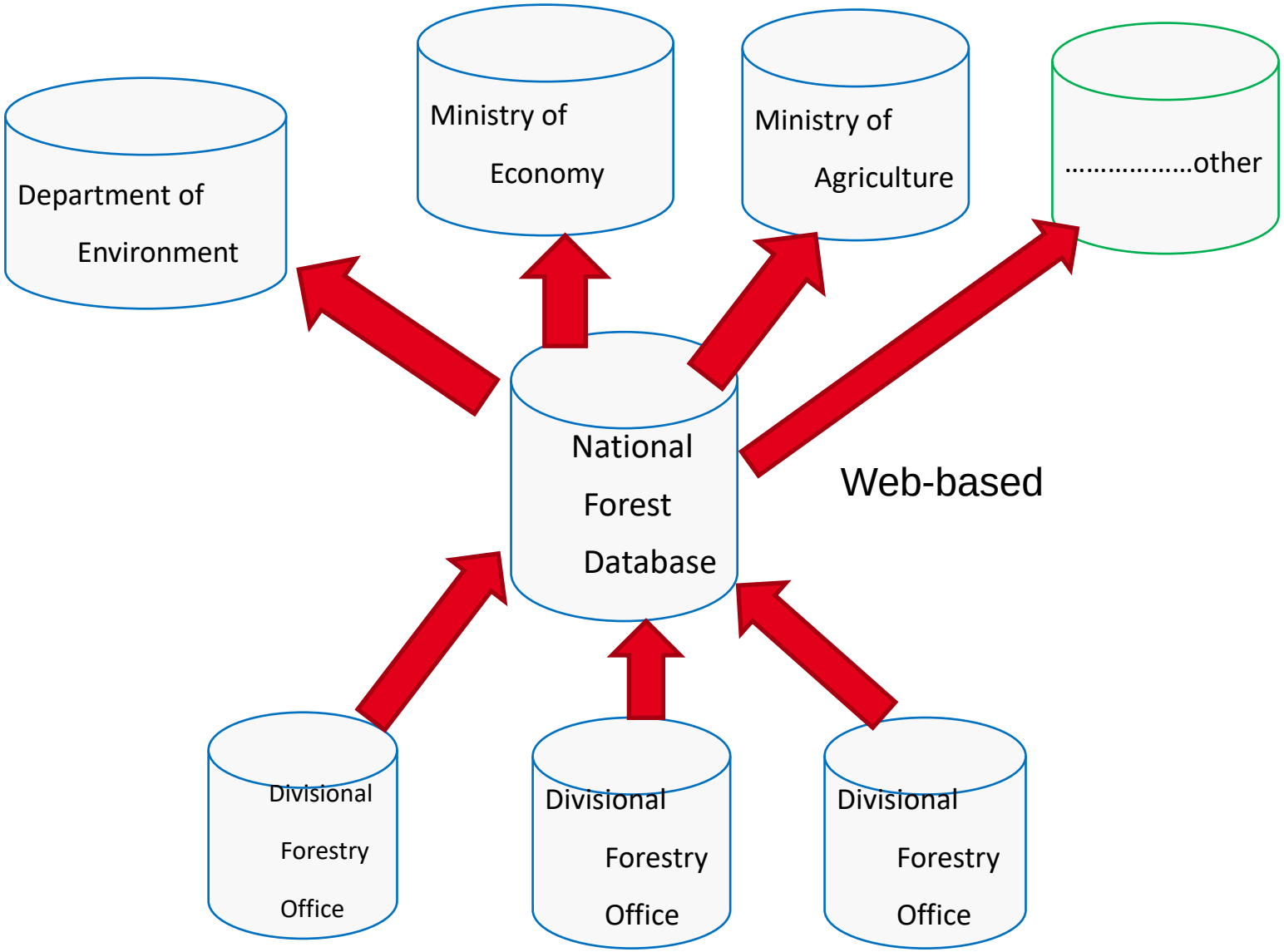
The essential improvements

- Allow wider access to the Database- web-based
- Provision to retreat the data; pre-process data will be available
- Pre-analysed tables
- Provision of Algorithms for reporting
- Methodology to link activity data
- Maps and field plot linked
- Based on open source programme

Proposed Architecture of the Database



Database Integration




Thank you
for your
Attention!

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Capacity building elements of consultancy

Institute for World Forestry
University of Hamburg

Suva, 2-3 May 2017

Content

- ToR- Capacity building
- Capacity gap assessment - examples
- Capacity building within assignment period
  - Roadmap, Approaches and Modalities
  - Capacity building within assignment period (2017 - 2018)
- Outlook

Countries need capacities

- Countries need to prepare to report on their forest carbon stock changes

- Remote sensing and forest inventories are key tools and data sources for monitoring

- Majority of REDD+ countries lack capacity to implement a complete and accurate NFMS system to measure the success of REDD+ impmentation using IPCC Guidance and Guiedlines (Romijn et al., 2012)

Countries need capacity strengthening

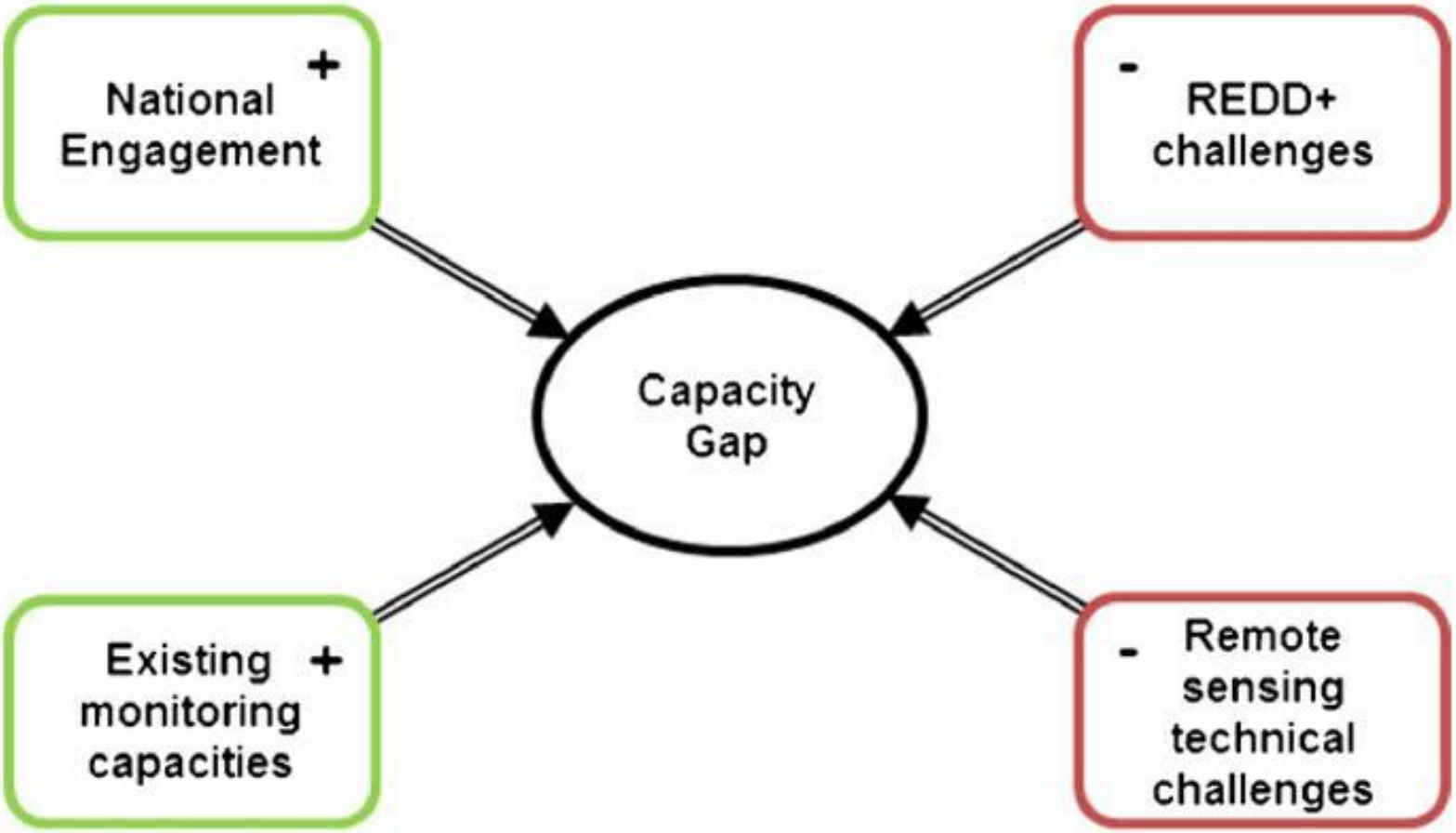
To achieve a fully functional NFMS, there is a need to strengthen many aspects of the capacity: institutional, human, technical, infrastructures ….

ToR describes capacity development task of the consultancy

- Consultants assess the capacities for national forest monitoring in the context of FRL and MRV
- Capacity devlopment strategy:
  - Capacity building within counsultancy period
  - Post-consultancy capacity development plan (implementation phase)

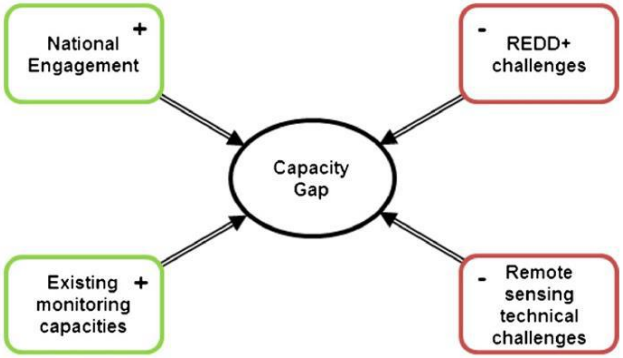
  (**M5 – M12**)

Capacity assessment for national forest monitoring - Fiji



Capacity assessment of catagories

Capacity assessment - Fiji



Source: after Romijn et al., 2012. Assessing capacities of non-Annex I countries for national forest monitoring in the context of REDD+

Criteria and Indicators	Capacity
Level of engagement in UNFCCC REDD+ process	Medium
Completeness of national UNFCCC reporting on GHG inventory	Low
Forest area change monitoring capacity	Low
Forest inventory capacity on growing stock and biomass	Low
Reporting on carbon for different pools	Low
Forest area effected by fire	Low
Proportion of forest area with high soil carbon content	Low
RS technical challenges	High

Human resource capacity -examples

Task	Existing capacities	Capacity gaps
NFMS	• PSP measurement team • MRV expert • Database manager	• MRV expert (backup) • Database manager (backup)
Forest Reference Level	• Well-trained NFI (PSP) field teams at MSD • Private sector has a number of experienced field teams	• Forest inventory expertise • Statistical expertise • Soil expertise • Mangrove expertise • Remote sensing expertise • GIS-expertise
Database Management	• Database manager (same as in NFMS)	• Database expert (backup) • Distributed Database expertise • Electronic data capture

Technical capacity - examples

Task	Existing capacities	Capacity gaps
FRL	• Forest cover map 2007 • GPS data of timber harvesting areas in DFO • Field data implemented in database • 100 PSP	• No activity data • No uncertainty/error assessment • Forest cover map 2017 • Forest change map 2006-2017
NFMS	• Dataset of NFI 2006 • Dataset of PSP (2010 -2016) • Pre-harvest inventory data in Divisional Forestry Office • Plantation database • Data on forest logging at MSD	• No anlysis of NFI/PSP data • No biomass functions • No analysis procedures • SOP/ Field manual • OA/QC procedures

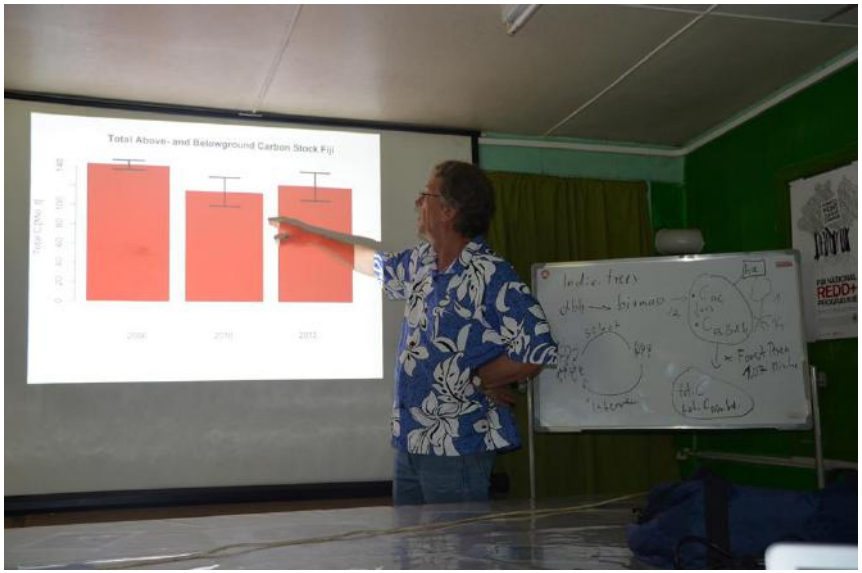
Capacity building within consultancy period

Roadmap for capacity building

- Change from **field measurement** to entire chian of processes/activities needed from raw data to final **Reporting Tables**!

Consultancy approach to capacity building

- Hands-on trainings



- Step-by-step approach

Capacity building modalities

- Workshops/Seminars
- On-the-job-training
- FGD
- Informing
- Consultation

Capacity building within assignment period

What?	When?
UNFCCC- REDD+ processes, and FCPF Carbon Fund Methodological Framework	M4
Activity Data-AD: Application of Remote Sensing/GIS for forest area change assessment, including uncertainty assessment	ongoing
Emission Factors –EF: Forest inventory, including QA/QC procedures	ongoing
Linking AD and EF: Statistical analysis	ongoing
Verification: Uncertainty analysis	ongoing
Reporting: IPCC Reporting Tables	ongoing

Outlook

- **Post consultancy Capacity Development Action Plan (M5 –M12)**

	Capacity	Up to 2019	From 2019
NFMS	Human		
	Technical		
	Infrastructure		
FRL	Human		
	Technical		
	Infrastructure		
Database	Human		
	Technical		
	Infrastructure		

To be decided

Thank you!

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Stakeholder analysis (Preliminary) for the development of FRL, MRV and Database

Duniversity of Hamburg.
Consultancy team
2-3 May 2017
Suva

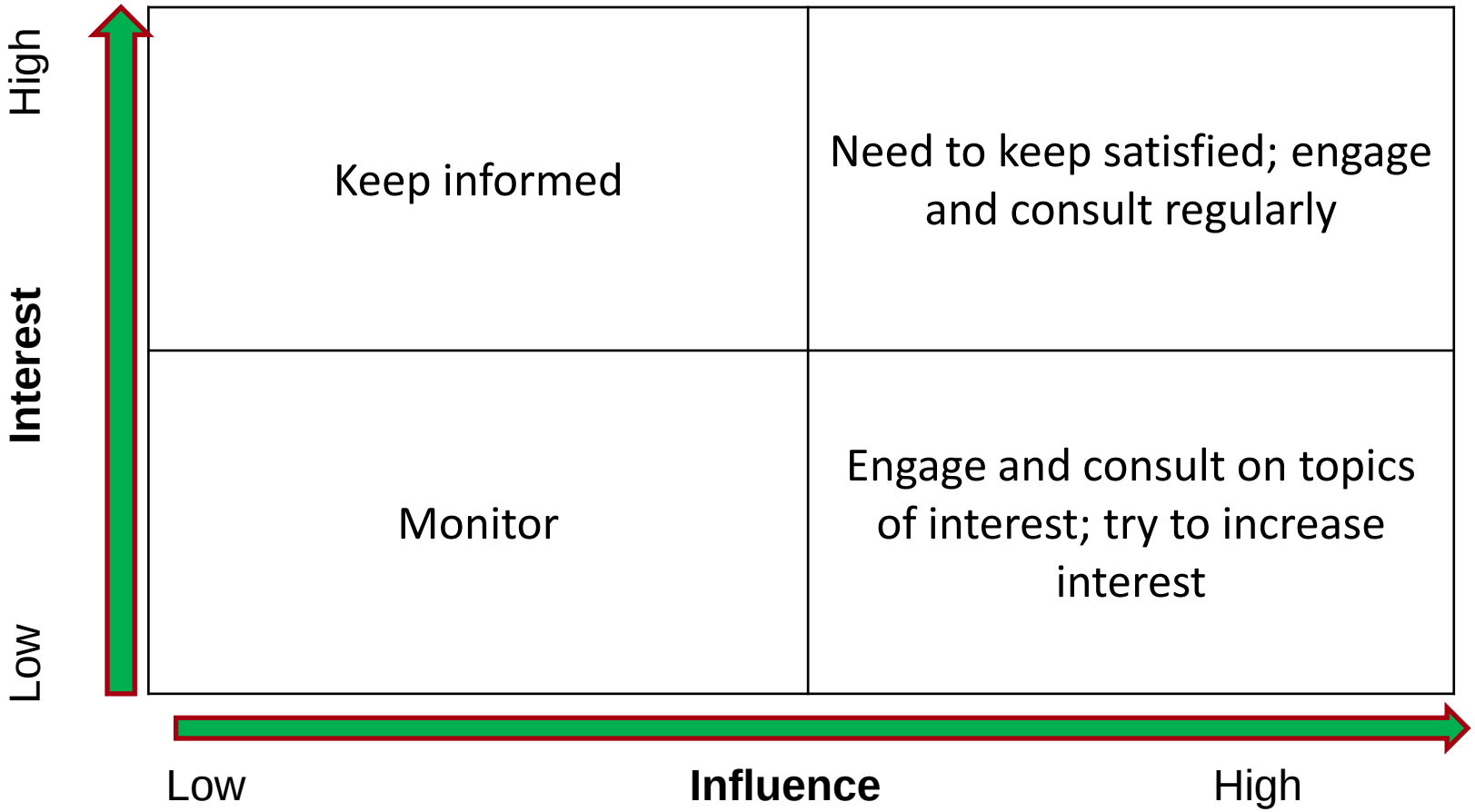
Background

- Stakeholders' participation: crucial in policy development and program implementation
- Stakeholder's role is paramount in REDD+ implementation
- Fiji REDD+ program has done stakeholder analysis for other REDD+ readiness activities
- However, stakeholders relevant for **FRL, NFMS** and **database** could be different from what the REDD+ program has identified before
- Thus, another round of analysis is performed to identify the stakeholders **relevant to this assignment**.
- The stakeholder list will be continuously updated by further stakeholder consultations

Stakeholder Analysis

- **Discussions** with REDD+ secretariat staff
- Document **review**
- Stakeholder **visits**
- "**Interest and influence**" framework of stakeholder analysis
- Stakeholders categories
  - **high** interest, **high** influence;
  - **high** interest, **low** influence;
  - **low** interest, **high** influence; and
  - **low** interest, **low** influence.
- Besides the criteria of interest and influence, stakeholder's **expectations** and **contribution** to REDD+ activities were also assessed

Stakeholder Analysis Framework



Stakeholder Mapping

Interest: Low → High

• Live and Learn Env. Education • Soqosoqo Vakamarama • Nature Fiji • SPC,GIZ,FAO • Scientific Forestry • Fiji Sawmiller's Association • Fiji Pine Trust • Fiji Mahogany Trust • Water Authority of Fiji • Ministry of I-Taukei Affairs • Conservation International	• Ministry of Forests (MSD,Divisional Forest Office) • Emalu landowners • Department of Environment • REDD+ Divisional Working Group • FNU, USP • Agriculture Department • Climate Change Unit (Ministry of Economy) • Division REDD Working Group • TLTB • Fiji Pine Ltd • Fiji Electricity Authority • Drawa Cooperative
• Sawmills • Provincial Council/Administrator • Ministry of Youths and Sports • Ministry of Social Welfare, Ministry of Women • District Offices • Fiji Crop and Livestock Council • Bureau of Statistics • Meteorology Department • NTROC • Ministry for Rural and Maritime • Ministry of Education, Heritage & Arts & National Archives of Fiji	• Media- Fiji times, Fiji Sun, Fiji TV1, FBC TV • Fiji Hardwood Corporation Limited • Department of Energy • Mineral Resource Department • Commissioners Office

Stakeholders that we met

Date	Method of consultation	Stakeholder's name	Major topic discussed
18.04.2017	Meeting in-person (MSD Meeting hall)	Climate Change Policy and Finance Department World Bank Group	• Forest Carbon Partnership Facility, Carbon Fund, Methodological Framework (FCPF CF MF)
18.04.2017	Half-a-day-Workshop (14 participants) (MSD meeting hall)	Ministry of Forests, MSD, REDD+ Secretariat Climate Change Policy and Finance Department World Bank Group	• Technical proposal of the Consultancy • Contact persons from Ministry of Forests (MF) for different Tasks specified in the ToR of the Consultancy
18.04.2017	Meeting (16 participants) (SPC- GSD)	REDD+ MRV WG	• FCPF CF MF, Availability of activity data • Information on sources of available data required for FRL and MRV system development
19.04.2017	Meeting (Hotel Grand Pacific, Suva)	Climate Change Policy and Finance Department World Bank Group REDD+ Unit	• Reference period for the FRL • Available activity data for 2007 – 2017 • Accuracy assessment of the activity data • Uncertainty assessment, Forest stratification

Stakeholders that we met

Date	Method of consultation	Stakeholder's name	Major topic discussed
20.04.2017	Half-a-day-Workshop (10 participants) (MSD meeting hall)	MF REDD+ Unit	• National Forest Inventory, Permanent sample plot • Availability of activity data, Database management
20.04.2017	Meeting (REDD+ Unit)	REDD+ Unit	• Content of Inception Workshop
23.04.2017	Field Visit (Mangrove Forests)	REDD+ Unit MF	• Status of Mangrove forests in Fiji • Biomass assessment of Mangrove forest
25.04.2017	Visit (Lautoka)	Divisional Forestry Office, Western Division	• Function, responsibility and organizational structure of the DFO • Forest area and forest cover • Log production and trends • A/R • Forest ownership

Stakeholders that we met

Date	Method of consultation	Stakeholder's name	Major topic discussed
25.04.2017	Visit (Lautoka)	Reforest Fiji	• A/R activities in sugar belt by cane growers • Forestry plantations and woodlots Performance based payment for plantation
26.04.2017	Visit	Nadarivatu Beat Office	• Forest harvesting in a village woodlot • Forest damaged by Winston • Carbon stocks in different types of forests
26.04.2017	Visit (Rakiraki)	Conservation International (CI) Field Office, Rakiraki	• Climate-focussed afforestation • Enrichment plantation – commercial tree plantation assisted by natural regeneration of native tree species • Alternative livelihood activities by the CI
27.04.2017	Visit	Ministry of Forests	• Results of preliminary analysis of carbon stocks and carbon stock change (2001 – 2012) • Non-availability of activity data to prepare the FRL as mentioned in the ToR • Problems sharing (e.g., no activity data, no uncertainty assessment of EF data)

Thank you!

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Work Plan

Duniversity of Hamburg
Consultancy team
02 -03, May 2017
Suva

Introduction

Assignment

Establishment of a Reference Level (FRL) for forest land and development of a System for Monitoring, Reporting and Verifying (MRV) carbon emission reductions from forests in FIJI

Client

Fiji Ministry of Fisheries and Forests, Fiji

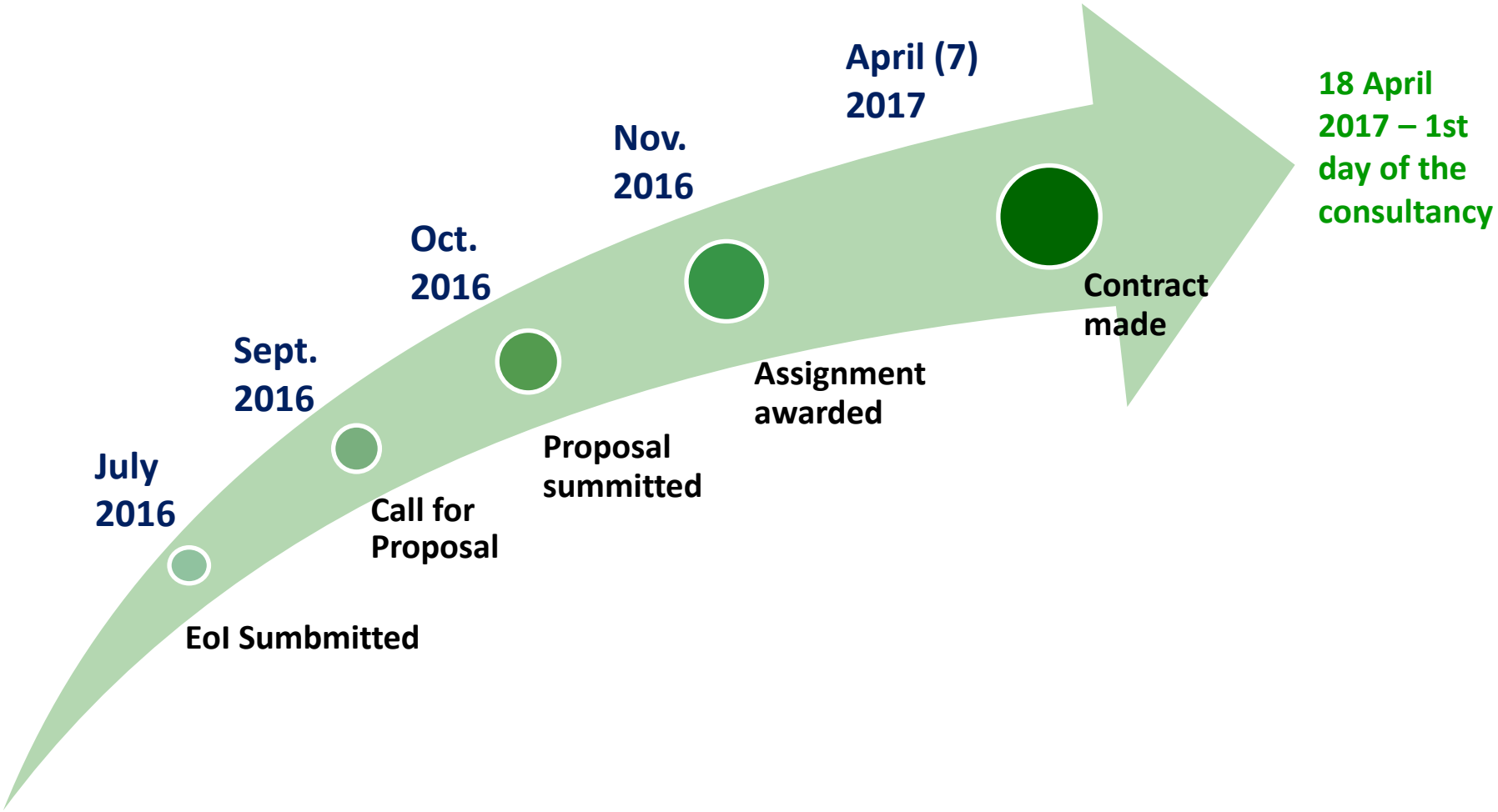
Consultant

Universität Hamburg, Germany

Duration

One year

Time line


July 2016
EoI Sumbmitted
Sept. 2016
Call for Proposal
Oct. 2016
Proposal summitted
Nov. 2016
Assignment awarded
April (7) 2017
Contract made
18 April 2017 – 1st day of the consultancy

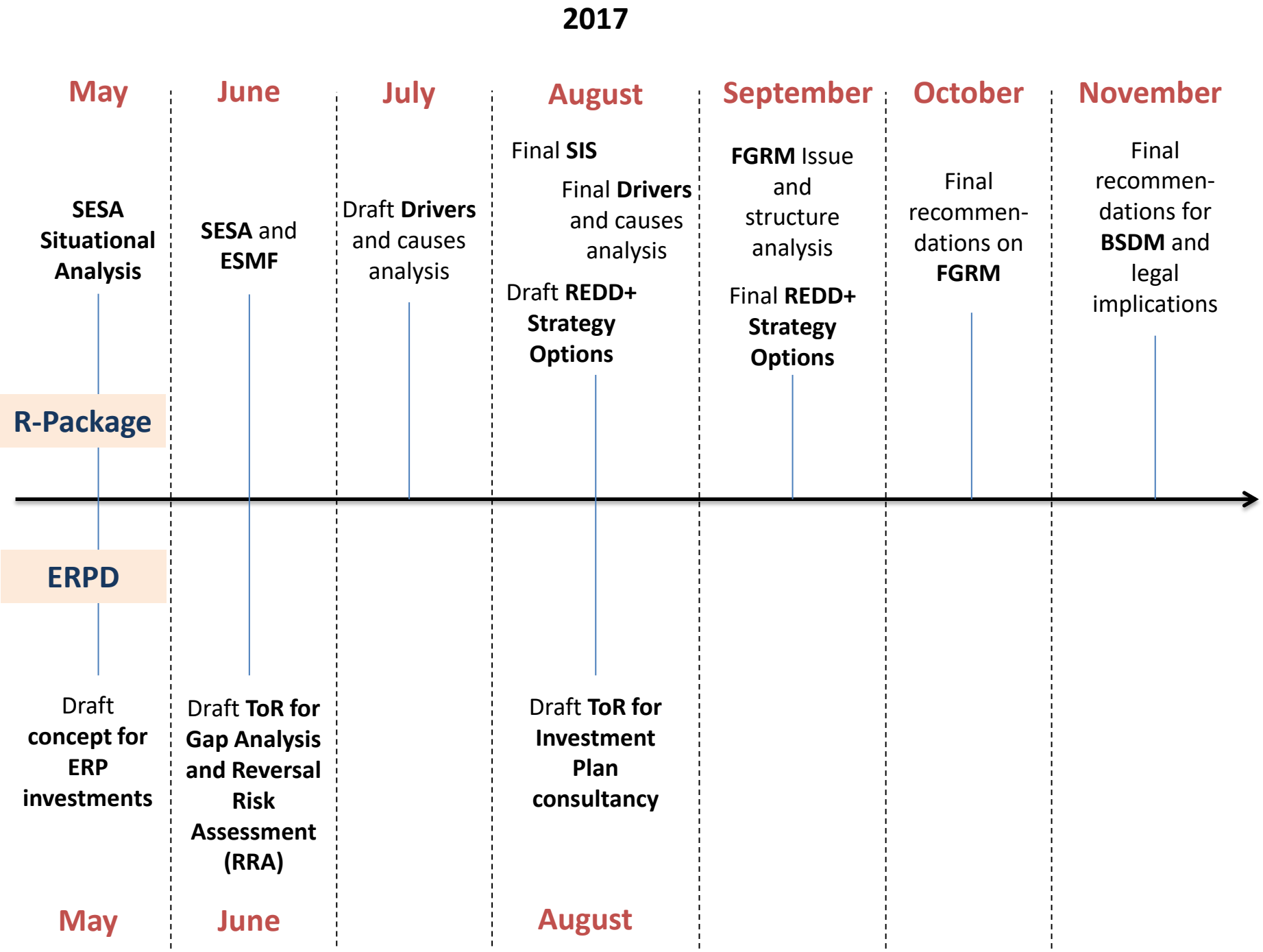
Work Plan

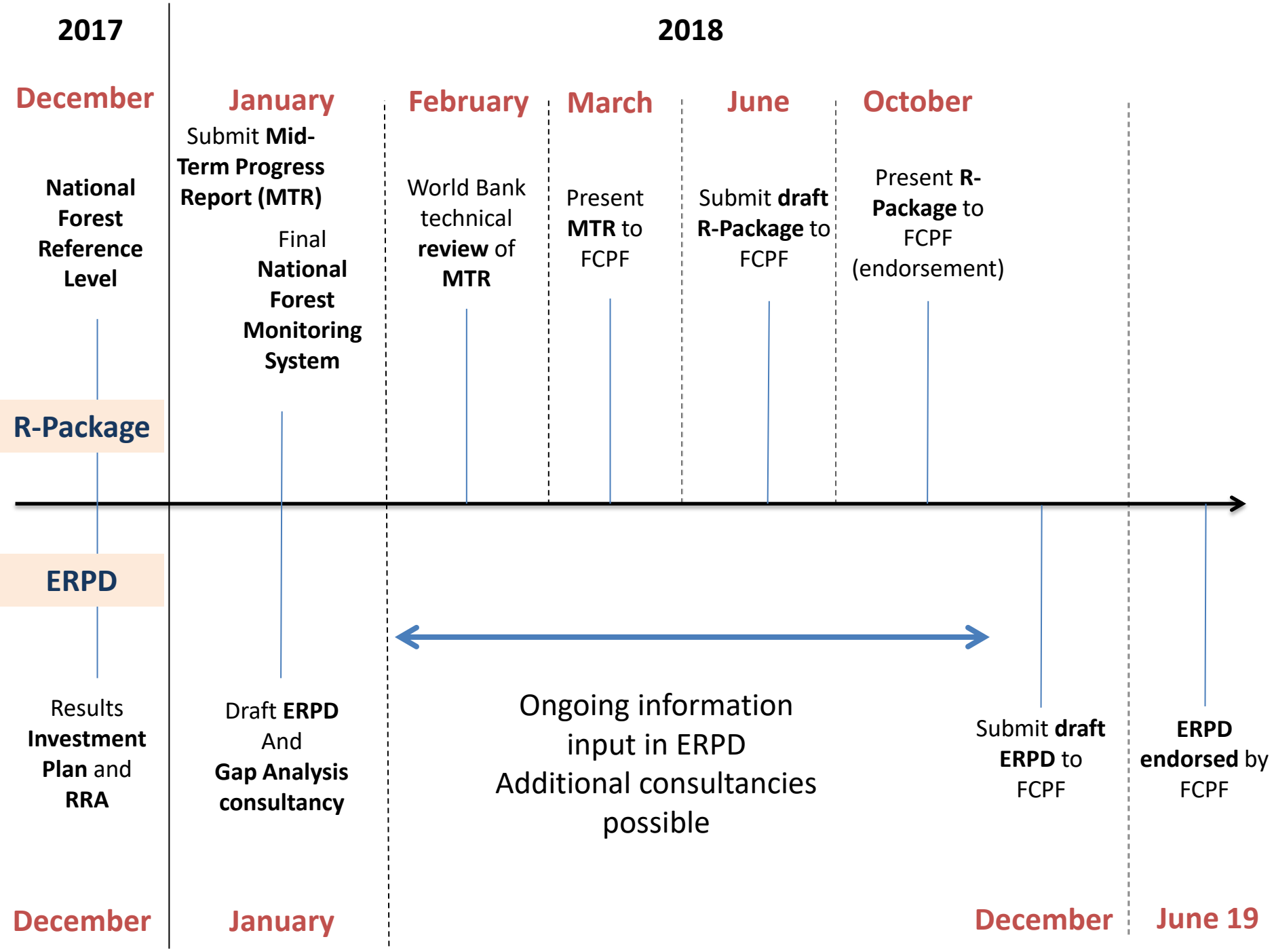
Project Task	Deliverables	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1. Situational analysis	1. R1- Situational analysis, including work plan and budget												
2. Development of a FRL	1. FRL integrating relevant REDD+ activities for the period 2007-2017 complying with UNFCCC and FCPF standards												
3. Development of NFMS including MRV	1. Methodology development for NFMS and MRV, 2. Module for SOP describing the applied methodology for NFMS and MMR												
4. Forest carbon forestry inventory test	1. Report on the preparation, implementation and analysis of the forest inventory including critical evaluation of all associated activities 2. Report" Collection of emission factor /field data to test all practical elements of the system" 3. Documentation of capacity building measures.												

Work Plan

Project Task	Deliverables	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
5. Database development	1. Functional database according to the TOR, 2. Module for SOP, documentation of capacity building measures.												
6. QA/QC procedures	1. Report on QA/ QC procedures, followed by expert peer review including future activities and validation processes, 2. A set of SOPs												
7. Guidance on the nesting of sub-national MRV and FRL within national	1. Report on nesting of sub-national with national MRV and FRL												
8. Capacity development	1. Report on “Capacity gap assessment, Capacity development plan” 2. Training / Seminar proceedings, and 3. Near-term Capacity Development Plan												

Thank you!


2017
May
June
July
August
September
October
November
SESA Situational Analysis
SESA and ESMF
Draft Drivers and causes analysis
Final SIS
Final Drivers and causes analysis
Draft REDD+ Strategy Options
FGRM Issue and structure analysis
Final REDD+ Strategy Options
Final recommen-dations on FGRM
Final recommen-dations for BSDM and legal implications
R-Package
ERPD
Draft concept for ERP investments
Draft ToR for Gap Analysis and Reversal Risk Assessment (RRA)
Draft ToR for Investment Plan consultancy
May
June
August


2017
2018
December
January
February
March
June
October
National Forest Reference Level
Submit Mid-Term Progress Report (MTR)
Final National Forest Monitoring System
World Bank technical review of MTR
Present MTR to FCPF
Submit draft R-Package to FCPF
Present R-Package to FCPF (endorsement)
R-Package
ERPD
Results Investment Plan and RRA
Draft ERPD And Gap Analysis consultancy
Ongoing information input in ERPD
Additional consultancies possible
Submit draft ERPD to FCPF
ERPD endorsed by FCPF
December
January
December
June 19